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LINKAGES BETWEEN THE FOOD MANUFACTURING SECTOR AND AGRICULTURAL ALLIED SECTOR OF INDIA

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Abstract:

The purpose of the study is to make a statistical analysis in order to examine the existence of a long-run relationship between the agricultural sector and the Food Processing Industry (FPI) and how this relationship is helpful for sustainable agriculture development of India. In other words, whether, the development of agriculture is linked with the development of FPI or not. The performance of the agriculture sector has been measured by the output of the Agriculture and Allied Sector (AAS), while the performance of FPI has been measured by Net Value Added (NAV) of the FPI at constant prices with the base year 200-05. The figures denote GDP of AAS (A_t) and Net Value Added of FPI (F_t) in billion rupees from 1974-75 to 2019-20.

Keywords: Sustainable Agriculture, Development, Allied Sector, Food Processing Industry.

Introduction: In India, agriculture development itself is a challenge for policy maker, However, sustainable agricultural development is a big challenge. There are two ways to increase the farmer’s income, one is through increasing agricultural production and the second is post-harvest management, value addition in agricultural production. So, for increasing production, farmers exceedingly use pesticides, fertilizers and other natural resources like water and land but excess use of these resources is unfavorable to our sustainable agriculture development. Overutilization of resources leads to lowering fertility of land and the environment, and agricultural land has will get a saturated point. Some area of Panjab, Haryana, West Uttar Pradesh has already gotten the saturated point and so many limitations to increased production. So, in these circumstances, the second option that post-harvest management, value addition and food processing can play a vital to increased farmers’ income, sustainable agriculture development and also helpful for food security. Food Security is big issue in India and postharvest wastage is also a big challenge for food security. In India, around 35 % fruits and vegetables and 15 % of food grains of total production are wasted in every year. So, if we increased former income through post-harvest management, value addition of agricultural and allied products with the protect and preserve the natural resources. The agriculture and agro-based processing industries were a key solution area of our problems relating to insufficient of

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food and value-added food products in India.[1]

One of the most important challenges facing by the country is providing remunerative prices with sustainable agriculture development to the farmer for their produce and consumer without incurring the additional burden of subsidies. This challenge could be addressed if processing level and value addition of the row produce can be enhanced to meet the growing demand for processed foods. Value addition and FPI have an important role to play in linking the Indian agriculture to consumers in the domestic and international markets. The growth and development of agricultural value chains for local and external markets can be considered as a powerful tool for poverty reduction and to fight against the challenge of food security in developing countries like India.[2] Adding value to agricultural products is a valuable endeavor because of the higher returns that come with the investment, the opportunity to open new markets and extend the producer's marketing season as well as the ability to create new recognition for the farm[3]

The literature spot that food and agro-based manufacturing industry help to each other development. The influences of agriculture on industry through three way of linkages-production, demand, and savings. Investment, production linkages, agricultural and industry are linked to each other through the input-output relationship[4]. The agro-industries has acquired new significance in recent years in the wake of growing need of interdependence between agriculture and industry[5].

It becomes important to study inter-linkages between the FPI and agriculture sector of the India. So that positive growth impulses on the rise between these two sectors could be identified and fostered to sustain the development of agriculture sector. The present study has examined and analyses inter-sectoral linkages between the FPI and AAS of the India by the econometric exercises Johnson co-integration test. The research objectives of the study is to make a statistical analysis in order to examining the existence of a long-run relationship between agriculture sector and FPI. In other worlds whether, the development of agriculture is linked with the development of FPI or not. The performance of agriculture sector has been measured by the output of AAS, while the performance of FPI has been measuring by NAV of the FPI at constant prices with base year 2011-12. The figures denote GDP of AAS (A_t) and Net Value Added of FPI (F_t) in billion rupees from 1974-75 to 2019-20.

1 Review of Literature: Many authors examine inter-sectoral linkages and structural changes in the Indian economy by the 1-0-model and the econometric exercises using co-integration and state space models such as: S. Uma Devi (1973-74), Rangarajan (1982), Ahluwalia and Ranga Rajan,(1989) Bhauacharya an and Mitra (1990), Ashok Mathur (1990), Bhupat M. Desai

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[5] Thalathi and Naik (2008)

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and N. V. Namboodiri (1992) Hansda (2001), Sastry etal (2003), Bathla (2003). D V S Sastry Balwant Singh. Kaushik Bhattacharya. NK vnnlkrishan (2003),Gunjeet Kaur, Sanjib Berdolol and Ray Rajesh (2007), Dilip Saikia (Dec, 2011), K.J.S Satyasai and K.U Viswanathan (1999). Thus , the existing literature examines the linkages among agriculture, industries, and services sector, however, the researcher didn't find a single study that checks the interdependency and BL&FL between agriculture and FPI in India.

