Causal Relationship Between Exports and Agricultural GDP in Pakistan

Memon, Manzoor Hussain and Baig, Waqar Saleem and Ali, Muhammad

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by

Manzoor Hussain Memon[*], Waqar Saleem Baig[**] and Muhammad Ali[***]

ABSTRACT

This paper is an attempt to investigate the causal relationships among agriculture gross domestic product (GDP) and exports in Pakistan by using time series data for the period between 1971 and 2007. There are several efforts reflecting greater interest in exploring the possible relation between the international trade and economic growth. Increasing of GDP is the main target of almost every economy. Promoting exports of the country is one of the ways of achieving economic growth. Pakistan is among the developing countries, emphasizing to boost its exports since its inception. The major share of Pakistan's export has strong backward linkages with the agricultural sector both in terms of primary and value added commodities. The findings have significant implications on Pakistan's economic policy as both the variables have shown strong long-run relationship. There is also a bi-directional Granger-causality between the total exports and agricultural GDP. However, for short-run, both the variable does not cause each other in either direction.

Keywords: Causality, Growth, Gross Domestic Product, Agriculture, Exports, Pakistan
JEL classification: C12, C32, C50, F14, F40, O40, Q10

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[*] Principal and Corresponding Author: Manzoor H. Memon is a Student, M Phil /PhD. (Applied Economics) at Applied Economics Research Centre (AERC), University of Karachi, Karachi.
Email:manzoorhmemon@yahoo.com

[**] Waqar Saleem Baig is Instructor Financial Management in Municipal Training and Research Institute (MTRI), Ministry of local Government and Rural Development, Karachi. Email: wsbaig@gmail.com

[***] Muhammad Ali is a Research Assistant in Institute of Business Administration (IBA), Karachi.
Email: alim@iba.edu.pk, alionline83@yahoo.com

1. Introduction

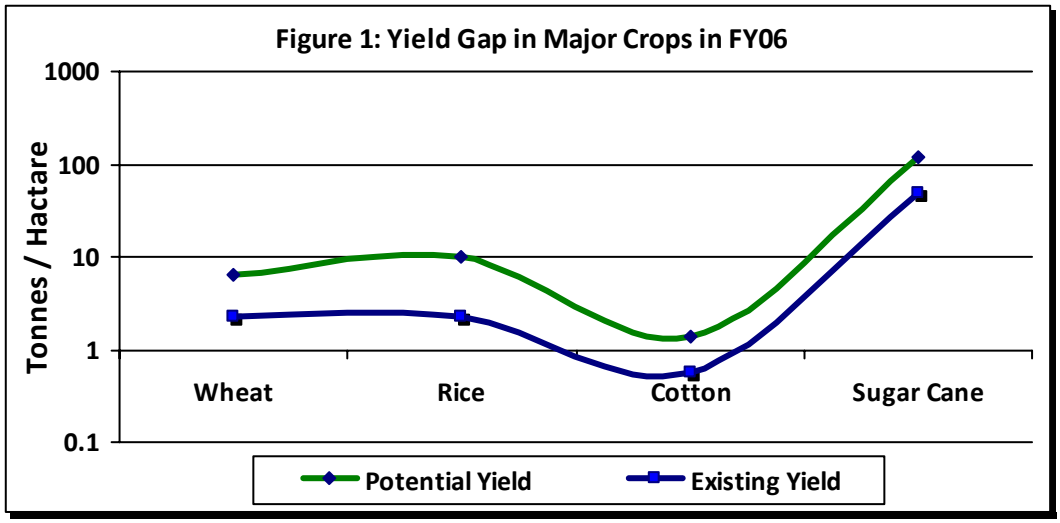
There has always been a debate among economist about the possible relationship between international trade and economic growth. Increasing GDP is one of the major targets of almost every economy (Shombe, 2005). There are several possible ways to achieve economic growth, also include international trade mainly foreign direct investment (FDI) and exports. The debatable question is in which direction country should focus on either to enhance exports for economic growth i.e. export-led growth or the other way around?

