Agricultural Production and Economic Growth in India: An Econometric Analysis

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Abstract
Despite increasing contribution of services sector to India’s economic growth helping the country to grow at a rate of 7.1 per cent annually, the fact that agriculture is still continuing to be the backbone of the economy is hardly exaggerated. The sector, though contributes 13.7 percent to total GDP it provides employment to 51.8 percent of the total population and constitutes the major source of their livelihood. It has a 10 per cent share in the total exports and is the fourth largest contributor. It is well understood that “with 75 percent of the World’s poor in rural areas and most of them dependent on farming, agriculture must be part of world economic growth, poverty reduction and environmental sustainability (UNDP, 2012)”.

The main objective of this study is to examine how agricultural production contributes to the economic growth in India during 1991-2012. The log linear regression growth model is used where gross domestic product is the dependent variable and the explanatory variables are the five major crops i.e. cereals, tobacco, tea, coffee and sugarcane. The regression analysis is performed using E-views-7. It is found that production of tea, cereals and tobacco are positively affecting the GDP growth in India whereas the coffee and sugarcane production is having inverse relationship with economic growth though not insignificant. Therefore, a decline in agricultural production has been accompanied by declines in GDP growth. Therefore it is suggested that, proper training to farmers, adequate storing marketing and insurance and irrigation facilities should be provided to encourage them to increase production.

Keywords- Agricultural Production, Economic Growth, India

I. INTRODUCTION
Despite increasing contribution of services sector to India’s economic growth helping the country to grow at a rate of 7.1 per cent annually, the fact that agriculture is still continuing to be the backbone of the economy is hardly exaggerated. The sector, though contributes 13.7 percent to total GDP it provides employment to 51.8 percent of the total population and constitutes the major source of their livelihood. It has a 10 per cent share in the total exports and is the fourth largest contributor. It is well understood that “with 75 percent of the World’s poor in rural areas and most of them dependent on farming, agriculture must be part of world economic growth, poverty reduction and environmental sustainability (UNDP, 2012)”. Until 1960-70, India used to import several food items to meet its domestic demand. Then Indian government reformed the agriculture policy and brought about the “Green Revolution” which helped in increasing farm output significantly in the states of Haryana, Uttar Pradesh, Punjab and later in West Bengal and Odisha and helped in ensuring food security.

A large chunk of India’s exportable is constituted by the agricultural products such as jute, tea, tobacco, coffee, spices and sugar. It helps in increasing the foreign exchange earnings. The major crops include cereals, pulses, tea, coffee, fresh vegetables, fresh fruits, dry fruits, coconuts, major spices, milk, millets, cotton, Jute, castor oil seed. India ranks second largest producer of wheat and rice in the world and also a major exporter of rice and wheat to countries like Nepal, Bangladesh and Africa. India is one the largest producer of Sugarcane in the world also.

In this backdrop the present study attempts to investigate how agricultural production affects the economic growth in India. It is organised in the following manner. The second section presents the Review of literature. Data and Methodology are given in section-III. Results and discussion are presented in Section-IV followed by the concluding section.

II. REVIEW OF LITERATURE
In this section a review of past research in the field has been compiled to enable better understanding of the problems concerned to the study.

Awokuse, O. T. (2009) in his paper titled “Does Agriculture Really Matters for Economic Growth in Developing Countries?” investigated dynamic interaction between agriculture productivity and economic growth in general term finding out the
relationship between agriculture and economic growth with time series analysis of fifteen developing and transition economies in Latin America, Asia and Africa. Economics variables used were export, agriculture value added per worker, real GDP per capita, population as proxy for labor and gross capital formation per worker as proxy for capital taken from the World Bank development indicators and international monetary for the period of 1971 to 2006. Auto regressive distributed lag model and co integration was used to find out the empirical relationship among variables. Results thus obtained are that agriculture is an important factor for economic growth. Empirical evidence supports the roll of private and public resource allocation to agriculture and infrastructure development. It was suggested that trade openness impact is positive and favourable on GDP per capita so should be increased.

