AGRICULTURE LED ECONOMIC GROWTH: THE CASE OF PAKISTAN

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Abstract

The study attempts to test agriculture led growth theory for Pakistan. Time series data have been used for the period 1980 to 2017. The data series are tested for stationarity and found to be stationary at the first difference (I (1)). As the data contained a mix of I (0) and I (1) variables the ARDL Bounds testing approach is used. The Bounds Testing approach confirms a long run relationship. Error Correction Model is used to obtain coefficients of both short and log run. Analysis of the model shows that except for Terms of Trade all the variables are highly significant with expected signs. The main variable of interest i.e, Agriculture has a significantly positive effect on GDP. A 10% increase in agricultural GDP results in 2.8% increase in the national GDP (real terms). Similarly, 10% increase in the Gross Capital formation results in 5% increase in the GDP. Population has a negative sign for the coefficient. The results show that the agricultural led growth hypothesis carried weight and agricultural value added has the potential to help the national economy. Therefore, Pakistan needs to go for more value added and more efficient agriculture to have a better impact on economic growth of the country in the years to come.

INTRODUCTION

The role of agriculture in economic growth of developing countries has been debated since long with basis of many resting on qualitative analysis, although many studies show a positive relationship still many don't support the thesis. Pakistan being an agricultural country for most of its history and has been known to be riding on the shoulders of the agriculture sector. The agriculture sector has been dominated by the crops sector through most of the course of history only to be overtaken by the livestock sector in the year 2014 (GoP, 2004). The crop sector was in turn dominated by only four crops viz. cotton, wheat, rice and sugarcane. Wheat was the food security crop while the other three contributed as the cash crops with cotton and rice leading the exports list. For a country where agriculture has been contributing over one fourth to the GDP, the decision of allocation of resources is too important to the ignored.

It has been opined that increasing agricultural exports is likely to increase incomes and add to foreign exchange earnings (Johnston and Mellor, 1961b). Others found that for developing countries like Pakistan agricultural exports have positive but insignificant association with the GDP growth, owing perhaps to the export of primary and raw commodities that find it difficult to compete in the international markets (Mahmood and Munir, 2017).

Results of most earlier studies have been doubted based on the reason that these which did not take into account the time series properties like unit roots in the data which could lead to spurious results (Tsakok and Gardner, 2007). Some studies attempted to the study the phenomenon using bivariate analysis using the Granger causality (Tiffin and Irz, 2006) which is considered to be too simple to capture the real life relationships as Titus, 2015 called it misspecification.

With limited resources it is valuable to have an idea of how to allocate resources among different sectors. The belief of Agriculture as the driving force behind developing economies needs to be tested quantitatively.

This study aims to quantify the impact of agricultural growth on the overall economy of Pakistan. Time series analysis techniques are suitable to achieve such objectives. Time series has seen a lot of development during the recent decades. The development of concepts like that of stationarity and the tests to check it have cast doubts over the reliability of results reported by earlier studies. One of the recent techniques in vogue today is the Autoregressive Distributed Lag (ARDL) that has an edge over the previous approaches. This approach is better suited when the data is small, and the variables have different orders of integration.

This study is divided into distinct sections. The following section focuses on the review of literature, followed by the section on methodology where the model is described while the results are discussed in section three. Section four finally concludes the study with suggestions for future research.

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To present response to the question of "does agriculture affect the economic growth?" is being under review among development economists. Many of the development economists including (Lewis, 1954; Fei and Ranis, 1961; Johnston and Mellor, 1961a; Jorgenson, 1961; Schultz, 1964) pioneered to investigate the issue. However, their work was mainly qualitative, focusing mainly on the possible impact of connections between agricultural and industrial sectors. After a pause in research on this issue, in the near past the issue has attracted the attention of development economists and among many (Echevarria, 1997; Humphries and Knowles, 1998; Gemmell *et al.*, 2000; Kogel and Prskawetz, 2001; Gollin *et al.*, 2002; Awokuse, 2005; Gardner, 2005; Olsson and Hibbs, 2005; Tiffin and Irz, 2006; Awokuse, 2007; Awokuse and Xie, 2015; Kang, 2015; Gemmell *et al.*, 2016; Keho, 2017) have worked to explore the issue.

