THE CAUSAL RELATIONSHIP BETWEEN AGRICULTURE EXPORTS AND AGRICULTURE GROWTH IN INDIA

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Abstract

This study examines the causal relationship between agriculture exports and agriculture growth in India. For the purpose of analysis, the study employed a variety of analytical tools, including unit root tests, Cointegration analysis and Granger causality test with VECM. The study sets three hypotheses for testing the causality and cointegration for India, (1) Accepted the first null hypothesis, (2) Accepted the second null hypothesis, (3) Rejected the third null hypothesis. The Granger causality test indicates that there is unidirectional causal relationship running from agriculture exports to agriculture growth in long-run, but not in short-run. This has important macroeconomic implications, since any economic policy which affects on one of these sectors will also have an impact on another sector in the long run. In view of above, identification of causality can help policy makers to design such policies which contribute to the economic growth of India, which could further promote international trade to achieve the higher level of economic growth.

Keywords: *Agriculture, Gross Domestic Product, Augmented Dickey-Fuller, Vector Error Correction Model*

Introduction

Agriculture sector continues to hold a prominent place in the Indian economy. It contributes 25 percent to the national income and is a source of employment to nearly 60 per cent of the rural labour force. Implementation of liberal macroeconomic policies from the early nineties has brought agriculture to the forefront, as India possesses comparative advantage in many commodities. The policy reforms assure accelerated rate of growth of agriculture through reduction in protection to industry, currency devaluation and alterations in distortionary trade and price policies. The performance of agriculture is seen in terms of responsiveness of crop acreage/supply to price incentives attributable to trade Liberalization, acceleration in exports and output growth. Agriculture in India helps to ameliorate the conditions of those who belong to the lowest rungs of the social and economic strata. It softens the harsh edge of extreme poverty and plays an important role in improving the health and nutrition of the India's rural masses. By providing income and upholding the human right to food, farming establishes a resilient rural sector as a basis for a relatively egalitarian distribution of income and production.

As a matter of fact, the sustained and accelerated development of agriculture in India is the key to the acceleration in tempo of its economic growth, equity and a significant dent in poverty and hunger. Janvry and Sadoulet report that there is an overwhelming body of evidence which shows that in India, a one percentage growth in agriculture is at least two to three times more effective in eliminating poverty than the same growth originating from the non-agriculture sectors. Hence, the growth in the agricultural sector remains a 'necessary condition' for the inclusive growth as envisioned in the approach paper for the India's 12th Five-Year Plan, with an appropriate title: "Faster, Sustainable and More Inclusive Growth". As such, the agricultural sector and its future growth potential hold a critical value for the Indian economy.

In the era of trade liberalization, globalization and the World Trade Organization regime, India's agriculture trade has undergone some noteworthy changes. The overwhelming importance of agriculture in the Indian economy has led to an intensive investigation of the drivers of its growth. From the relevant literature, it has been observed that there are some studies, which examine the role of the farm inputs management, marketing, institutions, irrigation, seeds, fertilizers, credit, investment, technology, productivity, climate change, cropping intensity, post harvest management, value addition, and extension services, etc., to call for the increasing agricultural growth rate. However, there is a dearth of empirical studies to examine the casual linkage between farm exports and agricultural growth in India. The study is undertaken to fill up this important gap in the literature and to make a quantitative contribution in the field of the objective assessment of the farm export liberalization for agricultural growth in India.

A survey of literature on the export-led growth hypothesis indicates that there are four main explanations for the relationship between exports and gross domestic product. These theoretical underpinnings are: (1) following short-run Keynesian arguments, the export growth leads to the income growth via the foreign trade multiplier, (2) the foreign exchange from exports can be used to finance the imported manufactured and capital goods and technology, which contribute to growth, (3) competition leads to the scale economies, the technological advance and growth, and (4) following endogenous growth theory, the export sector creates positive externalities, such as more efficient production methods, which lead to growth. During the last four decades, in average, agricultural exports accounted for 20 per cent of India's total merchandise exports. As agricultural exports are a substantial proportion of the total merchandise exports in India, it is perhaps reasonable to assume that agricultural exports cause the GDP of agriculture also. The establishment of the causal link between agricultural exports (AGRI) and GDP of agriculture (AGDP) has important implications for India's agricultural development strategies. If agricultural exports cause agricultural growth ($X \rightarrow G$), then the outward looking strategy is appropriate for the country. But if the causative process runs in the opposite direction ($G \rightarrow X$), then the inward looking may be useful for the country. A bi-directional causality between the agricultural export and agricultural growth ($X \leftrightarrow G$) would imply that one reinforces the other. Even in the situation of the feedback type relationship, restrictions on the agricultural export may impede the agricultural growth. It is, therefore, imperative to understand the dynamics of the causality between the India's agricultural exports and agricultural growth. Against this backdrop, the main objective of the study is to investigate the causal linkage between the agricultural exports and the GDP of agriculture in India.