The agricultural growth is observed highly volatile both in Pakistan and globally, due to its high dependence on weather and other natural resources. In the decade of 70s, the average growth rate at world level and Pakistan was at 1.5% and 1.9% respectively, in 80's it increase to 2.6% and 4.4%, in 90's it declined to 1.9% and 4.2%, and in the first five years of the new millennium, the average growth rate was 2.3% and 2.9%.[1] This trend has given rise to concern about the capability of world agriculture production to keep up with the pace of population growth. This also has raised the issue for the world food security, particularly in the vulnerable regions of the developing countries.

On the other hand the exports of world has been growing at high pace during the last two decades, especially on behalf of increased importance and greater attention by foreign direct investment, as a growth enhancing component of less developed countries in particular. The world exports has been growing on an average of around 7% in last 4 decades, where as exports of Pakistan is growing at the same rate showing the stagnant share of Pakistan's total exports in the total world exports.[2]

[1] Author's Calculation, Data Source: World Development Indicator (2007)
[2] Ibid

Pakistan's agricultural sector is still dominant in the economy of Pakistan, despite of unsatisfactory performance and highly volatile (mixed trends) in growth pattern. The sector is still the important segment and expected to remain noteworthy in future. However, the agricultural production is still three to four times less as compared to some of the developed countries like Japan, Holland and USA. There are multiple causes for the low productivity of the sector, one of which is the yield per unit area; there is more than 60% of the potential yield gap in almost every commodity group in the country (Mellor, 1996). Lack of comprehensive policy for the agriculture sector, has also not allowed the sector to post consistent growth.



Author's Calculation; Data Source: Mellor (1996) and Agricultural Statistics of Pakistan (2006-07)

The sector not only meets the food demand of the growing population but also provide the raw materials for the expanding industrial sector. The sector also gaining importance in view of second generation growth concept of economy, as per contribution made by the small and medium enterprises in this sector. The sector employs much larger proportion of labor force accounting for around 45% of total labour force of the country.

Pakistan's Export mainly consists of agricultural commodities from which major proportion is of raw material which is transformed into the finished goods within the home country. Since 1971, on an average, the share of agriculture based commodities both in raw and value added form comprises of around 63% of total exports. However this share declined from 89% in 1974 to 56% in 2007.[3] Of the total share, the crop sector contributed major portion of the total agricultural related exports accounted for over 95% in last three decades. The share of the crop sector accounts for 60% in the total exports of the country better describe the reliance of exports on the agricultural sector. The importance of agriculture can further be analyzed from the fact that about 11% of the exports of Pakistan are Food products that are directly dependent on agriculture and 64% of the total Pakistani exports are based on textile that are again wholly dependent on agriculture (Ali, 2007).

The agricultural GDP comprises of four major sub sectors includes crops (major and minor), livestock, fisheries and forestry. The largest portion of the agricultural GDP is on account of crops and livestock with share of 48% and 49% respectively, followed by the fisheries and forestry by 4% and 9% respectively. However, in the late 90s and earlier, the crop sector was dominating and accounting for more than 50% of the total agricultural GDP.[4] Due to lack of importance and an improper agricultural policy in the crop sector, the sector started losing its share in the early years of new millennium. According to the world report, Pakistan's agricultural sector possesses the potential to be a lead sector in accelerating the economic growth as well as reducing the poverty in the country, however, historically, the sector has received less attention from the governments than other issues (Rizvi, 2002).

