

# Agriculture Value Added and Poverty Reduction in Pakistan: An Econometric Analysis

Dilawar Khan<sup>1</sup> Adnan Khaliq<sup>2\*</sup> Muhammad Yaseen<sup>1</sup> Abid Zada<sup>1</sup>

1.Department of Economics, Kohat University of Science and Technology, Kohat 26000, Pakistan

2.School of Public Affairs, University of Science and Technology of China

Postal code, 230026, Anhui, Hefei, China

## Abstract

Agriculture plays an important role to reduce poverty in developing countries. This study was conducted with the core objective to examine the role of agriculture in poverty reduction in Pakistan using time series data for the period 1972-2013. This study also analyses the role of services and industrial sectors to mitigate poverty in Pakistan. The study has applied Augmented Dickey-Fuller test to examine the data for stationary. On the basis of ADF test all the variables are stationary at first difference i.e. I (1). Johansen Co-integration test was also applied to assess the long-run relation between the variables. There are two co-integrating vectors. So the results show that all the sectors---agriculture, services and industrial---have long-run relation with poverty reduction. Results of error correction model confirm the long-run relation of agriculture, services and industrial sectors with poverty reduction.

**Keywords:** Agriculture, Poverty Reduction, co-integration, VECM, Pakistan.

## 1. INTRODUCTION

The agriculture sector contributes 20.9 percent of GDP in Pakistan economy. It also generates employment opportunities for 43.5 percent human power of the country. In rural area 60 percent population depend on agriculture sector for its livelihood. Agriculture is also important for industrial development. Economic development is one of the major objectives of (GoP, 2014) every society in the world and basic of economic development is economic growth. Employment opportunity, poverty reduction are major objective of development policy of any government. Agriculture production increase per capita income. Poverty reduction occurs by increase in per capita income. Industrial value added and service sector value added also causes poverty reduction

Service sector is the largest contributor in the GDP of the Pakistan economy. The services sector is also important for Pakistan as it constitutes 58% of the country's GDP. Pakistan also exported services worth \$5.3 billion with a deficit of \$3 billion in 2014. The sector has strong backward and forward linkages with other sectors of the economy, while it significantly contributes to cross-border trade as well.

The industrial sector contributes 20.30 per cent in GDP; it is also a major source of tax revenues for the government and also contributes significantly in the provision of job opportunities to the labor force. Industrial sector continued growth process and recorded growth at 3.62 per cent as compared to 4.45 percent last year (GoP, 2014). In the pioneer study in income inequality and growth relationship concluded an inverted U shaped relationship between growth and income inequality of the country. Poverty reduction provides the stability in an economy by providing the opportunities to the individuals of the society to equally benefit from the growth and development of the economy. The productive capacity of the economy is increased by this process. This growth of the economy would benefit everyone if the distribution of income is equal in the economy. On the other hand, with the higher income inequality the lesser portion of population would benefit from the process of development. This empirical finding is known as Kuznets Hypothesis in economic literature. According to Kuznets hypothesis, distribution of income worsens at early stages of growth but income inequity start declining at higher growth levels (Kuznets, 1955).

Green revolution helped to reduce income disparities in Pakistan. He concluded that productivity level and income of small farmers increased more rapidly that of large farmers. The introduction of new technology in agriculture sector increased the demand for labor that helped to increase the wages of rural workers. Green revolution also resulted in changing the social political and economic environment of the country (M. H. Khan, 1983) Amjad and Ahmad (1984) gave conclusions in contrast to Chaudhry (1982) that income inequality increased in the process of green revolution in Pakistan because the advance technology and credit was available to big landlords. Financial restraints to small farmers and entailed them to benefit from HYVs seeds, adequate water, and fertilizers due to higher initial costs. Regional disparities also increased during the process of green revolution. Growth of agriculture sector generates employment opportunities.

Landownership is more skewed than the income inequality in Pakistan. The authors identified nonfarm, agricultural, transfer, livestock and rental income as the sources of income in rural Pakistan. Non-agricultural income constituted 30-34 percent total per capita income. Hafeez (2008) supported the hypothesis for the Pakistan economy, in the earlier stages of growth income inequality increase and then it decreases after a certain

level of growth (Adamse, Jr., 1995).