Methodology

The study is based on secondary data only. The secondary data have been collected from Hand Book of Statistics on Indian Economy and Published by RBI.

Tools for Analysis

The secondary data is meaningfully analyzed by using econometrical tools such as Granger Causality Test. Three methods are Unit Root Test, Johansen's Cointegration Test and Vector Error Correction Model. Analysis has been done by using E-views 7 and MS-Excel.

Period of the Study

The period of the study taken up for the analysis was a period of 36 years, from the year 1980-81 to that of the year 2015-16.

Hypotheses

The study is based on three hypotheses for testing the causality and cointegration for India, which are as follows:

1. H_0: There is no bidirectional causality between GDP of agriculture and agricultural exports.
2. H_0: There is no unidirectional causality between GDP of agriculture and agricultural exports.
3. H_0: There exists no long run relationship between GDP of agriculture and agricultural exports.

Mathematical Background and Overview of Techniques

Test for stationarity

Unit root test

Time series analysis is about the identification, estimation and diagnostic checking of stationary time series.

Definition: The sequence yt is said to be covariance stationary if for all t and t - s

$E(y_t) = E(y_s) = \mu$

$E(y_t - \mu)^2 = E(y_{t-s} - \mu)^2 = \sigma$

$E(y_t - \mu)(y_{t-s} - \mu) = E(y_{t-j} - \mu)(y_{t-j-s} - \mu) = \Upsilon^2$

The Augmented Dickey-Fuller Test for Unit Roots

Dickey and Fuller (1979, 1981) devised a procedure to formally test for the presence of a unit root. The Augmented Dickey-Fuller test simply includes AR (p) terms of the Xt term in the three alternative models. Therefore we have:

$$\Delta X_t = \gamma Y_{t-1} + \sum_{I=1}^{P} \beta_I \Delta X_{t-1} + \varepsilon_t$$

Cointegration Tests

Johansen Test

This test permits more than one cointegrating relationship so is more generally applicable than the Engle Granger test which is based on the Dickey Fuller (or the augmented) test for unit roots in the residuals from a single (estimated) cointegrating relationship. In fact, Johansens procedure is nothing more than a multivariate generalisation of the Dickey-Fuller test. Consequently, he proposes two different likelihood ratio tests namely

- The trace test
- Maximum eigenvalue test

Johansen's method takes as a starting point the vector auto regression (VAR) of order p given by

$X_t = \Pi_1 X_{t-1} + \Pi_2 X_{t-1} + u_t$

where Xt is an n * 1 vector of variables that are integrated of order one. u_t is an n * 1 vector of innovations while Π_1 through Πp are m*n coefficient matrices.

Trace test

The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The test statistic is given by

$$\tau_{trace} = -T \sum_{i=r+1}^{k} \ln(1-\lambda_i)$$

Maximum eigenvalue test

The maximum eigenvalue test, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of (r + 1) cointegrating vectors. Its test statistic is given by

$$\tau_{trace} = -T(-\lambda r) + 1$$

Where T is the sample size, and λ_i is the i^{th} largest canonical correlation.

Causality Tests

Granger Causality Test

Granger pointed out that if a pair of time series is cointegrated, then there must be causation in at least one direction. According to the Granger causality (Granger, 1969) approach a variable Y is caused by X, if Y can be predicted better from past values of Y and X, than from past values of Y alone. Moreover X 'Granger causes' Y if past values of X can help explain Y. If Granger causality holds this does not guarantee that X causes Y. But, it suggests that X might be causing Y. Four patterns of causality can be distinguished:

- unidirectional causality from X to Y;
- unidirectional causality from Y to X;
- feedback or bi-directional causality; and
- no causality.

