A Causal Relationship between Agricultural Production and Exports: An Impact on Indian Economy

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Abstract

In this paper, we analyze the impact of agricultural exports and agricultural production on Indian economy, this paper also analyzes the effect of Agricultural production on GDP. Moreover it analyzes the causal relationship between agriculture exports, agricultural production and GDP. Variable which we have taken to fulfill our objective are AP (Agricultural production), AXp (Agricultural Export), GDP (Gross Domestic Product) in which GDP is dependent variable and AP, AXp are independent variables. In order to attain our objective, we will undertake certain methodology in which we will use pair wise granger causality and also use the regression model to find out the impact between the variable. This paper is divided into three parts - first part of the study tries to show the trend between the variable and use CAGR to find out the volume or magnitude between the periods of the study. Secondly, with the help of pair wise granger causality test, we try to show the causal relationship between the variables in order to perform the regression model. Finally, at the end of our study, we have used the regression model to explore the impact of agricultural export on Indian economy.

Keywords: *Agricultural production, agricultural exports, India's GDP.*

Introduction

We live in a country where a large portion of the population reside in rural areas and agriculture employs 60% of the Indian population thus agriculture accounts for substantial share in production as well as exports. In 2005, 70% of all production in India was located in rural areas and keeping this in mind, it is obvious to pose the question that how the conditions in the rural areas affect firms, particularly the production part of the firms which thereby affect the export sector of the economy. One should know that the most important and fundamental aim of the developing countries is rapid economic growth and development and exports are considered as one of the most important tool for attaining economic growth. Indian agriculture has greatly contributed to foreign trade even in its traditional form. Agricultural products have been facing stiff competition from Asian countries for long time. Due to globalization and liberalized regime, this competition is likely to increase further and new initiatives in agriculture development shall have to meet the emerging challenges. The performance of agriculture after amalgamation with the world markets is linked to the success of exports. In its bid to increase overall exports, the government of India has decided to achieve this objective by giving a push to production and export of agricultural commodities. After more than two decades of liberalization it is quite appropriate to talk about the impact of liberalization on Indian Agriculture production, exports and India's GDP. The available literature reveals that economic environment in India has undergone qualitative changes as the 'import substitution inward oriented development strategy' has been replaced with 'export promotion outward oriented strategy' with implementation of economic reforms in agriculture sector. The outward orientation of the economy including that of the agricultural sector leads to higher growth of the economy. On the superiority of the export-promotion strategy over inward looking strategies, the reforms initiated in 1991 facilitated higher exports of a number of commodities. The growth rate of agricultural-export has accelerated from 11.9 percent per annum in 1980s to 18.6 percent during first half of 1990s. While it seemed to be strong initially, there was a significant slowdown in the exports after 1995. During 1996-2000, agricultural exports have in fact shown a negative growth. There is a marked decline in the percentage share of agricultural exports to total exports during1996-97 periods. However in 1996-97 agricultural export of India amounted to 20.40 percent of total exports, in 2000-01, it decline to 14.43 per cent, which further fell to 10.47 percent in 2010-11. During the past five years, agricultural sector has seen a lot of growth and advancement in terms of increased productivity of food grain, oilseeds, cash crops, fruits, vegetables, dairy products etc. India has emerged as the highest producer of milk in the world and second highest in terms of fruits and vegetables. This paper is divided into three sections. Section I is attributed towards showing the trend and growth pattern of agriculture production and agriculture exports with the help of CAGR. It will help us to show whether the growth taking place in the agriculture sector has been positive or negative by taking into account the annual and compound annual growth rates. Section II empirically tests the causal relationship between the three variables, viz, Agriculture Production (AP), Agriculture Exports (AXp) and India's GDP using pair wise Granger causality test, thereby proving the causal relationship between the above

mentioned variables. Test has been conducted between AP and AXp, AXp and India's GDP, and AP and India's GDP. Section III is dedicated towards defining the impact of the two independent variables i.e. AP and AXp on the dependent variable i.e. GDP of India with the help of multiple regression conducted separately on the variables. The future growth in agriculture must come from viz.