This study work will enhance knowledge in field of agriculture, services and industrial sector might improve the poverty reduction in Pakistan. It argued that agriculture, services and industrial sector can help in poverty reduction in Pakistan and significantly affects the process of income generation in the agriculture, industrial and services sector. This study also examines to see the long-run and short-run impact of agriculture, industrial and services sectors with poverty reduction. Following are the objectives of the study.

- i. To examine the relationship of Agriculture, Services and industrial GDP with per capita income.
- ii. To prescribe some policy for the poverty reduction.

Krugman (1990) examined the three most significant elements for the overall economy productivity, income distribution and unemployment. He works to identify the main determinants of employment, productivity and income distribution and their possible inter connection. He concluded that the links between employment, productivity and output growth discussed in this paper are central to the overarching theme of poverty reduction. Employment, productivity and output growth are positively related to poverty reduction (Krugman, 1990).

Kanwar (2000) studied the co-integration of the different sector of Indian economy in a multivariate vector autoregressive skeleton and expected the relations between agriculture and industry using the johansen procedure. He found that the agriculture, infrastructure and services sector significantly affect the process of income generation in the manufacturing and construction sector, but the reverse is not been true (Modeling & Issues, 2000). O'Rayani and Miller (2003) examined the role of Agriculture in poverty alleviation, Income distribution and economic development for Chile economy. He examines the impact of the agriculture and agro-industrial sectors on poverty and income distribution, an increase in agricultural production, agro-industrial production and industrial production is simulated. This increase is obtained through either Increasing total productivity or a price subsidy to the sectors products. He concluded that the agriculture sector and the agro-industrial sector are important to alleviate poverty. An increase in labor productivity in agriculture has higher impacts on the poorest declines than an increase in the industrial sector (O'Ryan & Miller, 2003).

Landmann (2004) clarifies the links between employment, productivity and output growth and traces the changing nature of these links over different time frames (Landmann, 2004). It raises issues central to the overarching theme of poverty reduction and productivity in the World Employment Report 2004 published by the International Labor Organization. Hye (2009) analyzed that the agricultural sector play a significant role in promoting modern sector to achieve economic development (Muhammad & Hye, 2009). That study estimated these two sectors in Pakistan by employing ARDL co-integration approach proposed by Pesaran, et al. (2001). For the period of 1971–2007, he revealed that the sectors have apposite relationship both in the short and long run. On other hand, the industrial output only can influence the agricultural sector in long run.

Ahmed and Ahsan (2011) examined that services sector has provided steady support to Pakistan's economic growth. Services sector is largest and fastest growing sector in the world economy. The higher growth of service sector gives a new dimension of stability to Pakistan's growth process. The analysis shows that other commodity-producing sector growth rate in employment is stagnant or declining, while the services sector provides more opportunities in employment generation (Ahmed & Ahsan, 2011). This helps to reduce the poverty alleviation and improve the quality of life. (M. Khan and co-workers 2012), examined on the participation of women in agriculture activities in district Peshawar. He uses cross-sectional data. Most of the farmers in research area were small landholders ranging between 2 to 4 acres. The study of women in this area show active participation in agriculture activities. They participate in harvesting, cultivation time and livestock activities. The participation of women has positive effect on income of household. They encourage the women to be a useful part of the economy and accelerate economic growth in Pakistan.

Salman (2012) examined that how much agricultural sector can be helpful in achieving GDP growth as major determinant, to see the mutual relationship between Agricultural, GDP and economic growth, how agricultural sector change economic development as a major determinant, to give policy recommendations according to this study. This study is valuable because it analyzes both the variables (agricultural growth and GDP) scientifically. 31 observations have been taken since 1980 to 2010. Econometric techniques have been used to show the relationship between the variables. Results shows that agricultural affects the GDP growth of Pakistan significantly in long run and short run, which has been shown by Johansen co-integration test and ECM. Ali, et al. (2013) examined the impact of Agriculture value added, Services value added, Export of goods and services and foreign direct investment percentage of GDP on income inequality in Pakistan. ADF unit root test is applied to find each time series variable stationary at its first difference (Ali, Mustafa, & Shahbazi, 2013). Johansson's co integration approach is applied to analyse the long-run determinants of income inequality. This study reveals the agriculture production positive effect on income inequality in Pakistan but this result is significant.

