

# Co-integration Analysis of Indian Service Sector with Agriculture and Industry

<sup>1</sup>Dinesh Kumar Choudhury, <sup>2</sup>Barun Kumar

<sup>1</sup>Assistant Professor, <sup>2</sup>Consultant, KPMG

<sup>1</sup>Department of Economics,

<sup>1</sup>Sri Sathya Sai Institute of Higher Learning, Anantapur, Andhra Pradesh, India

**Abstract :** This paper makes a comprehensive investigation into India's services sector, the growth engine for the economy over the past 25 years and its interdependence with different sectors. This paper attempts to assess whether or not the services sector in India has acted as engine of growth in its structural transformation and its linkages with different sectors. The paper estimates the linkages between the series of the three broad sectors namely agriculture, Industry and services in India for the duration of 1961-2015. The results derived through Co-integration reveals that the different sectors like agriculture, industry and services have long run relationship together over the selected time period and for this reason, their growth rates are interdependent. The long relationship between agriculture, industry and services shows that the services sector has absolutely contributed to the industrial sector and the actual fact is that services act largely as input to the industrial sector; however the agriculture doesn't absolutely influence services. After the Granger Causality test the results shows that there exists unidirectional relationship from services to industries

**Index Terms -** Service sector, Industry, Agriculture, Time Series, Co-integration, Granger Causality

## I. INTRODUCTION

Service sector is also known as the tertiary sector. The service sector is expanding at faster rate when we compare with the other sectors of the economy. The activities of the service sector begin from the production of goods and service till it reaches the consumer which is the final goal of the services sector. According to the data we see that from last 25 years we have seen the substantial shift from primary (agriculture) to Industry to finally the services. Of course now it has become the largest sector of the economy. Further the services sector can be classified into: Trade, Hotels & Restaurants, Transport, Storage and Communication, Business Services, Insurance and Real Estate, Community, Social and Personal services. The services are major contributor to the Gross Domestic Product. The trade in the services played an important role and the volume of the trade has increased over the time. Because there is increasing growth in the services the global attention got caught if this service sector. As we know that the reforms that took place in Indian economy had made the services to grow to a large extent. Actually the services sector started growing from the mid-1980s but actual growth accelerated from the year 1990s. Growth of the services in the 1990s was mostly due to the growth in the communication services, financial services, and business services (IT) and finally the community services.

The Indian economy has been one in every of the world's star growth performers in recent decades. Growth has been supported by market reforms, immense inflows of FDI, rising interchange reserves, each IT and property boom, and a flourishing capital market. Economic development has traditionally been related to structural changes within the national economies. It has, in fact, most often, been outlined as a method combining economic process with dynamic share of various sectors within the national product and labour force. As economy grows it'll endure some structural changes. The composition of its GDP and structure of employment can change. This has been the expertise of all the developed and developing economies. Structural amendments discuss with change within the structure of the economy. The foremost common structural amendment that had been ascertained traditionally followed a sequence of shift from agriculture to Industry and so to services. Thus, a predominant share of agriculture characterizes underdeveloped economy. With development the share of industry will increase which of agriculture declines, and afterward when reaching high level of development, the service sector will increase in importance, changing into a significant part of the economy. This pattern has not solely been ascertained traditionally, however additionally holds across the countries with completely different levels of development. India greatly lagged behind economically and socially compared to the developed world. An outsized mass of the population was living in difficult conditions. The national government fashioned when independence placed priority on 'economic growth with social justice'. Although the pace of the structural transformation was a lot of or less slow throughout the pre-reform amount, it became speedy when the introduction of latest economic reforms within the decade of the nineties. At the time of independence, Indian economy was preponderantly rural and agricultural. At the start years of the primary Five-year, contribution of the first sector in GDP at issue value was largest followed by tertiary sector and secondary sector. Thereafter, the foremost drive towards diversification and modernization of the Indian economy within the following plans resulted in magnified shares of the secondary and tertiary sectors and declined share of the first sector within the national product. The share of the first sector in GDP at issue value declined from 55.56 percent in 1950-51 to 28.87 percent in 1999-00 whereas share of the secondary sector was 17.11 percent in 1950-51 and magnified to 25.98 percent in 1999-00. Indian economy additionally toughened a significant structural amendment at intervals the commercial sector as a results of the fore-most drive for industrial diversification within the fifties. Whereas the share of the capital product industries and also the basic product

industries within the total industrial worth additional magnified a lot of or less quickly, the share of the buyer product in total industrial worth additional declined significantly over the years.