[3] Author's Calculation, Data Source: Statistical Supplement, Economic Survey of Pakistan (2006-07)
[4] Ibid, Data Source: Agricultural Statistics of Pakistan (2006-07)

Pakistan produces wheat, rice, cotton, sugarcane, maize and other cereal in sufficient quantities. Wheat is the major food grain, followed by rice, the second most important food grain in Pakistan. While cotton is an important cash crop of the country, as it is exported in sufficient quantity both in raw from and in value added form. Rice, sugarcane, tobacco, rapeseed and mustard are also large export earners. Pakistan is the ninth largest producer of wheat, 12th largest producer of rice, 5th largest producer of sugarcane and 4rth largest producer of cotton among the top producers in the world as per statistics of FY05.[5] Despite of the high volatility in the sector, Pakistan remains the top producer of the said major crops in the world economy. As far as the productivity is concern Pakistan ranks far below with reference to its total production in world economy. It ranked 9th, 14th, 10th and 14th, among the highest yield (tones/hectare) of wheat, rice, seed cotton and sugar cane respectively in FY05.[6]

Apart from the sector immediate economic contribution it also has indirect linkages with the other parts of the economy. The sector provides the raw materials for major industries, such as textile, sugar and to several other medium and small scale industries which account for about 50% of total value of industrial production (Alam, 2005). Any change in agricultural productivity, therefore, sends a ripple effect throughout the other sectors of the economy. The recent commodity inflation is one of the examples of the slowdown in the agricultural productivity due to many reasons; the world is also affected with the rise in inflation both in food and oil prices, in-turns reflected to some extent the impact of the sector.

Therefore, the main focus of the paper is to further analyze empirically the existence and direction of Granger causality and co-integration between agricultural GDP and the total exports to help the policy makers for having a better insight into economic growth and to

[5] Ibid, Data source: http://www.fao.org and Agricultural Statistics of Pakistan (2006-07)
[6] Ibid

formulate effective economic policies. The time has come to take strategic decisions where the world demand for food is expanding more rapidly than ever before in history.

2. Review of Selected Literature

Econometric evidence has an important role to play in investigating the relationship between the economic growth and exports. There are several studies with a hypothesis of export-led growth in general; however, very few studies are conducted to find the relationship between the specific sectors of economic growth and exports in particular. In recent studies, export-led growth has been put forward and declared significant to development strategies. It is also believed that it leads to higher total-factor-productivity growth. Export-led growth gain its importance in some empirical studies as it is found that it also encourage FDI in countries, which in-turn leads to increase productivity and reduce inefficiencies.

The classical theory also argued about the importance of international trade in country's economic growth, and discussed the gains from specialization. These theoretical arguments by classical and neo-classical in later stage have been supported by different empirical studies. Stiglitz (2007) found that the export-led-growth and technology played an important role in success of two growing nations in the sub continent i.e. India and China.

Maneschiöld (2008) has examined the role of export in the economic growth process in Argentina, Brazil and Mexico using causality tests within an error-correction framework. The findings lend support to an export-oriented growth strategy in promoting an enhanced growth potential in these countries.

Shombe (2005) investigated causal relationships among agriculture, manufacturing and exports in Tanzania using the time series data for the period between 1970 and 2005. The empirical results found the evidence of Granger causality where agriculture causes both exports and manufacturing. Khalafalla and Webb (2001) empirically test the export-led growth hypothesis for Malaysian economy undergoing major structural changes. They investigated the relationship between the exports and economic growth in Malaysia using the quarterly data from 1965-1996.

In Pakistan, several studies are conducted both on the agricultural sector and exports; however, none of them is on the relationship among the two main sectors of the economy. Bashir (2003) studied the impacts of economic reforms and trade liberalization on agricultural export performance in Pakistan. The author suggested that the agricultural export performance is more sensitive to the domestic factors, which changes due to economic reforms. Khan and Saqib (1993) established positive relationships between real GDP, real exports, real manufactured exports, and real primary exports in a study for Pakistan (Shombe, 2005).

Shirazi and Manap (2004) re-investigate the exports-economic growth nexus, using the data from 1960 to 2003 period. The results strongly support a long-run relationship among the three variables i.e. imports, export and output. As far as the causality between the exports and output growth is concerned, exports causes' output growth, but converse is not true. Ahmed and Martini (2000), in agricultural policy analysis in Pakistan, argued that both agricultural and industrial sector have to be in balance in order to sustain growth and ultimately development.