## 2. METHODOLOGY

This section designs the variables, the nature of variables, set-up and the source of the data. This includes three

sub-sections. The first section explains the data. Unit root tests are given in section two. The last section gives the co-integration analysis.

## 2.1 The Data

The main objective of this study is to explore the links between agriculture, industrial, services and per capita income of Pakistan. The study uses annual time series data of Pakistan for the period 1972 to 2013 taken from World Development indicator (WDI). The study uses Agriculture GDP measured at constant 2005US\$ (AGDP), services GDP measured at constant 2005 US\$ (SGDP), industrial GDP at constant 2005 US\$ (IGDP) and per capita income GDP measured at constant 2005 US\$ (PGDP).

## 2.2 Unit Root Test

Unit root test is used to detect whether the data is stationary or not. A data is said to be stationary if its mean, variance and covariance remain constant over time (B. Y. D. a Dickey & Fuller, 1981; D. A. Dickey & Fuller, 1979). Consider the following model AR (1) model:

$$Y_t = \phi Y_{t-1} - \varepsilon_t \quad (1)$$

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{i=1}^p \beta_i \Delta Y_{t-1} + e_t \quad (2)$$

$$\Delta Y_t = \alpha_o + \gamma Y_{t-1} + \sum_{i=1}^p \beta_i \Delta Y_{t-1} + e_t \quad (3)$$

$$\Delta Y_t = \alpha_o + \gamma Y_{t-1} + \alpha_{2t} + \sum_{i=1}^p \beta_i \Delta Y_{t-1} + e_t \quad (4)$$

## 2.3 Co-integration Test

Johansen co-integration test is used to test the long-run relationship among four variables. Therefore, four both variables are examined for co-integration. Johansen co-integration test is used to check the long-run movement of the variables (S Johansen, 1991; S Johansen, 1988).

$$\Delta GDP_t = \delta_1 + \sum_{i=1}^j a_{1i} \Delta GDP_{t-1} + \sum_{i=1}^j \beta_{1i} \Delta AGDP_{t-1} + \sum_{i=1}^j \gamma_{1i} \Delta IGDP_{t-1} + \alpha \zeta_{t-1} + EC_{t-1} \quad (5)$$

$$\Delta PGDP_t = \delta_2 + \sum_{i=1}^j a_{2i} \Delta AGDP_{t-1} + \sum_{i=1}^j \beta_{2i} \Delta PGDP_{t-1} + \sum_{i=1}^j \gamma_{2i} \Delta AGDP_{t-1} + \alpha_2 \zeta_{t-1} + EC_{t-1} \quad (6)$$

$$\Delta AGDP_t = \delta_3 + \sum_{i=1}^j a_{3i} \Delta GDP_{t-1} + \sum_{i=1}^j \beta_{3i} \Delta AGDP_{t-1} + \sum_{i=1}^j \gamma_{3i} \Delta PGDP_{t-1} + \alpha_3 \zeta_{t-1} + EC_{t-1} \quad (7)$$

## 3. RESULTS AND DISCUSSION

### 3.1 Unit Root Test Results

The stationary properties of the variables are checked by using Augmented Dickey-Fuller (ADF) unit root tests before conducting tests for co-integration and causality. These tests were applied to determine the order of integration of time series on level as well as on first difference. Stationarity of all variables are tested at intercept and trend. All variable are stationary at first difference i.e.  $i(1)$ .  
 $AGDP \sim I(1), IGDP \sim I(1), SGDP \sim I(1), PCI \sim I(1)$

Results of the ADF test are given below.