For a simple bivariate model, the pattern of causality can be identified by estimating regression of Y and X on all the relevant variables including the current and past values of X and Y respectively and by testing the appropriate hypothesis. The causal relations between stationary series xt and yt can be established based on the following equations:

$$\Delta X_t = \alpha_0 + \lambda_1 EC^1{}_{t-1} + \sum_{i-1}^{m} \alpha_i \Delta X_{t-i} + \sum_{j=1}^{n} \alpha_j \Delta Y_{t-j} + \varepsilon_{1t}$$

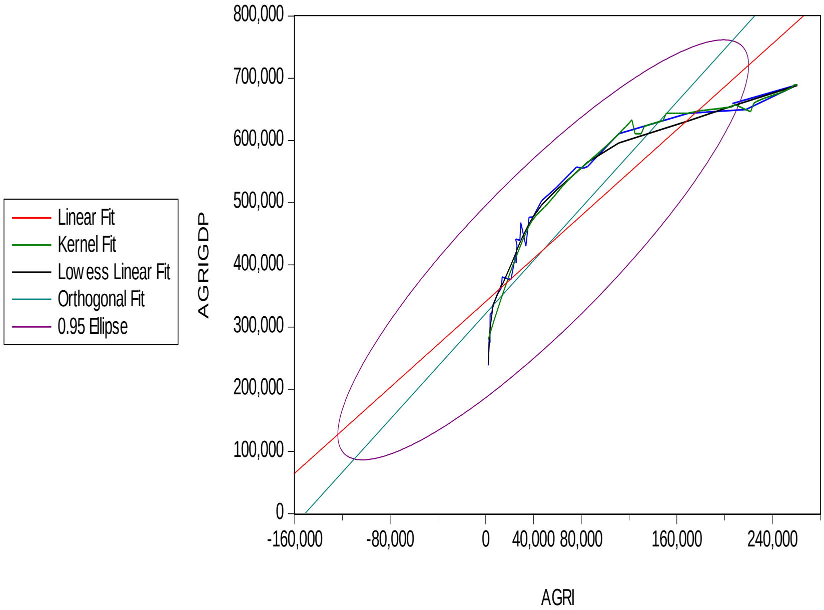
$$\Delta Y_t = \beta_0 + \lambda_2 EC^2{}_{t-1} + \sum_{i-1}^{m} \beta_i \Delta Y_{t-i} + \sum_{j=1}^{n} \beta_j \Delta X_{t-j} + \varepsilon_{2t}$$

Where Δ is the first difference operator; EC_{t-1} is the error correction term lagged one period; λ is the short-run coefficient of the error correction term ($-1 < \lambda < 0$); and ε is the white noise. The error correction coefficient (λ) is very vital in this error correction estimation as the greater coefficient indicates higher speed of adjustment of the model from the short-run to the long-run. Sometimes we check for Granger causality simply (albeit imperfectly) using only t-tests. The P-values for the t-states on individual coefficients can be used to determine whether Granger causality is present.

Result Analysis

Graphical Method

Graphical presentation of data is very useful to identify the trend and underlying relationship between the variables. The Linear Fit, Kernel Fit, Nearest Neighbor Fit, Orthogonal Fit and Confidence ellipse graphs show that not strong positive relationship between Agriculture Exports and Agriculture Growth. Also show Agriculture Exports and Agriculture Growth series are not highly correlated.



Unit Root Test Results

To empirically analyse the GDP of agriculture – agricultural exports relationship in India, the present study primarily tested the stationarity of the selected time series data for which unvariate Augmented Dickey – Fuller test have been conducted and its results are presented in Table-1.

Table-1

Unit Root Test

LnAGDP	t-Statistic	Prob.*	LnAGRI	t-Statistic	Prob.*
ADF test statistic	-10.099	0.000	ADF test statistic	-5.237	0.000
Critical values: 1% level 5% level 10% level	-3.646 -2.954 -2.615		Critical values: 1% level 5% level 10% level	-3.646 -2.954 -2.615	

Source: Author's own calculation.