Khan *et. al.* (1995) investigated the direction of causation between exports growth and economic growth using the granger causality test and co-integration methods. They find stable long-run two way relationship between total exports and output while one way relationship between output and primary exports. They also find the bi-directional causality between total exports growth and economic growth.

Kavoussi (1984) conducted his study on low -income and middle-income countries and found a positive relationship among the export growth and economic growth. They also found that export expansion is associated with economic performance and that one important cause of this association is the favourable impact of exports on TFP.

There are several studies conducted on the exports and economic growth, some of them are country specific and some are conducted on different economic regions. Most of them have found strong positive relationship between the export and economic growth for example Balassa (1978), Jung and Marsahll (1985), Keong *et. al.* (1998), McCarville and Nnadozie (1995).

However, there are few cases where there is no causality found as in the case of Argentina (Chow, 1987). Ahmad & Hanhirun (1996), Studied the cointegration and causality between the exports and economic growth, they found that there is no statistical evidence of a long-term relationship from exports to economic growth in the Association of Southeast Asian Nations (ASEAN) region. The findings from causality tests also support the conclusion that it is domestic economic growth that causes exports to grow in all member countries of the ASEAN, rather than growth being export-led.

Bahmani-Oskooee and Alse (1993) raises the reliability of the earlier studies, as they did not test for co-integration and did not establish that the economic time series were stationary, the results are questionable. They point out that Granger causal inference is invalid if the series used are co-integrated.

Traditionally, it has been assumed that exports are exogenous to domestic output but this could be an inappropriate assumption because output can also affect exports (Shombe, 2005).

3. Methodology Framework

The paper is based on three hypotheses for testing the causality and co-integration for Pakistan (i) whether there is bi-directional causality between agricultural GDP and total export, (ii) whether there is unidirectional causality between the two variables, (iii) whether there is no causality between agricultural GDP and total exports (iv) whether there exists a long run relationship between agricultural GDP and total exports..

We have adopted different econometric approaches and methods to test the long run and short run relationships as well as causal relationship between the agricultural GDP and total exports. Annual data of the exports has been collected from Economic Survey of Pakistan (2006-07) and Agricultural GDP from Annual Reports (Various Issues) and Handbook of Statistics of Pakistan Economy, by State Bank of Pakistan (SBP).

The data used in the study are transformed in to natural log to minimize the variance in time series data set. The data series are denoted as lnAGDP (log of agricultural GDP) and lnEXPS (log of total exports).

To test the stationary of variables, we use the Augmented Dickey Fuller (ADF) test along with the newly developed Dickey-Fuller Generalized Least Square (DF-GLS) test. For time series data, ADF test are mostly used to test for unit root. Following equation checks the stationarity of time series data used in the study:

$$\Delta y_t = \beta_1 + \beta_1 t + \alpha\, y_{t-1} + \gamma \sum_{t=1}^{n} \Delta y_{t-1} + \varepsilon_t \qquad (1)$$

Where ε_t is white nose error term in the model of unit root test, with a null hypothesis that variable has unit root. However, the test for the small sample size is not fully reliable as it rejects the null hypothesis when it is true and accept when false, and this is mainly due to its size and power properties (Dejong et al, 1992 & Harris, 2003).