- New technologies which are not only "cost effective" but also "in compliance" with natural climatic regime of the country;
- Technologies pertinent to rain-fed areas specifically; Sustained genetic improvements for better seeds and yields;
- Data improvements for better research and sustainable planning;
- Bridging the gap between facts and tradition and
- Proficient management practices and sustainable use of natural resources.

Objectives of the Study

- To find out the trend and magnitude of agriculture productivity and agriculture exports.
- To explore the causal relationship between the variables viz, agriculture production, agriculture exports and the GDP of India.
- To find out the impact of agriculture production and agriculture exports on Indian economy.

Hypothesis of the Study

- H0: There is no significant impact of agriculture exports on India's GDP.
- H0: There is no significant impact of agriculture production on India's GDP.

Data and Methodology

For conducting the study the variable which are included are AP (Agriculture Production), AXp (Agricultural exports) and GDP (Gross Domestic Product) where GDP is dependent variable, AP and AXp are independent variables. In the above variables we will examine the impact of agriculture Production and exports on GDP which is a dependent variable.

Table 1: Trend and Growth pattern of Agriculture Production, Agriculture Exports and India's GDP

YEAR	GDP (at Factor cost)	Agriculture Production	Annual Growth Rate (%)	Agriculture Exports	Annual Growth Rate (%)
1991-92	1367171	390201	-	7838.04	-
1992-93	1440503	416153	6.65	9040.30	15.33
1993-94	1522343	429981	3.32	12586.55	39.22
1994-95	1619694	450258	4.71	13222.76	5.05
1995-96	1737740	447127	-0.69	20397.74	54.26
1996-97	1876319	491484	9.92	24161.29	18.45
1997-98	1957031	478933	-2.55	24832.45	2.77
1998-99	2087827	509203	6.32	25510.64	2.73
1999-00	2254942	522795	2.66	25313.66	-0.77
2000-01	2348481	522755	-0.007	28657.37	13.20
2001-02	2474962	554157	6.00	29728.61	3.73
2002-03	2570935	517559	-6.60	34653.94	16.57
2003-04	2775749	564391	9.04	36415.48	5.08
2004-05	2971464	565426	0.18	41602.65	14.24
2005-06	3253073	594487	5.13	49216.96	18.30
2006-07	3564364	619190	4.15	62411.42	26.80
2007-08	3896636	655080	5.79	79039.52	26.64
2008-09	4158676	655689	0.09	85551.67	8.23
2009-10	4516071	660987	0.80	89341.5	4.42
2010-11	4918533	717814	8.59	117483.6	31.49
2011-12	5247530	753832	5.01	187609.3	59.68
2012-13	5482111	764510	1.41	232041.1	23.68
2013-14	5741791	800548	4.71	268469.1	15.69
CAGR	**6.74%**	**3.32%**		**17.42%**	

The table given above shows the growth pattern of our variables. An increasing trend in all the variables is quite evident, though the rate of growth may differ. As far as GDP and agriculture production is concerned, both of them have seen an average rise of 6.7% and 3.3% respectively. The slow growth in agriculture production may be attributed to the negligence of our policy makers towards this sector. Some years have even seen negative growth which is due to the various factors underlying the production process mainly the traditional processes undertaken by the farmers which still occupies the major portion of this sector. But if we have a look at export growth, it has experienced a high jump of more than 17% in the post-reform era. The reason for such a boost in exports is quite obvious- opening up of the economy. Adoption of the New Economic Policy has given a boost to our export industries which has directly influenced our foreign exchange reserve, thus making way for our country's growth and development.