2 Method of Analysis: One of the problems with applying the regression analysis of time series data is that the standard OLS regression procedures can easily lead to an incorrect conclusion. It can be shown that in the cases of time series data, the regression results showed very high and significant values of R-Square and t-values while the variables used in the analysis have no interrelationship. In this phenomenon, the result of OLS estimation will earn spurious regressing, if the variables used in the regression are non-stationary. Hence, researchers should be careful in conducting regression analyses of time series data. Thus, time series data should be tested to check for the behavior of the unit-roots before applying any time series estimation techniques. In the present case, two tests namely 'Augmented Dickey-Fuller (ADF)' and Phillips-Parron Test' has been used for testing the presence of unit roots.

3 Unit Root Tests: It is necessary to carry out a univariate analysis to ensure a stationary co-integration relationship among variables to avoid the problem of spurious regression before employing the Error Correction Model (ECM). The results will have no economic meaning if they are estimated the relationship without identifying the stationary of data. Unit root tests are performed to test the stationary series. The present study employs the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test to check the unit root of time-series yearly data. These tests are performed to the level variables as well as to their first difference in logarithms term of the series for intercept and trend & intercept model.

3.1 Augmented Dickey-Fuller (ADF) Test: Dickey and Fuller extended their test procedure suggesting an augmented version of the test which includes extra lag terms of the dependent variables in order to eliminate auto-correlation. The unit root test actually applied in the present case is the simply Augmented Dickey-Fuller test with the intercept only and with intercept and trend shows in the following equations where 'Y_t' represents a time series.

$$\Delta y_t = \beta_1 + \lambda y_{t-1} + \alpha \Delta y_{t-1} + \mu_t \quad \text{……………...........(1)}$$

$$\Delta y_t = \beta_1 + \beta_2 + \lambda \Delta y_{t-1} + \alpha \Delta y_{t-1} + \mu_t \quad \text{………………………2}$$

Where, it is time period are coefficients

The first equation shows the regression of first difference on logged variables of the time series with intercept (ß1) only while second equation shows the regression of the first difference on

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lagged values of the time series and time (t). The null hypothesis that there is a non-stationary time series:

$$H_0 : \lambda = 0$$

$$H_0 : 0 = \lambda$$

The decision rule is that if the computed absolute value of tau (τ) Statistic is less than the critical t-value, it can be concluded that the time series is stationary. Hence, the time series variable is following stationary behavior.

The result of ADF unit root test pertaining to the time series of the GDP of AAS (At) and FPI (Ft). The test has been conducted for both the model namely, model only with intercept and model with intercept and trend. The table 1 shows that in case at the computed tau (τ) value (-2.613) is greater than the critical value -3.75 or in absolute terms |-2.6131| = 2.613, is less than |-3.75| =3.75. This implies that the null hypothesis, 5=0 cannot be rejected. Hence, it is concluded that, the variable At is non-stationary; it implies that the variable is following non unit root behavior.

Similarly, same procedure has been followed for the model with trend and intercept, the computed tau value (absolute) 3.546 is less than the absolute critical value 4.38 at 1 present level of significance, this is implying that the null hypothesis, S=0, cannot be rejected. Therefore, the series is non-stationary. The result of ADF test explored that the null hypothesis of non-stationary (λ=0) behavior of the variable FPI (Ft) cannot be rejected at one percent level of significance. Thus, it can be concluded that the variable at and Ft are non-stationary series at zero order difference.

Since the variables are non-stationary at zero order difference, the first order difference has been taken. Both the series Ft and At are found to be stationary at 1 percent level of significance. It implies that both the series are integrated order one.

3.2 Phillips-Perron Test: The different between the ADF test and the PP-test lies in the fact the former test considers the case of possible serial correlation in the error terms by adding lagged different terms of the regress, while PP-test use non-parametric statistical methods to assume there is no serial correlation exist in the error term. The empirical results regarding the PP-test are shown in table 2, the simple critical t (tau) values are applicable in the context at of both the models. The table shows that in case of At, the computed tau (τ) values pertaining to 'intercept model', and the 'intercept and trend model' are -2.611 and -4.241 respectively which are greater than the corresponding values of critical tau (τ) values which are -3.75 and -4.38 respectively. Hence, the series is said to be non-stationary.

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In case of the variable Ft, the computed values of tau (τ) for the 'intercept' and 'intercept and trend' model are-2.611 and -3.542 respectively. These values are greater than the corresponding values of critical tau (τ) values which are -3.75 and -4.38 respectively. This shows that the PP test of unit root test confirms that the two series At and Ft are non-stationary.

Similar to the ADF test, the first order difference has been taken for PP test also. Both the series Ft and At are found to be stationary at 1 percent level of significance. It implies that both the series are integrated order one, hence, the time series estimation techniques are applicable.