To avoid the situation, Dickey-Fuller Generalized Least Square (DF-GLS) is also used. This test could solve the problem of the data size and power properties. The newly developed test is also called as the de-trending test, developed by Elliot et al. (1996). The follows the calculation of order of integration of y_t and enhance the power of ADF test. The test is based on null hypothesis $H_o : \alpha = 0$ in the regression:

$$\Delta y_t^d = \alpha^* y^d_{t-1} + \alpha_1^* \Delta y^d_{t-1} + \ldots\ldots + \alpha^*_{p-1} \Delta y^d_{t-p+1} + \eta_t \qquad (2)$$

Where y_t^d is the de-trended series

The next step is to investigate the relationship both in the long and short run. There are several econometric techniques to investigate the long run relation ship among the macro-economic variables. The co-integration techniques comprises of uni-variate co-integration includes Engle-Granger (1987) and Fully Modified Ordinary Least Squares (FMOLS) of Philips and Hansen (1990); and multivariate co-integration techniques includes Johansen

(1988); Johansen & Juselius (1990); and Johansen's (1995). These are also commonly used methods for conducting co-integration tests. However, in recent years, the autoregressive distributed lag (ARDL) model approach, developed by Pesaran and Shin (1996 and 1988), Pesaran *et. al.* (1996) and Pesaran *et. al.* (2001) has become more popular and preferred to other conventional co-integration approaches.

The main reason for applying the new techniques of ARDL, discussed in several studies, is that it can be applied irrespective of the order of integration i.e. purely I(0), purely I(1) or mutually co-integrated (and in small samples) while other cointegration techniques require all variables be of equal degree of integration i.e. either purely I(0) or I(1) (and large samples). All the variables are assumed to be endogenous in the said approach. In this study we employed the Pesaran *et. al.* (2001) approach to investigate the existence of a long-run relationship in the form of unrestricted error correction model for each variable as follows:

$$\Delta \ln AGDP_t = \beta_1 + \sum_{i=1}^{n} \alpha_1 \Delta \ln AGDP_{t-i} + + \sum_{i=0}^{n} \alpha_2 \Delta \ln EXPS_{t-i} + \delta_1 \ln AGDP_{t-1} + \delta_2 \ln EXPS_{t-1} + \varepsilon_{1t} \quad \textbf{(3)}$$

$$\Delta \ln EXPS_t = \beta_1 + \sum_{i=1}^{n} \alpha_3 \Delta \ln EXPS_{t-i} + + \sum_{i=0}^{n} \alpha_4 \Delta \ln AGDP_{t-i} + \delta_3 \ln EXPS_{t-1} + \delta_4 \ln AGDP_{t-1} + \varepsilon_{2t} \quad \textbf{(4)}$$

Where lnAGDP is the nominal Agricultural GDP in natural log, lnEXPS is the nominal exports in natural log, while ε_{1t} and ε_{2t} are error terms in the model. The parameters δ_i where i = 1, 2, 3, 4 are the corresponding long-run multipliers, α_i where i=1, 2, 3, 4 are the short dynamic coefficients of the underlying ARDL model. We test the null hypothesis of no cointegration i.e. $H_o : \delta_i = 0$ or $\delta_1 = \delta_2 = 0$ in equation 3 and $H_o : \delta_i = 0$ or $\delta_3 = \delta_4 = 0$ in equation 4, against the alternative using the F-test with critical values tabulated by Pesaran and Pesaran (1997) and Pesaran *et al* (2001).

The ARDL approach involves two steps for estimating the long run relationship (Pesaran *et. al.*, 2001), first step is to investigate the long run relationship among the variables specified in the equation, and the second step is to estimate short run bi-directional causality. The second step is only applied when existence of long run relationship found in the fist step (Narayan *et. al*. 2005). Two sets of asymptotic critical values are provided by Pesaran and Pesaran (1997) and Pesaran *et. al.* (2001). The first set assumes that all variables are I(0) while the second based on the assumption of I(1). The null hypothesis of the no cointegration will be rejected if the calculated F-statistic is greater than the upper bound critical value, implying that there exists long run relationship among the variables. If the computed statistics is less than the lower bound critical values, we cannot reject the null hypothesis. Lastly, if the computed F-statistics falls with in the two bound critical values discussed above, we can not conclude i.e. the result will be inconclusive.