Table 6: Composite Ranks of Scheduled Commercial Banks

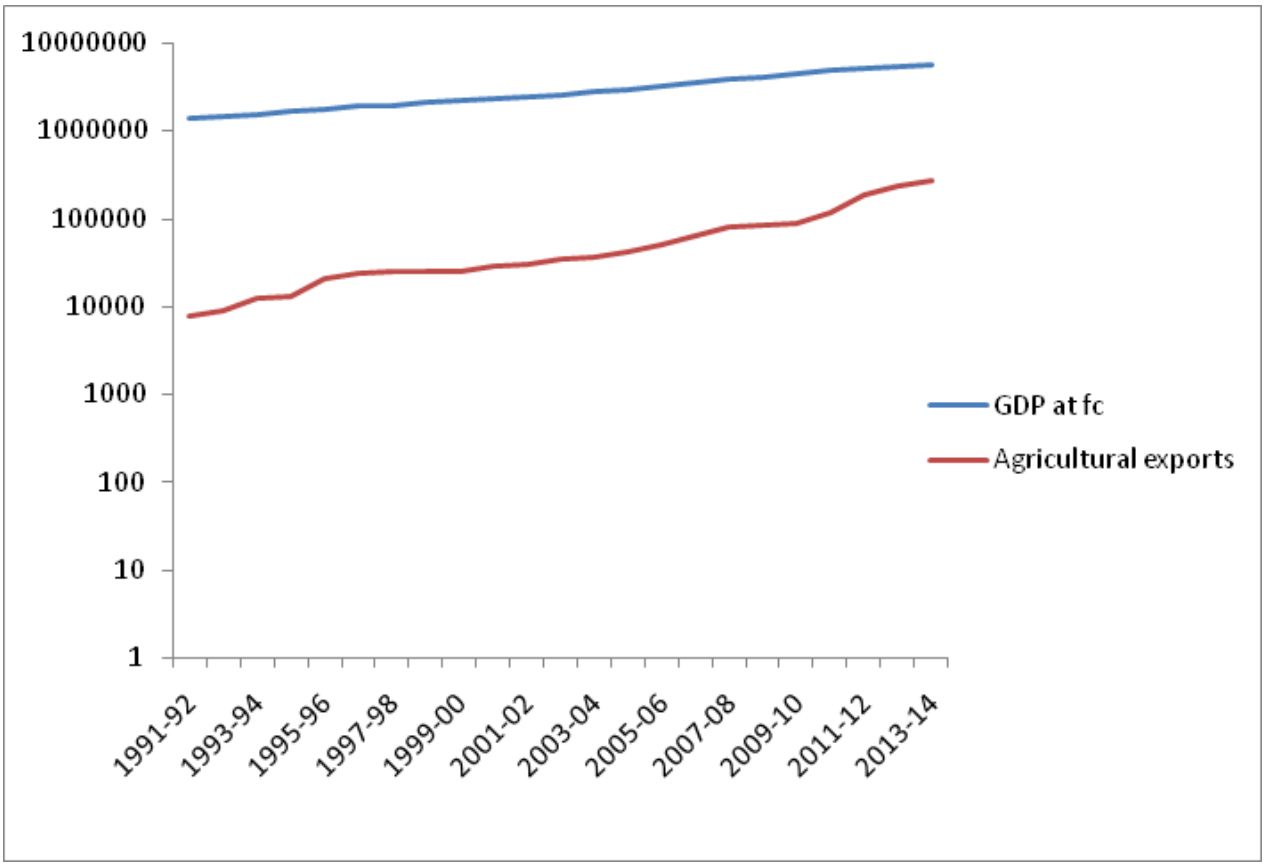


Chart 1 given above shows the trend line of Agriculture exports and GDP. The data values have been converted into log values in order to make the growth pattern clearly visible in the diagram. The positive relationship can be clearly seen between the variables which suggest that increasing amount of Agriculture exports is giving way for country's growth in the form of rising GDP. One more inference can be drawn from the graph that the two lines areslowly and steadily converging in which exports are growing at a higher rate as compared to GDP. So, this paper could serve as a base for other researchers to conduct future forecasting and find out whether this convergence continues or drifts apart. Another point to be mentioned here is that GDP is more or less growing at a constant rate with a nice smooth slope