**Table I Result of ADF test**

Variables	Intercept	Intercept and trend
LAGDP	-0.005784 (0.6461)	-0249572 (0.5058)
$\Delta$ LAGDP	-1.389772 (0.0000)**	0.110983 (0.5058)
LIGDP	-0.013543 (0.1057)	0.194652 (0.2291)
$\Delta$ LIGDP	-0.842535 (0.0010)**	-0.003557 (0.9832)
LSGDP	-0.011633 (0.0414)*	0.247100 (0.1195)
$\Delta$ LSGDP	-0.705335 (0.0002)**	0.101944 (0.5174)
LPGDP	-0.009608 (0.4100)	0.214356 (0.1833)
$\Delta$ LPGDP	-0.638159 (0.0029)**	-0.130596 (0.4215)

Figures without parenthesis indicate t-statistics and in parenthesis are p-values. \*\*, \* show that the variables are stationary at 1% and 5% respectively.

### 3.2 Johansen Co-integration Test

Since all the variables are integrated of order one, i.e., I(1), the co-integration hypothesis among the variables is examined by Johansen co-integration test. Results of Johansen co-integration test are given in Table II. Both Trace statistics and Max-Eigen values are greater than the critical value at 5% level of significance. Therefore, the null hypotheses of no co-integrating vectors ( $r = 0$ ;  $r \leq 0$ ) against the alternative ( $r = 0$ ;  $r = 1$ ) are clearly rejected. Hence both test statistics indicate two co-integrating vectors. Thus there is long-run equilibrium relationship among poverty, agriculture value added, industrial and services sectors.

**Table II Results of Johansen Co-integration Test**

Null Hypothesis	Alternative Hypothesis	No. of CE(s)	Trace Statistics	5% Critical Value	Max-Eigen Value	5% Critical Value
$r = 0$	$r = 1$	None*	79.75940 (0.0001)	54.07904	33.88637 (0.0095)	28.58808
$r \leq 1$	$r = 2$	At most (1)*	45.87303 (0.0025)	35.19275	26.20975 (0.0135)	22.29962
$r \leq 2$	$r = 3$	At most (2)	19.66328 (0.0603)	20.26184	14.35214 (0.0859)	15.89210
$r \leq 3$	$r = 4$	At most (3)	5.311143 (0.2510)	9.164564	5.311143 (0.2510)	9.164546

**Note:** \* indicates significance at 5% level. Figures in parentheses are p-values.

### 3.3 Result of Error Correction Model (ECM)

ECM model was used to examine the short and long-run relation between poverty and its determinants. It can be observed from Table III that there exist short-run causal relationships between poverty, agriculture, industries and services sectors. Error correction terms (ECT) have negative sign and are significant at 5 percent which show that all the models are in equilibrium in the long-run.

**Table III Result of Error Correction Model**

Variables	Coefficient	Stad. Error	t-statistic	Prob
C	-0.009879	0.004762	-2.074569	0.0452
D(LOG(AGDP))	0.164598*	0.052756	3.120002	0.0036
D(LOG(SGDP))	0.242068*	0.057334	4.222559	0.0002
D(LOG(IGDP))	0.216326**	0.091598	2.361699	0.0237
E(-1)	-0.501730	0.130216	-3.853068	0.0005

\*Significant at 1%, \*\* significant at 5%

R<sup>2</sup>=0.70, DW=1.89, F-stat=21.3, F (prob) =0.000

#### 4. CONCLUSIONS

The purpose of study was to analyses the short and long-run dynamic of agriculture, industrial and services sectors on poverty reduction in Pakistan. The study concludes that poverty is correlated negatively both in short and long run with agriculture, industrial and services sectors GDP. Agriculture value added improves the distribution of income in Pakistan. The results of the study demand a robust agriculture policy focused on the development of agriculture infrastructure, diversification, and adaptation of modern technology in agriculture and promotion of horticulture. There is a need to overcome the problem of water shortage in Pakistan. The construction of large and small water reservoirs would help to fulfil water shortage and it would also help to manage the energy crises in the country.

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