The empirical investigations have shown a mix evidence for agriculture-led growth (ALG) proposition. Some of the economists (Johnston and Mellor, 1961a; Gemmell *et al.*, 2000; Gollin *et al.*, 2002; Thirtle *et al.*, 2003; Awokuse, 2005; Gardner, 2005; Awokuse, 2007; Awokuse and Xie, 2015) have proved and supported the ALG and others (Lewis, 1954; Fei and Ranis, 1961; Jorgenson, 1961) strongly disagree with its proponent.

According to Johnston and Mellor (1961a), Gemmell *et al.* (2000), Gollin *et al.*, (2002), Thirtle *et al.* (2003), Awokuse (2005), Gardner (2005), Awokuse (2007), Awokuse and Xie (2015), development of agricultural sector is a prerequisite for industrial and economic growth. The advocates of ALG argue that the agricultural sector could be a stimulus for national income as it directly and indirectly affects rural income and provides raw materials for industrialization (Thirtle *et al.*, 2003). According to Bhagwati and Srinivasan (1975), industrialization in developing economies without investment and development in agricultural sector showed dismal economic growth.

Recent study by Kang (2015) has shown that in major rice producing economies, rice exports are imperative for fuelling economic growth. In the same lines, studies by Thirtle *et al.* (2003), Awokuse (2005), Tiffin and Irz (2006), Awokuse (2007), Awokuse and Xie (2015) suggested that development of agriculture might be instrumental for economic growth, with varying effects across different economies. Analyses for some economies back the hypothesis of ALG while for some others the analyses suggest that vibrant aggregate economy is a precondition for agricultural growth.

OBJECTS AND METHODS

Objects

This study aims to find the association between economic growth and agriculture, gross capital formation, population and terms of trade. Data on real GDP (current U.S. dollar), real agricultural value added[1#] (current U.S. dollar), population (in number head counts and includes residents regardless of legal status or citizenship), real imports and exports of goods and services (current U.S. dollar), and real gross capital formation[2#] (current U.S. dollar) are extracted from the World Bank Development Indicators data set[3#].

Net GDP is obtained by subtracting real agricultural value added from real GDP. As terms of trade (ToT) is the ratio of exports and imports, therefore, ToT is obtained by dividing real exports over real imports. All the data are converted into million and then into logarithmic form by taking natural logs of all the desired variables. Time series data are used for the period 1980 to 2017.

Methodology

As mentioned earlier several development economists have studied the association between agriculture and economic growth. Studies conducted in past except few have used the ordinary least squares (OLS) techniques and/with simple correlation coefficient

[1#] Agriculture corresponds to International Standard Industrial Classification (ISIC) divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.

[2#] Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.

[3#] https://databank.worldbank.org/data/home.aspx, accessed on April 09, 2019.

tests that may have misspecification problems (Tsakok and Gardner, 2007). According to Tsakok and Gardner (2007), correlations might be spurious as the earlier studies did not take care for cointegration and unit roots properties of the time series data. In addition, some of the studies show correlation between agriculture and GDP growth but fail to explain the direction of causality and this issue could be best investigated through time series framework. In this connection, Tiffin and Irz (2006) estimated the bivariate Granger causality tests. Though, their study was improvement on previous studies, but they failed to check the impact of other determinants (trade, capital and labor) of economic growth which may lead to misspecification problems (e.g., omitted variables), and spurious correlation (Awokuse and Xie, 2015).

Model

In the light of the above discussion, this study follows the model developed and estimated by Awokuse and Xie (2015) to analyse the association between agriculture and economic growth of Pakistan. According to Awokuse and Xie (2015) their model is an extension of the neoclassical growth model. The neoclassical growth model considers agriculture as a major player to growth as it affects total factor productivity.

To get empirical results the following model is estimated using autoregressive distributed lag (ARDL) approach to meet the objective to investigate both the short- and long-run relationships between agriculture and economic growth.

Assuming Cobb-Douglas Production function:

$$GDP_t = C_t^{\alpha} H_t \quad (1)$$

Where: GDP_t is per capita GDP of Pakistan, C_t^{α} is the gross capital formation, and H_t represents the Hicks-Neutral productivity term.