Chart 2: Trend of GDPand Agricultural Production

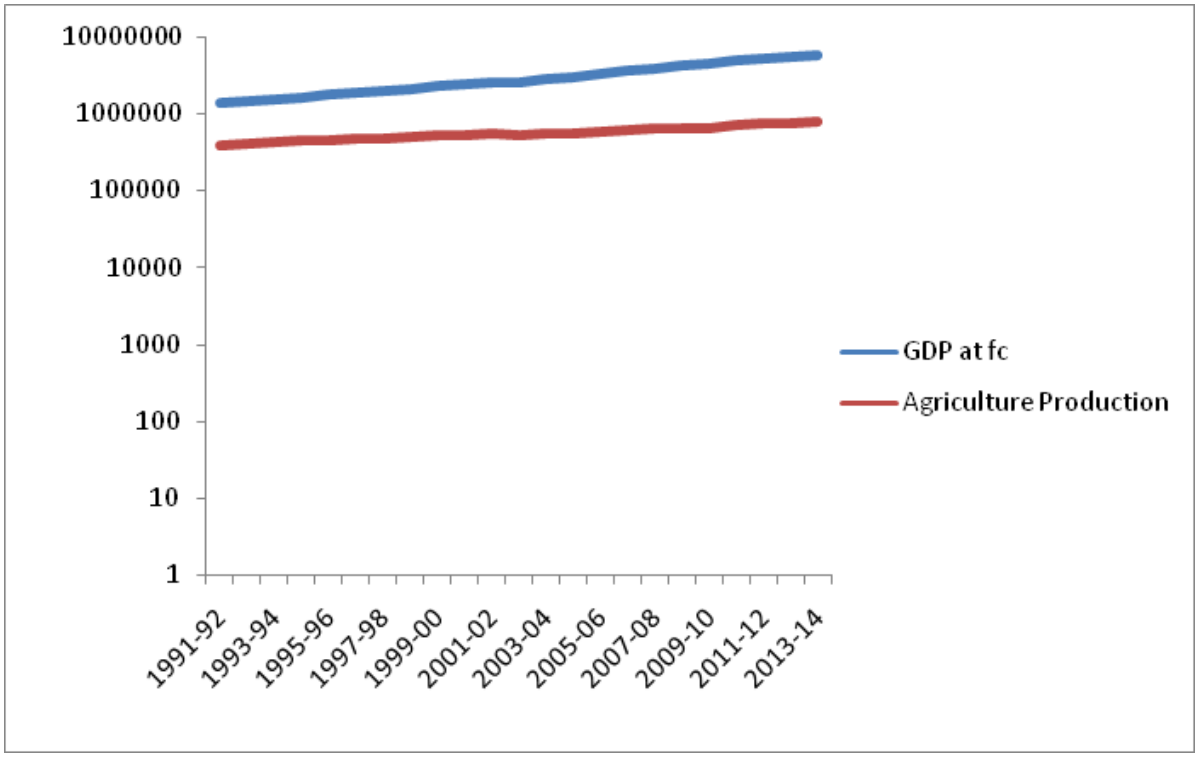
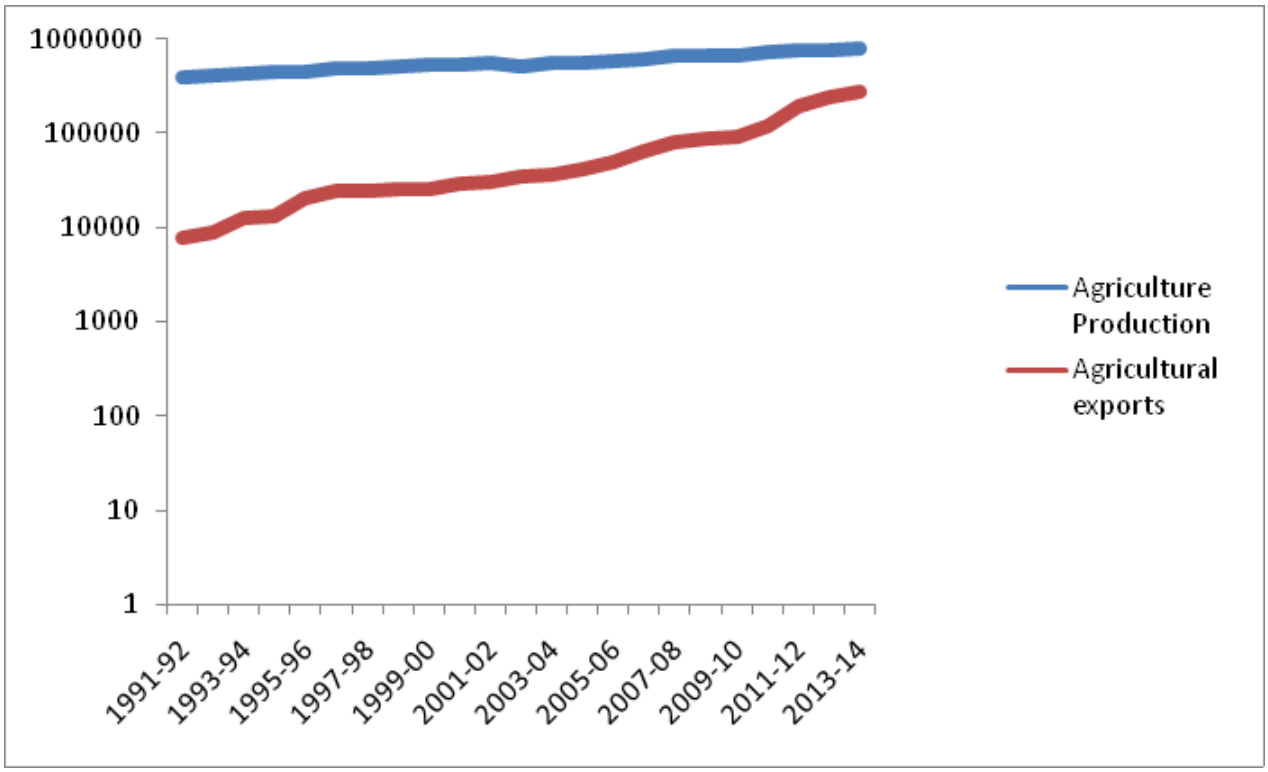