Cao, K.A. and Birchenall, J.A. (2013) in their working paper titled “Agricultural productivity, Structural Change and Economic Growth in Post Reform China” observed that the role of agricultural productivity is an important determinant of China’s post reform economic growth and sectoral reallocation. Using microeconomic farm level data and treating labor as highly differentiated inputs it is found that labor input in agriculture decreased by 5% annually the agricultural TFP grew by 6.5%. And also using a calibrated two sector general equilibrium model, found that agricultural TFP growth a. accounts for the majority of output and employment reallocation toward non-agriculture by Contributing as much to aggregate and sectoral economic growth as non-agricultural TFP growth. It influences economic growth primarily by reallocating workers to the non-agricultural sector where rapid physical and human capital accumulation are currently taking place.

Awan, A.G. and Vashma, A. (2014) in their paper titled “Impact of Infrastructure Development on Economic Growth” tried to examine the major determinant of agricultural sector and mutual relationship between agriculture economic development and GDP. 31 observation was used since 1980 to 2010. Gross domestic product and agriculture growth were taken as economic variables. Data were taken from the World Bank Meta data of Pakistan. Co integration and vector error correction model was used as econometric technique for measuring the variable relationship. Results show that there exists statistically significant and positive relationship between agriculture growth and GDP growth. It was suggested that the agriculture growth is very essential for economic growth.

Oyakhilomen, O. and Zibah, R.G. (2014) in their research work titled “Agricultural Production and Economic Growth in Nigeria: Implication for Rural Poverty Alleviation” asserted that agricultural production and economic growth in Nigeria are positively related. Using time series data on the index of agricultural production, real gross domestic product, interest rate, exchange rate and inflation rate, the bounds testing (ARDL) approach to co integration is employed to analyse the data leading to the key finding of the study. It is established that agricultural production is positively related to economic growth in Nigeria and the relationship is significant both in the long run and in the short run.

Awan, A.G. and Alam, A. (2015) in their article titled “Impact of Agriculture productivity on Economic Growth: A Case Study of Pakistan” explained the impact of agriculture productivity on economic growth. The secondary source of data covering the time period 1972 to 2012 is employed. Used the auto regressive distributed lags method (ARDL) to estimate the economic growth. Different variables used are real gross domestic productions per capita gross capital formation, employed labor force, inflation rate, trade, openness, agriculture value added. The inflation rate has negative effect on economic growth while all other variables are positively related to economic growth. The study concluded that the share of agriculture is more in economic growth and suggest that government should enhance employed labor force by increasing the higher education in both agriculture and industrial sector. Share of agriculture in GDP can be doubled in Pakistan because Pakistan is an agriculture country and have a very high potential in its agriculture sector.

III. METHODOLOGY

The present study makes use of secondary data drawn from Statistical Handbook of RBI and Economy Survey of India from the period 1991 to 2012. The data analysis is done using Econometric-Views 7 (E-views7).

Model Specification

This study used a Log Linear Growth Regression Model. The dependant variable is Gross Domestic Product (GDP) and the independent variables include five major crops such as Cereals, Tobacco, Tea, Coffee and Sugarcane.

The Log Linear Regression Model is as follows

\[
\text{Log GDP} = \beta_0 + \beta_1 \text{Log CER} + \beta_2 \text{Log TOBC} + \beta_3 \text{Log TEA} + \beta_4 \text{Log COFFEE} + \beta_5 \text{Log SUGCAN}.
\]
Where, \( \text{Log GDP} = \) the logarithm for Gross domestic Product,

\[ \beta_0 = \text{a constant} \]

\( \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \) and \( \beta_6 \) are parameters to be estimated. \( \text{Log CER, TOBC, TEA, COFFEE and Log SUGCAN} \) are the logarithms for the value of agricultural production for Cereals, Tobacco, Tea, Coffee and Sugarcane respectively.