*Mackinnon (1996) one side p – values.

The unit root tests reveals that the GDP of agriculture and agricultural exports series are found to be stationary at first order level and integrated at the order of I (1).

Johansen's Cointegration Test Results

Johansen's Cointegration test is performed to examine the long-run relationship between GDP of agriculture and agricultural exports and its results are presented in Table-2&3.

Table 2
Unrestricted Cointegration Rank Test (Trace)

Cointegration Equation	Eigenvalue	Trace statistics	5% critical value	Probability **
None* At Most 1	0.258 0.003	9.981 0.125	15.494 3.841	0.282 0.723

Trace test indicates no cointegrating equations at the 0.05 level.
*denotes rejection of the hypothesis at the 0.05 level.
**Mackinnon – Haug – Michelis (1999) p – values.

Table 3
Unrestricted Co-integration Rank Test (Maximum Eigen)

Cointegration Equation	Eigenvalue	Max-Eigen statistics	5% critical value	Probability **
None*	0.258	9.856	15.494	0.221
At Most 1	0.003	0.125	3.841	0.723

Source: Author's own calculation.
Max-Eigen value test indicates no cointegrating equations at the 0.05 level.
*denotes rejection of the hypothesis at the 0.05 level.
**Mackinnon – Haug – Michelis (1999) p – values.

Both the tables show that we can't reject the hypothesis of 'no cointegrated equations' at 5 per cent level of significance. So we can conclude that agricultural export is not cointegrated with share's in agriculture GDP, in other words there is no long run relationship between agricultural export and share's in agriculture GDP.

Granger Causality Test Results

The results of Granger Causality test have been presented in table-5.

Table 5
Granger Causality Test

Null Hypothesis	F Statistic	Probability	Decision
LnAGDP does not Granger Cause of LnAGRI	2.496	0.100	Accepted
LnAGRI does not Granger Cause of LnAGDP	0.853	0.436	Accepted

Source: Author's own calculation.

There are two ways in which causality can express itself: through the F-test of joint significance of the lagged differenced terms, and through the error-correction term. The results are reported in Table 5. It can be seen that in this case of India F-statistics are insignificant at 95 per cent level of confidence. Thus, the data suggest that there is no causality in either direction. If one looks at the error-correction terms, they appear insignificant in both equations for India, implying that there is no long term causality runs from agricultural export to exchange rate.

Conclusion

This paper has examined the possibility of Granger causality between the agricultural exports and share's in agriculture GDP in India during 1980-81 to 2014-15. The study findings suggest that agricultural exports and share's in agriculture GDP are not co integrated, so there is no the long run relationship between agricultural export and share's in agriculture GDP. The double steps procedure has evidenced that it can be reasonable to better investigate in the amount of share's in agriculture GDP of predicting short and long term macroeconomic growth. On the other side it can be concluded that the share's in agriculture GDP is not a good indicator for predicting future quantity of agricultural exports. Advanced econometric methodologies have been applied in order to investigate the short- and long-run causality relationship between agricultural exports and share's in agriculture GDP. One of the merits the advocates of depreciation of local currency commonly put forward is its contribution to increase export earnings. In fact in the era of devaluation the authority in India, like in many third world countries, used to place export as one of the foremost reasons of devaluing local currency against US$. For India's agricultural export to be price elastic, policies that help increase the share of domestic goods in exportable commodities by the expansion of production base and that help diversification of the pattern of the export items should be prioritized. However, the impact of exchange rate depreciation might not be same for all sub-sectors of export. This is why the relation of exchange rate with various sub-sectors of export should be analyzed and considered separately. In addition, careful investigation of various incentive options is required to select an effective and pragmatic policy to support export. One policy may not fit all. Moreover, the bad impacts of depreciation on other sectors of economy should also be considered seriously before taking any policy that help depreciation. India's exchange rate policy, which is generally aimed at supporting agricultural exports, will need to be re-evaluated. Exchange rate policy should not aim at export promotion in isolation, instead it should balance both exports and imports growth. This will, in turn, help Indian firms to export more and, more importantly, facilitate firms to achieve a higher level of productivity and efficiency.

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