Chart 3: Trend of Agriculture Production and Agriculture Exports



whereas, if we focus on our exports, the growth there have been quite rough with few ups and down but still has made its way up. Next, in chart 2, we have tried to portray the relationship between GDP and Agriculture Production. The two variables are again sharing the positive relationship with huge gap in the growth rate and the gap has been persistent throughout the period of study. Where GDP has shown an average growth of almost 7%, agriculture production grew at less than 4%, infact some years have even seen negative growth. This is a matter of concern that despite agriculture being the dominant sector of Indian economy, still it bears such sluggish growth rate, reason being the ignorance of the policy makers towards this sector. In our opinion, the problem behind such issue may be giving extra importance to the industrial sector and developing it at the cost of our very own agriculture sector. Industrialization is, no doubt, an important tool for development but we should not ignore other sectors in this race. Lastly, chart 3 depicts again a positive relationship between Agriculture production and Agriculture Exports. Whereas AP have seen a nominal growth, AXp have grown rapidly with a growth rate as high as 17%. As we all know, we are discussing post-reform era, therefore such high growth is understandable. Indian economy, after undertaking economic reforms, has seen an upward swing in not only agriculture exports but overall exports of India has also increased to a large extent. As we can see in the graph, the huge gap between the two variables has been converging very rapidly. This implies that the reform which on one hand has elevated the agriculture exports has not been of much importance for agriculture production.

ACausal Relationship betweenthe Variables

There are different types of variables which inter connectedly shows the impact on the Indian economy. Some of the variable has the bilateral relationship whereas some shows the uni directional relationship, in this study we have tried to find out that whether the directional relationship between the variables exist or not and either they have one sided relationship or double sided. This part of the study tries to show the relationship between the variables that we are using in this paper. To find out the causal relationship, we are using three variables in which our first relationship is between the annual agriculture production and gross domestic product, second between the annual agricultural exports and gross domestic product and lastly shows the relationship between the agriculture production and agricultural exports. Actually this part of our paper tries to show the impact of these two independent variables on gross domestic product but it is important to know how these variables are inter-related or we can say that whether our study is going in the right direction or not that will be defined by the use of pair wise granger causality test. The relationship between the variable can easily be seen from the diagram given below:

Chart 4: Relationship between the Variables

With this chart we can easily show the relationship between the variable that have been taken from the Economy. With the given set of data the relationship between the variables is quite clearly visible. There is the impact of agricultural exports on GDP which can be clearly seen from the gear diagram that increase in the agricultural export leads to the increase in the GDP whereas according to our result, the GDP in itself is not capable to gear the agricultural exports in the Indian Economy. By the gear diagram we can effortlessly analyze that both agriculture production and exports seems to gear or say circulate the GDP.