The granger causality test augmented with a lagged error-correction term (ECM) was also conducted in the final stage. If long run relationship exists among the variables specified, there must be granger causality in at least one direction (Engle-Granger, 1987). To avoid misleading in the presence of co-integration, granger causality is not conducted at first difference through vector auto regression (VAR) method. The inclusion of an additional variable the error correction term to VAR method, would also help in capturing the long run relationship among the variables. The ECM is formulated in bi-variate *pth* order vector error-correction (VECM), as follows:

$$\begin{pmatrix} \Delta \ln AGDP_t \\ \Delta \ln EXPS_t \end{pmatrix} = \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \sum_{i=1}^{n} \begin{pmatrix} \alpha_{11i} & \alpha_{12i} \\ \alpha_{21i} & \alpha_{22i} \end{pmatrix} \begin{pmatrix} \Delta \ln AGDP_{t-i} \\ \Delta \ln EXPS_{t-i} \end{pmatrix} + \begin{pmatrix} \alpha_1 \\ \alpha_2 \end{pmatrix} \begin{pmatrix} ECM_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \quad \textbf{(5)}$$

ECM_{t-1} represents the error correction term derived from long-run con-integration equation through a newly developed technique of ARDL, β_i(i=1, 2) are constant terms, and ε_i (i=1, 2) are the serially uncorrelated random disturbance term with mean zero. Long causality can also be revealed through the model specified in equation (5), with the significance of the lagged ECM by t test, while the short run causality with the help of F-statistics or Wald test, will be taken from the significance of joint test with an application of lags of explanatory variables in the model.

4. Empirical Results

Though there is no requirement to run the unit root test in ARDL application for long run and short run relationship, but, we run the test of stationarity as we may also apply some conventional techniques if the order of integration will remain the same for the defined variables. The statistics given in table-1, illustrates, in ADF test, variables have not shown the unit root problem and are stationary both at the level and after first differencing. However, applying the DF-GLS, the variables have shown the unit root problem at level and are stationary after first differencing. Due to difference in the results of two test of unit root, and the order of integration is not clear, we applied the best fitted approach of ARDL.

Table-1: Unit Root Test Results

Variables	ADF TEST		DF-GLS TEST	
	Level	1st Difference	Level	1st Difference
lnAGDP	**-4.896320***	**-5.588741***	-1.704613	**-5.45812***
lnEXPS	**5.045777***	**-8.699397***	-2.544860	**-4.332842***

** Significance at 1% level*

The lag order has been selected on the both Schwarz Criterion (SC) & Hannan-Quinn Information Criterion (HQ) and estimated results as given in table-2, did not allow us to take

more than one lag because of small data. It is worthwhile notifying that SC is a better measure of choosing lag lengths since it imposes a harsher penalty of adding more restrictions (Gujarati, 2003).

Table-2: Optimal Lag Selection

Lag	AIC	SC	HQ	Log-Likelihood
	Level	1st Difference	Level	1st Difference
1	**-4.900717***	**-4.631360***	**-4.808859***	**89.31220**
2	-4.706588	-4.257658	-4.553490	90.01199
3	-4.670915	-4.042414	-4.456578	93.40556

** indicates lag order selected by the criterion*
AIC: Akaike Information Criterion, SC: Schwarz Criterion, & HQ: Hannan-Quinn Information Criterion

Going further, we applied the ARDL approach to find out the long run relationship among the variables, the statistics are given in table-3.

Table-3: Bound Testing for Co-integration

Dependent Variable(s)			F-Statistics	Wald Test
ΔlnAGDP			*F(2,34)=6.76*** *P= 0.0039*	*F(2,29)= 5.602* *P=0.0088*
ΔlnEXPS			*F(2,34)=9.15** *P< 0.001*	*F(2,29)= 8.083** *P=0.0016*
Critical Value	Pesaran *et al* (2001)[i]		Narayan P (2005)[ii]	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
1%	8.74	9.63	10.150	11.230
5%	6.56	7.30	7.080	7.910
10%	5.59	6.26	5.915	6.630

** (**) Significant at 5% (10%), according to Pesaran et. al., 2001*
[i] Table CI (V): Unrestricted Intercept & Unrestricted Trend, (Pesaran *et. al.* 2001, 301)
[ii] Table CI (V): Unrestricted Intercept & Unrestricted Trend, (Narayan, 2005, 1990)

The results through an estimation of F-statistics, indicates the long run relationship among the variables in both directions, and there are two co-integrating vectors between the exports growth and agricultural GDP growth.