Hwa (1988) incorporated agriculture to the growth equation. Awokuse and Xie (2015) estimated the growth equation by incorporating exports and terms of trade as Hwa (1988) and Wunder (2003) termed both the exports and terms of trade explaining economic growth of a country (Awokuse and Xie, 2015). As ToT is a ratio of exports and imports, therefore exports is excluded from the final equation and population as included as one of the determinants affecting overall economic growth of a country. Therefore, the Hicks-Neutral productivity term , which is considered as a residual term in production function, is assumed to be a function of agriculture , population , and terms of trade , to curtail the residual term.

$$H_t = f(Agr_t, Pop_t, ToT_t) = Agr_t^{\beta} Pop_t^{\gamma} ToT_t^{\delta} + \varepsilon_t \quad (2)$$

Where: ε_t is the error term that captures other missing variables that may affect growth.

Substituting equation (2) in equation (1) gives the following model:

$$GDP_t = Agr_t^{\beta} Pop_t^{\gamma} ToT_t^{\delta} + \varepsilon_t \quad (3)$$

Equation (3) is converted into the following linear form by taking natural logs:

$$\ln GDP_t = \alpha \ln C_t + \beta \ln Agr_t + \gamma \ln Pop_t + \delta \ln ToT_t + \varepsilon_t \quad (4)$$

The Augmented Dickey and Fuller (ADF) and Phillip-Perron tests are used to test for cointegration in time series data.

Time and place of the study

This study aims to analyze agriculture led economic growth theory for Pakistan. In this regard, to estimate the model mentioned at equation 4 and meet the objectives of the study, time series data are extracted on the required variables for the period 1980 to 2017.

RESULTS AND DISCUSSION

The final model is based on the Net GDP (Net of Agriculture) and four independent variables viz. Agricultural Value Added (lnAgri), Gross Capital Formation (lnC), Population (lnPop) and the Terms of Trade (ln ToT), all in real terms and in natural log form making it easier to interpret the elasticities.

The data series are tested for stationarity using Phillips Perron and Augmented Dickey Fuller tests. Although ARDL Bounds Testing approach accommodates a mix of both I (0) and I (1) variables it does not allow for any variable that is I (2). Except for the population that is found to be stationary all the other variables are found to be I (1) i.e these become stationary at the first difference. As none of the variables is I (2) the Bounds Testing approach is used comfortably. Results of the PP and ADF are given in Table 1 and 2 respectively.

As the data contained a mix of I (0) and I (1) variables the ARDL Bounds testing approach is used. Using the Bounds Testing approach a long run relationship is confirmed with a reasonably high F-value (28.9) that surpassed the upper bound (7.09) for the small sample (40) limits (Table 3). Narayan tables (Narayan, 2005) are used as the sample is small and the (Pesaran, 1999) tables caters for much larger samples over one thousand.

Table 1. Tests for stationarity

Phillips-Perron Test						
	At Level					
		lnGDP	lnAgr	lnC	lnPop	lnToT
With Constant	t-Statistic	0.6270	0.5330	0.0439	-9.7078	-1.6485
	Prob.	*0.9886*	*0.9857*	*0.9567*	*0.0000*	*0.4484*
		Ns	*Ns*	*ns*	***	*ns*
With Constant & Trend	t-Statistic	-1.6080	-1.6047	-2.0842	-4.5180	-1.3076
	Prob.	*0.7705*	*0.7718*	*0.5373*	*0.0048*	*0.8704*
		ns	*ns*	*ns*	***	*ns*
	At First Difference					
		d (lnGDP)	d (lnAgr)	d (lnC)		d (lnToT)
With Constant	t-Statistic	-5.8458	-5.8189	-5.5656		-5.8193
	Prob.	*0.0000*	*0.0000*	*0.0000*		*0.0000*
		***	***	***		***
With Constant & Trend	t-Statistic	-6.0761	-6.1580	-5.5744		-6.1033
	Prob.	*0.0001*	*0.0001*	*0.0003*		*0.0001*
		***	***	***		***
Augmented Dickey Fuller test						
	At Level					
		lnGDP	lnAgr	lnC	lnPop	lnToT
With Constant	t-Statistic	0.5598	0.5429	0.0439	-1.8703	-1.6065
	Prob.	*0.9866*	*0.9860*	*0.9567*	*0.3416*	*0.4693*
		ns	*ns*	*ns*	*ns*	*ns*
With Constant & Trend	t-Statistic	-1.6080	-1.5714	-1.9583	-4.2676	-1.2955
	Prob.	*0.7705*	*0.7851*	*0.6041*	*0.0110*	*0.8735*
		ns	*ns*	*ns*	**	*ns*
	At First Difference					
		d (lnGDP)	d (lnAgr)	d (lnC)		d (lnToT)
With Constant	t-Statistic	-5.8458	-5.8188	-5.5656		-5.8191
	Prob.	*0.0000*	*0.0000*	*0.0000*		*0.0000*
		***	***	***		***
With Constant & Trend	t-Statistic	-6.0358	-6.0765	-5.5744		-6.0267
	Prob.	*0.0001*	*0.0001*	*0.0003*		*0.0001*
		***	***	***		***