Pair-wise Granger Causality Test

Granger Causality has been conducted to see whether one time series such as variable X is useful for forecasting another variable Y or not. This research will see the causality relationship between Exports AXP with GDP. Secondly research will analyze the causality relationship between Agriculture

Production with GDP and thirdly our research will see the causality relationship between Agriculture Production with Agricultural Exports. Enders have Suggested granger causality test in order to understand that whether the lag value of one variable cause another variable or not. If there are two equation models X and Y having p lags, x is granger cause y if the whole co efficient is not equal to zero. Generally the pair wise granger causality test model in the form of X and Y are:

$$Xt = \beta 0 + \beta 1 Yt-i + \beta 2 Xt-j + u1t$$
$$Yt = \beta 0 + \beta 1 Yt-I + \beta 2 Xt-j + u2t$$

Here we assume that X and Y variables are stationary and we also suppose that the disturbance of U1t and U2t are uncorrelated. The null hypothesis of Granger causality can be expressed as: H0: Y does not Granger, cause, X and vice versa.

Table 2: Result From Pair-Wise Granger Causality Test with Lags 1

Null Hypothesis:	Obs	F-Statistic	P-value
AXP does not Granger Cause AP AP does not Granger Cause AXP	22	0.86389 1.23125	0.364 0.281
GDP does not Granger Cause AP AP does not Granger Cause GDP	22	17.4342 0.92533	0.000 0.348
GDP does not Granger Cause AXP AXP does not Granger Cause GDP	22	2.75658 23.2400	0.113 0.000

Table 3: Result From Pair-Wise Granger Causality Test with Lags 2

Null Hypothesis:	Obs	F-Statistic	P-value
AXP does not Granger Cause AP AP does not Granger Cause AXP	21	0.06611 2.02573	0.9363 0.1644
GDP does not Granger Cause AP AP does not Granger Cause GDP	21	7.42402 8.21293	0.0052 0.0035
GDP does not Granger Cause AXP AXP does not Granger Cause GDP	21	3.23556 6.12380	0.0661 0.0106

Result of the granger causality test has been judged under the 5% level of significance, it means that if the result is less than the 5% level of significance it will lead to rejection of the null hypothesis whereas if our result comes out to be greater than 5% we will accept null hypothesis. Now, we have two results of granger causality test- first one with lag 1 and second one with lags 2. Actually we have an opportunity to conduct the test up to four lags because Akaike Information Criterion and Schwartz Information Criterion suggest us to perform the test within four lags, so our both result is correct but to perform the regression test we have to choose one and which one is best for our analysis depends on the how much relationship we have found to be significant.

The result from the lag 1 shows that most of the null hypothesis seems to be accepted or we can also say that p-value is not significant with 5% level of significance that's why we are not considering this result and the result from the lag 2 are as follows:

- AXp(Agriculture exports) Probability value is 0.9363 which is greater than significant value so null hypothesis is accepted and we may conclude that Agriculture exports does not have affect on the Agriculture production.
- AP(Agricultural production) P-value is 0.1644 which is greater than significant value so null hypothesis is accepted and we may conclude that agriculture production is not a granger cause of agricultural exports.
- GDP (Gross Domestic Product) P-value is 0.0052 which is less than significant value so null hypothesis is rejected and conclude that GDP affect agriculture production.
- AP(Agricultural production)P-value is 0.0035 which is less than significant value so null hypothesis is rejected and can

be concluded that agriculture production affect the GDP

- GDP(Gross Domestic Product)P-value is 0.0661 which is greater than significant value so null hypothesis is accepted and we may conclude that GDP does not affect the agricultural exports
- AXp (Agricultural exports) P-value is 0.0106which is less than significant value so null hypothesis is rejected and we may concluded that agricultural exports affect GDP. If Agricultural exports increase it will have an impact on GDP, Causing increase or decrease in the GDP.