4 Co-integration Test: As it has been discussed in the Unit root section; regression of a non stationary time-series with another non stationary time series would give spurious results. The estimated results of ADF and PP test also revealed that both the time series At and Ft are stationary at first order differences. There is a possibility that residual of stationary variables may not be following common trend. Hence, it needs to check whether the residual of two variables At and Ft are following common trend or not. Therefore, Jonson co integration estimation has been applied to check whether the variables are co integrated or not. The estimated result presented in Table 3 shows that, there is only one co integration equation exist between At and Ft. The absolute tau value is greater than the critical tau value at the 5 percent level of significance. Hence, there is one co integration equation is exist.

5 Co-integration and Error Correction Mechanism (ECM): We have just conducted a Co-integration test and found that LAt and LFt are Co-integrated time series i.e., there is long-term relationship between these two variables. But it is possible that there is disequilibrium in the short-run. The error term in the regression can be treated as equilibrium error. The ECM was first used by Saran and popularized by Engle and Granger. It corrects for disequilibrium. Granger representation theorem states that, if two variables are Co-integrated be expressed as ECM. The ECM between LAt and LFt can be expressed as

$$DLA_t = \beta 0 + \beta 1 DLF_t + \beta 2 LXV_t - 1$$

Where, DLAt and DLFt are the first differences of LAt and LFt respectively. This is the long values of the error term. The above ECM equation states that DLAt depends on DLFt and also on the equilibrium error term. The error correction coefficient which measures the speed of adjustment to bring back to the equilibrium level. The coefficient of error term is expected to be negative. The table 4 shows the estimates coefficient of the ECM -0.23 is significantly different from zero. The results show that the disequilibrium between two variables adjusts 23.6 percent

Concluding Remarks: The stationary nature of the variables At and Ft was checked with the help of ADF and PP test. The result of ADF and PP explored that both the variables are integrated order one. In case of time series data, variables may individually follow stationary behavior but they might not be having stochastic trends. Hence, to check whether the variables

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At and Ft are co-integrated or not, Jonson co-integration is employed. The co-integration result revealed that the residual of At and Ft are stationary. It means, there is a long run relationship exists between these two variables.

Since the result of Jonson, co-integration confirms the existence of a long-run relationship between two variables ECM model is applied to check the short-run adjustment in these two variables. The ECM coefficient of the variable At is negative and of Ft is positive. The opposite sign of the two variables explains that the equilibrium might be restored when the FPI variable will more rapidly increase than the AAS variable. Moreover, the speed of adjustment in the variable At is 26 percent. It conveys that 26 percent of disequilibrium in At is adjusted by Ft in each period.

Table 1: **Augmented Dickey-Fuller Unit Root Test Results**

Variables	Model	Level	1st Difference
LA_t	Intercept	-0.013	-6.668*
		(-2.613)	(-3.642)
	Trend & Intercept	-3.973*	-6.640
		(-3.646)	(-4.260)
LF_t	Intercept	-1.247	-4.927*
		(-2.613)	(-3.642)
	Trend & Intercept	-3.066	-4.927*
		(-3.646)	(-4.260)

Note: The critical t values for 26 degrees of freedom (which is closest to our sample size) are –3.76 for 'intercept only' and -4.38 for 'intercept and trend' forms of the equation respectively.

* Indicates that data are stationary at 1 percent level of significance.

Table 2: PP Unit Test Results

Variables	Model	Level	1st Difference
LA_t	Intercept	-0.617*	-12.960
		(-2.611)	(-3.636)
	Trend & Intercept	-6.782*	-12.862
		(-4.241)	(-4.260)
LF_t	Intercept	-1.196*	-8.888
		(-2.611)	(-3.636)
	Trend & Intercept	-3.860*	-8.776
		(-3.642)	(-4.260)

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Note: The critical t values for 26 degrees of freedom (which is closest to our sample size) are –3.76 for 'intercept only' and -4.38 for 'intercept and trend' forms of the equation respectively.

* indicates not significantly different from zero at one percent level of significance.

Table 3: **Johansen test for co-integration**

				Number of observation 41 **Number of lag 1**	
Maximum rank	parms	LL	Eigen value	Trace statistics	Critical value at 5 percent
0	0	-416.12			
1	3	-410.98	0.25	17.01	12.53
2	4	-470.61	0.18	6.74	3.84

Table 4: Error Correction Mechanisms (ECM)

Dependent Variable: DLX_t

Included observations: 36 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLF_t	0.08	0.04	1.82	0.07
LAV_{t-1}	-0.23	0.12	-1.89	0.06
C	0.02	0.009	2.41	0.02
R-squared	0.12			

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