Notes: a: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1% and (ns) Not Significant; b: Lag Length based on SIC; c: Probability based on MacKinnon (1996) one-sided p-values.

Table 2. ARDL Bounds Test for the model (3, 0, 0, 0, 0)

Test Statistic	Value	K
F-statistic	28.917	4
Critical Value Bounds (Narayan)		
Significance	**I (0) Bound**	**I (1) Bound**
10 per cent	3.374	4.512
5 per cent	4.036	5.304
1 percent	5.604	7.172

The model developed for this study is tested for a long-run relationship using Bounds testing approach which clearly shows the existence of a long run relationship (Table 2). An Error Correction Model is estimated and coefficients of both short an log run are obtained. The long and short-run coefficients are given in table 3 and 4, respectively. Except for Terms of Trade all the variables are found to be highly significant and have expected signs. The main variable of interest i.e Agriculture is found to be highly significant at the 1% level and has a positive effect on GDP. A 10% increase in agricultural GDP results in 2.8% increase in the national GDP (real terms). Similarly, 10% increase in the Gross Capital formation results in 5% increase in the GDP. The Terms of Trade is found to be non-significant even at 10% level. Population is found to be significant at 5% level of significance and has a negative sign for the coefficient.

Table 3. Long-run Coefficients ARDL model (3, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	Prob.
lnAgr	0.282	0.076	0.001
lnC	0.500	0.085	0.000
lnPop	-1.308	0.552	0.026
lnToT	0.061	0.054	0.263
C	9.233	2.565	0.001
Trend	0.053	0.014	0.001

Source: Authors' calculations.

Table 4. Short–run Coefficients for ARDL model (3,0,0,0,0)

Variable	Coefficient	t-Statistic	Prob.
d (lnGDP(-1))	0.052	0.518	0.609
d (lnGDP(-2))	-0.059	-0.601	0.553
d (lnAgri)	0.293	3.057	0.005
d (lnC)	0.519	7.672	0.000
d (lnPop)	-1.357	-2.460	0.021
d (lnToT)	0.064	1.186	0.246
d (Trend)	0.053	3.744	0.001
CointEq (-1)	-1.000	-9.134	0.000

Source: Authors' calculations.

An Error Correction Model is formed to workout the speed of adjustment. The speed of adjustment reflects the time that is expected to be required to bring the system back to equilibrium form any disturbance. The smaller the coefficient the longer will it take to adjust. The speed of adjustment is found to be very high with 100 % of the correction taking place in the first period.

Agriculture contributes around 19% to the national GDP of Pakistan and even the agriculture sector contributed to a great extent in the exports of Pakistan. The services sector is to a large extent powered by agriculture. It is therefore logical to hypothesize that Pakistan's economy could grow with the growth in agriculture sector. The long-run coefficient for agriculture supported the hypothesis of agricultural led growth. Gross Capital formation that includes all the sub-sectors logically contributes more. Population of Pakistan has an ideal composition at present with most of the population falling between 15 to 35 years of age. This is the stage at which the labour force can contribute to the economy the most. The negative coefficient of the variable could be due to the fact that the country's economy has not been able to productively employ the available population to its potential. In addition to unemployment, there could be under-employment with a sizeable proportion of the youth working below their potential.

The equation is tested for a variety of conditions that need to be fulfilled. Heteroskedasticity needs to be avoided and to check for this, Breusch-Pagan-Godfrey test is used but the null hypothesis of homoscedasticity could not be rejected and hence the problem of heteroskedasticity is not observed (Table 5). Jarque-Bera test for normality is used and no normality problem is observed. Specification is tested using the Ramsey-Reset test up to the power of two and the model is found to be well specified. Serial correlation is tested using the Breusch-Godfrey Serial Correlation LM Test and the null hypothesis of no serial correlation could not be rejected.