**Variables used in the Model**

**Gross Domestic Product:** In this study GDP at factor cost is taken as a proxy for economic performance which measures the total amount of goods and services produced in an economy (Lipsey & Crystal, 1999). It measures how big the economy is and has been chosen as a favourable indicator in this case because it captures all the variables that concerns economic growth. GDP has been included because it measures the output produced in any one period at prices of the same base year.

**Cereals:** Cereals is the combined production of foodgrains like rice, wheat, jowar, maize, ragi, small millets and barley. It is the staple food and one of the major exported products of the country. It is grown in almost all parts of India. Rice, maize and wheat together accounted for 89 percent of all cereal production (FAO, 2012). Uttar Pradesh is at the top of the list for cereals production with 48413 Thousand Tonnes followed by Punjab i.e. 28490 Thousand Tonnes. This crop is mainly grown for domestic consumption, stock feed production, starch manufacture and export purposes.

**Tobacco:** It is a cash crop. India is the third largest tobacco producer in the world with annual production of about 800 million kg. It has a major exportable variety-the ‘Flue Cured Virginia’ (FCV) tobacco grown in only three states i.e. Andhra Pradesh, Karnataka and Telangana with an annual production of around 300 million kg. In India, out of seven tobacco research centres Guntur (AP) is the first and well known place for tobacco. 96,865 registered farmers are working in the tobacco centres in India. Around 0.25 percent of the cultivated land is used for tobacco production and it accounts for 9 percent of the total production

**Tea:** Botanical name of the Tea is ‘Camellia Sinensis’. After water, tea is the most widely consumed beverage in the world. Tea is an evergreen plant that mainly grows in tropical and subtropical climates. Commercial cultivation of the tea started in India from British era when one Robert Bruce in 1823 discovered tea plants growing wild in upper Brahmaputra valley. In May, 1838 the first Indian tea from Assam was sent to England for public sale. Tea grows in a moderately hot and humid climate which is preferred for better yield, crop distribution and quality. Flushing in the tea plants starts from March with the rise in temperature. The Acidic soil with around 4.5-5.5 pH is most suitable for tea. India is world’s second largest tea producer after China. In 2013, India has estimated tea production is 900 million kilograms, which counts for around 23.24 percent of global tea production. The top five producer countries of tea are China, India, Kenya, Sri Lanka and Turkey. Tea is grown in 16 states in India. Assam, West Bengal, Tamil Nadu and Kerala account for about 95 percent of total tea production in the country.

**Coffee:** It is one of the major plantation crop in India. The area under coffee plantations in India has increased by more than three times, from 120.32 thousand hectares in 1960-61 to 397.147 thousand hectares in 2015-16. Most of this area is concentrated in the southern states of Karnataka (54.95 percent), Kerala (21.33 percent) and Tamil Nadu (8.18 percent). India has emerged as the seventh largest coffee producer globally after Brazil, Vietnam, Columbia, Indonesia, Ethiopia and Honduras. In 2015-16, India accounted for 4.05 percent of global coffee production. The production of Robusta coffee in India is almost double to that of Arabica while notably both share equal cropped area viz. Robusta 52 percent and Arabica 48 percent. Both Karnataka and Kerala produce more Robusta whereas Tamil Nadu produces more Arabica. In other parts of India such as Andhra Pradesh and Odisha mostly Arabica Coffee is grown.

**Sugarcane:** India is the second largest sugarcane producing country after Brazil. Largest sugarcane producing state of India is Uttar Pradesh, which has 38.61 percent share in overall sugarcane production as per 2013-14 figures. The second and third largest states are Maharashtra and Karnataka. Other main sugarcane producing states of India include Bihar, Assam, Haryana, Gujarat, Andhra Pradesh and Tamil Nadu. In India, sugarcane is produced in both tropical and subtropical regions. Productivity of sugarcane is higher in Maharashtra and Gujarat in comparison to other areas. Flat, plain and level plateau is an advantage for sugarcane cultivation because it facilitates irrigation and transportation of cane to the sugar mills. Sugarcane cultivation requires heavy manures and fertilizers because it exhausts the fertility of soils quickly and extensively. Sugarcane is Labour oriented crop and needs cheap labour.