Granger causality test has been conducted using VAR and VECM. The VAR test implied, as indicated in table-4, there is a bi-directional causality found among the two variables. The agricultural GDP strongly influence the exports and causation from exports to agricultural GDP, both are significant at 1% level.

Table-4: Engle-Granger Causality Test (VAR)

Variables	lnAGDP	lnEXPS
lnAGDP	-	*F(1,36)=11.174** *P=0.00212*
lnEXPS	*F(1,36)= 7.09264** *P=0.01187*	-

** Significant at 1% level*

To estimate the short-run dynamics and the granger causality using VECM among the natural log of agricultural GDP and total exports, results are exhibited in Table-5. We have employed F-test on lagged variables that show no causality in either direction. However, the error correction term in both equations, shows the pace of adjustment in the long run in the occurrence of shock in either variable. In Result (5a), shock in exports in the short run, then the agricultural GDP will adjusted with the pace of 26% (0.26) per year. Whereas the result in (5b); shows the adjustment with a higher pace of 63% (0.63), due to the shock in agricultural sector of Pakistan.

Table-5: Engle-Granger Causality Test (VECM) / ARDL Short Run Causality

Variables	ΔlnAGDP	ΔlnEXPS	ECM_{t-1}	
ΔlnAGDP	-	F(2,30)=1.55 *ns*	*-0.26* *t(34)= -3.722** *P<0.001*	**(5a)**
ΔlnEXPS	F(2,30)=1.67 *ns*	-	*-0.63* *t(34)= -3.76** *P<0.001*	**(5b)**

** Significant at 1% level,* *ns Not Significant*

5. Conclusion and Policy Implications

The findings suggest that there is a long-run relationship exists between the two major sectors of the economy. The results are robust indicating that agricultural GDP is an important wheel for enhancing exports of the country. Engle-Granger Causality estimation also confirms the bi-directional causality among the variables under consideration. Whereas in short run analysis, there is no short run causality among the variables. The ARDL short run result suggest the sensitivity of Agricultural GDP with respect to the short run shock in the exports of Pakistan i.e. pace of adjustment needed much more time to adjust with shock. The reason behind the short result is because of the forward linkages of agricultural sector with the manufacturing sector for value addition. The short run result further opens the avenues of research in terms of relationship among the manufacturing GDP and total exports of Pakistan, as well as the relationship among the two GDPs of the country i.e. agricultural GDP and manufacturing GDP. These studies may enable to answer the reason of no short run causality in our study.

As far as the policy implications are concerned, agricultural sector plays an important role either directly or indirectly in gearing the economic growth. The sector fulfills the domestic demand in terms of food and raw material for domestic industry but also a source of foreign exchange earnings of the country. Despite of its strategic importance, the sector is neglected both at policy level as well as in social reforms. In order to increase exports, to maintain existing level of production and to increase the total-factor-productivity (TFP), there is a need of allocation of sufficient funds for Research and Development (R&D) activities.

Most of the industrial sectors have backward linkages to the agriculture sector, where growth may be affected on account of an inconsistent growth pattern in the sector. Rising commodity prices both domestically & internationally make a strong case for developing the local agricultural sector.

Government should put more emphasis on the agriculture sector by encouraging the farmers and other economic agents linked with the sector. The government should also encourage the concept of corporate farming particularly to small and medium size farmers. There is a need to develop comprehensive policies to give confidence both the domestic investors as well as the foreign investors.

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