Table 5. Diagnostic Tests

Test	Test Statistic	p-value
Breusch-Godfrey (χ^2)	3.448	0.178
Ramsey RESET	0.028	0.682
Jarque-Bera (χ^2)	0.765	0.682
Breusch-Pagan-Godfrey (χ^2)	9.66	0.290

Source: Author's calculations.

Long-run stability of the model is tested using the CUSUM and CUSUMSq tests and the test lines stay well within the 5% limits. The CUSUM lines need to stay between the 5% bounds without touching any of these to show that there is no breaking.

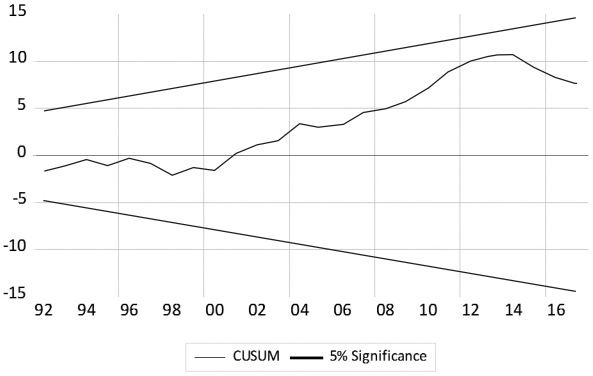

Figure 1. CUSUM Test for the ARDL Model

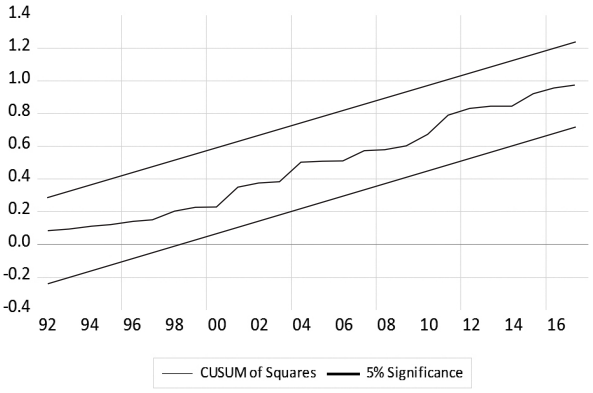

Figure 2. CUSUMSq Test for the ARDL Model

CONCLUSIONS

This study tests the hypothesis of agricultural led growth that investing in agriculture could have positive effect on the overall economy of Pakistan. The elasticities are estimated to quantify the possible effects. In addition to value added in agriculture a few exogenous variables are included to make the model reflects the ground realities. These variables include population, gross capital formation and the terms of trade. The results show that the hypothesis carry weight and agricultural value added has the potential to boost the national economy. The coefficient is however not very strong perhaps due to the transitionary stage of the country in the journey of economic development. Secondly its indirect role may be fully reflected in the model. Terms of trade does not come out to be significant, during the last few decades Pakistan's economy struggling for a positive terms of trade with not much success. The gross capital formation however contributes more as expected. Pakistan needs to go for more value added and more efficient agriculture to have a better impact on economic growth of the country in the years to come.

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DEVELOPING AGROFORESTRY PRODUCTION FOR SUSTAINABLE POVERTY REDUCTION AND HUNGER ERADICATION IN THE NORTHERN MIDLAND AND MOUNTAINOUS REGION OF VIETNAM

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Abstract

The Northern midland and mountainous region of Vietnam is recognised as having very rich resources for agricultural production. This sector plays a dominant role in the economic structure of the region, which accounts for 68.3% of the household income and ranked second within eight ecological regions of Vietnam. However, this region has been still in the poorest area of the country, which 24.5% of the total household ranked as poor while this rate was only 8.2% in the whole country. By reviewing the most updated data and scientific reports, this paper analysed the status of agricultural sector and identified the most significant challenges in the application of agroforestry for poverty reduction in the region. This paper also analysed relevant factors to highlight the opportunities to promote sustainable agriculture production. Based on that, suitable recommendations were also made to take the advantages and eliminate the drawbacks in order to promote the sustainable agroforestry production. In which, diversification of cropping, application of future smart foods, and improvement of supporting policy are highly potential solutions.

Keywords: Agroforestry, hunger eradication, northern midland and mountainous regions, poverty reduction

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