IV. RESULT AND DISCUSSION

**Unit Root Test**

The Augmented Dickey Fuller Test (ADF) is used to test for stationarity of the time series data. Here,
1. If the absolute value of the ADF is less than the absolute critical value, the test accepts the null hypothesis that the variable is not stationary.

2. If the calculated ADF test statistic is greater than the critical t-values, then the null hypothesis will be rejected and the variables are stationary. The Unit Root tests have conducted on the 6 variables which are presented in the Table-1.

Table-1 Summary of Test Root Result

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADF Test</th>
<th>Order of Integration</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>2.233060</td>
<td>1</td>
<td>Stationary</td>
</tr>
<tr>
<td>Cereals</td>
<td>-0.251264</td>
<td>1</td>
<td>Stationary</td>
</tr>
<tr>
<td>Tobacco</td>
<td>-2.282324</td>
<td>1</td>
<td>Stationary</td>
</tr>
<tr>
<td>Tea</td>
<td>0.126104</td>
<td>1</td>
<td>Stationary</td>
</tr>
<tr>
<td>Coffee</td>
<td>-1.651380</td>
<td>1</td>
<td>Stationary</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>-1.580583</td>
<td>1</td>
<td>Stationary</td>
</tr>
</tbody>
</table>

This table examined that the first difference of GDP, cereals, tobacco, tea, coffee and sugarcane productions become stationary at 99 percent level of confidence.

**Johansen Co-Integration Test**

Table-2 represents the series for all the variables in the model used have tested for co-integration using the maximum Eigen value test. Here, the maximum eigen value test indicates that there are 4 cointegrating variables. It indicates that the GDP and the explanatory variables are co-integrated at 95 percent level of confidence.

<table>
<thead>
<tr>
<th>Hypothesised No. of CE (s)</th>
<th>Eigen value</th>
<th>Trace Statistic</th>
<th>0.05 Critical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0.999705</td>
<td>276.9791</td>
<td>95.75366</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.940453</td>
<td>122.5404</td>
<td>69.81889</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.863410</td>
<td>68.94157</td>
<td>47.85613</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.620315</td>
<td>31.11689</td>
<td>29.79707</td>
</tr>
<tr>
<td>At most 4</td>
<td>0.486182</td>
<td>12.71704</td>
<td>15.49471</td>
</tr>
<tr>
<td>At most 5</td>
<td>0.003426</td>
<td>0.065199</td>
<td>3.841466</td>
</tr>
</tbody>
</table>

Key: Max. Eigen value test indicates 4 co-integrating variables at the 0.05 level.

\( ^*\) denotes rejection of the null hypothesis at the 0.05 level.