The final result from the pair wise granger causality test shows that there is an impact of Agriculture Production and Agricultural

Exports on India's GDPwithinthe 5% level of significance. Impact of Agriculture Production and Agriculture Exports on GDP

sith the result from the Pair wise granger Causality test we may say that there is the relationship between the variable and we are now able to perform the multiple regression to show the impact of APand AXpon GDP.

Model,

$\ln GDP = \beta 0 + \beta 1 \ln AXp + \beta 2 \ln AP + u1$

Where,

lnAP= Natural Logof Agriculture Production

lnAXp= Natural Logof Agricultural Exports

lnGDP= Natural Logof Gross Domestic Product

U1 and U2 = Error terms

And Coefficient of variable is $\beta 0$, $\beta 1$ and$\beta 2$

Resultfrom Step-wise Regression

Stepwise regression is a semi-automated process of building a model by successively adding or removing variables based on thet-statisticsorfstatisticsoftheirestimatedcoefficients.

Table 4: Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	Lnaxp	.	Stepwise (Criteria: Pro_ba_bil_ity-of-F-to-enter <= .050, Probability-of F to remove >= .100).
2	Lnap	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

Dependent Variable: lngdp

Table 5: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.975	.197		50.632	.000
	lnaxp	.457	.018	.983	24.723	.000
2	(Constant)	12.151	.642		18.914	.000
	lnaxp	.507	.021	1.091	24.499	.000
	lnap	-.206	.059	-.156	-3.496	.002

Dependent Variable: lngdp

Table 6: Excluded Variables

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Lnap	-.156[a]	-3.496	.002	-.616	.520	1.925	.520

Predictors in the Model: (Constant), lnaxp Dependent Variable: lngdp

In this study we use stepwise multiple regression method to find out the independent variables that have the most significant impact on the dependent variable. The time series data that we have used in this regression model have been converted into natural log so as to make the series stationary or normal. From table 4 we can see that both of our independent variable comes under the entered variable with the consideration that f value should be less than 0.05(5%). In table 5 there are two models that

show the significance level of the coefficients, so the result by the step wise regression tries to explore the model that is best fitted to our study. Both the variable that we have taken shows the significance level under the 5%, which means our model is best fitted but if we have a look at the coefficients values of agriculture production and agricultural exports that is -0.206 and 0.507 respectively, we can say that 1 percent increase in the India's Agricultural exports will leads to change in GDP by 0.507. According to the coefficient and significance level this variable clearly shows the impact on GDP whereas the coefficient of agricultural production shows negative impact on the GDP, this means that if there is 1 percent increase in the agriculture production it will lead to change in the GDP by -0.206.But if we see from the first part of our study, the data clearly shows positive trend thus we cannot say that the increase in the agriculture production will lead to negative impact on GDP according to the data. It means that there is a problem in the model that we have not clearly seen. Further the table 6 shows the excluded variable in the model, so with the help of stepwise regression model we easily find out the variable that we exclude from the model. Now, if we compare the result of pair-wise granger causality test and step-wise regression model of the same variable then we can easily analyze that why we use regression after the use of granger causality test because granger causality test shows the relationship between the variable whereas the step-wise-regression model shows the cause and effect that how much the dependent variable is affected by the independent variable and excluding the least effective independent variable from the model. At the end we can say that by the use of stepwise regression model there is the relationship between the variables that we consider in our study and reached to the conclusion that our pre assume null hypothesis are rejected under the 5 percent level of significance, it means that there is the impact of both the variable on GDP.

Conclusion

The above parts of the study tried to explore the impact of agriculture production and exports on Indian Economy. The first part of the paper shows that there is the relationship between the variables which we can see from the diagram, the direction of independent variables is same as the direction of the dependent variable which reveals some type of relationship between the variables in the diagram, so it means that there is the impact of independent variables on GDP. In second part of the study we found that there is the bilateral relationship between the agriculture production and GDP whereas the relationship between the agricultural exports and GDP is uni-directional and we could not find any relationship between the independent variables, which means that by the use of pair-wise granger causality test we are able to say that, there exist some type of relationship in between the dependent and independent variables in the study. Third part of the study also shows the significant impact of the both independent variables on the GDP by the use of regression model but with the use of stepwise regression model we are also able to find out the excluded or entered variable. At the end, we can say that there is the impact of agriculture production and exports on Indian economy.

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