**Long Run Relationship**

Table-3 shows the results of long run estimates in which GDP at factor cost is set as the dependent variable and the rest of the variables are defined as the explanatory variables. Both R² and adjusted R² show quite significant outcomes at 75.82 percent and 69.78 percent respectively. The adjusted R² of 0.697805 implies that about 69 percent of the variations in GDP are explained by the explanatory variables (cereals, tobacco, tea, coffee and sugarcane).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistics</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.0144871</td>
<td>0.020468</td>
<td>-0.7077822</td>
<td>0.4858</td>
</tr>
<tr>
<td>LOG CEREALS</td>
<td>0.079495</td>
<td>0.083905</td>
<td>0.93215</td>
<td>0.3858</td>
</tr>
<tr>
<td>LOG TOBACCO</td>
<td>0.000615</td>
<td>0.023364</td>
<td>0.026316</td>
<td>0.9794</td>
</tr>
<tr>
<td>LOG TEA</td>
<td>0.0512184</td>
<td>0.067804</td>
<td>7.553849</td>
<td>0.0000</td>
</tr>
<tr>
<td>LOG COFFEE</td>
<td>-0.014425</td>
<td>0.039115</td>
<td>-0.368776</td>
<td>0.7174</td>
</tr>
<tr>
<td>LOG SUGARCANE</td>
<td>-0.000771</td>
<td>0.043764</td>
<td>-0.017617</td>
<td>0.9862</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.758244</td>
<td>Mean Dependent Var.</td>
<td>1.000000</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-Squared</td>
<td>0.697805</td>
<td>Sum Squared Resid</td>
<td>0.008130</td>
<td></td>
</tr>
<tr>
<td>S.E. of Regression</td>
<td>0.000991</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durbin-Watson Stat.</td>
<td>1.763470</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Here,  
\( ^*\) (P<0.10) = 10 percent significance level  
\( ^*\) (P<0.05) = 5 percent significance level  
\( ^*\) (P<0.01) = 1 percent significance level

The figure 1.763470 of the Durbin-Watson Statistic (1.5 < DW < 2.5) is close to the optimum level of 2 and shows that there is no autocorrelation between GDP and the explanatory variables. There is a positive relationship between GDP and tea production. The coefficient of 0.512184 indicates that for every one percent increase tea production, GDP increases by 51.21 percent on an average. This is because tea is a high value plantation crop which is produced in different states spreading over North East to South of the country. It is found that the contribution of tea is significant at 1% level of significance.

The results also show that there is a positive relationship between GDP and cereals as denoted by a coefficient of 0.074945. However, it is statistically insignificant in explaining variations in GDP. It is also found that tobacco is having a
positive contribution towards GDP but that contribution is not statistically significant. There is an inverse relationship between GDP and coffee production as denoted by a coefficient is -0.014425. This is due to fluctuating production accounted by unfavourable weather causing delayed blossom and backing shower and high temperature in major coffee producing areas of Kerala and Karnataka. Even though these areas have irrigation facilities for a good harvest of coffee there is an absence of subsequent natural showers has reduced the coffee production in recent years. It is a curse of climate change.

In the case of sugar cane, there is an inverse relationship with GDP as denoted by a coefficient is -0.000771 which indicates that for every unit increase in production of sugarcane results in a decrease in the GDP but not significantly because of labour intensity and done by large. This may be attributed to reduction of area under sugarcane cultivation, the low price of sugarcane and absence of an organised base of information coupled with presence of absentee large farmers which discourage the sugarcane production. Insufficient irrigation is another cause.

**V. CONCLUSION**

Keeping in view the importance of agriculture in the life of Indians, it is highly imperative that crop production should increase and start contributing significantly to the GDP of the country. It is evident from the study that tea is contributing significantly towards GDP growth so its cultivation is to be given ample importance. However as cereal has a different type of importance being the staple food of majority of Indians and also because of its positive contribution to GDP, thrust need be given to improve its productivity and production.

Following are some suggestions that we would like to make.

a. Farmers need be given training regarding the use of modern techniques of cropping so that the productivity can be enhanced through attainment of resource use efficiency. Their work should also be regularly monitored.

b. Irrigation facilities need to be improved with a view to protecting the crops from the vagaries of nature.

c. Adequate credit and insurance facilities are to be provided to encourage farmers to improve farming activities.

d. Storage and marketing facilities should be made available to prevent distress sale which has a disincentive effect on agricultural production.

e. Farmers should be encouraged to produce high quality products that will fetch a good price in the market. Also they should be assured of fair prices for their products.

f. Conversion of fertile agricultural land into homestead and industrial land should be minimised.

No doubt Indian Government is taking different initiatives to protect the interest of the farmers. Still sincerity from each and every stakeholder starting from planners, executors to farmers in achieving the goal is highly necessary.

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