However, the pace of transition of the Indian economy from agricultural economy to industrial one was quite slow since 1961. It had been within the decade of the eighties the economy emerged from the section of slow rate and speed. Finally, a significant shift within the economic policies within the decade of the nineties accelerated the pace of the structural transformation of the Indian economy and set India on a high growth flight. In terms of average rate, the performance within the nineties was higher than that recorded within the eighties. The commercial and other services sectors registered comparatively high growth rates throughout recent amount, agriculture and allied activities toughened a comparatively low rate of growth as compared to the eighties. This underlines a significant structural shift within the Indian economy in recent years, with economic process changing into a lot of at risk of the performance of business and other service sector.

## II. REVIEW OF LITERATURE

Hirschman, (1958) the concept of sectoral linkage has evolved from Hirschman's theory of 'unbalanced growth'. It provides a major role in guiding strategies for future economic development. The sectors with the highest linkages lead to rapid growth of production, income, and employment.

The trends of services in India's BOP was highlighted by Goud S. Limba (2011) and found that before the economic reforms i.e. ever since independence India has never come across such surplus in services. He also explains the importance of growth in Services balance in curtailing the deficit of India's Balance of Payments. The economic reform which was initiated to overcome the BOP problems has helped a lot to improve the exports of the services. The increase in the export services has helped a lot to curtail its current account deficit, despite of huge trade deficit. The main contribution of the services exports was the strong growth of the software and IT services and the payments was mainly dividends paid on foreign investment and payments on external debt.

Banga and Kumar (2011) explore the role played by the demand side and supply side factors in growth of exports of the exports of services for the period from 1970 to 2008. They expound that most studies show that conventional model of merchandise trade can also be successfully applied to trade in services. On the basis of the exports demand function, the authors undertake a similar exercise for aggregate services exports as well for different kinds of services where real export of services of India to the world are seen to depend on real world income and real effective exchange rate. Income elasticity's of India's export demand for different kinds of services as well as aggregate exports are found to be much higher than the price elasticity's of service exports, emphasizing the importance of world GDP growth on India's export growth of services. With respect to supply side variables, a host of other variables like infrastructure, technological and organizational capacity, level of economic development etc. have also found to influence the trade in services.

Kanwar (2000) examined the cointegration among different sectors of the Indian economy using a multivariate vector autoregressive framework, and estimated the relationship between agriculture and industry through Johansen method. He observed that the agriculture and service sectors significantly affect the process of income generation in the manufacturing sector, but the reverse is not true.

There has been a structural change in sectoral composition of Indian economy from agriculture based economy during 1970s to Service sector based economy since 1990s. According to (Singh, 2007 and Gordon and Gupta, 2004) there is one-way linkage between agriculture and service sector but there is two-way linkage between industry and agriculture and also there is two-way linkage between industry and service sector. The level of linkage between industry and service sector is higher compared to the linkage between agriculture and service sector. Moreover, Service sector has strong backward linkage with agriculture and industry compared to the forward linkage.

G. Ramakrishna (2010) examined that service sector has led to the growth of Indian economy. Agriculture, industry and open liberalization policies of 1990s also impacted India's economic growth positively but the contribution of service sector is more in the economic growth of India. Income elasticity of demand and growth of sectors like telecommunication, banking and finance, trade and business has led to the growth of service sector

Dilip Saikia (2011) examined the inter-sectoral linkage among three major sectors-agriculture, industry and service sector of Indian economy employing input-output framework. He observed that inter-sectoral linkages have been experiencing structural changes during the pre and post reform period in India. He also observed that agriculture-industry linkage has declined over the years as both production and demand linkage which were primarily from industry to agriculture changed to agriculture to industry from pre-reform period to post reform period. Furthermore, industry has strong linkage with service sector from both production and demand sides while agriculture's linkage with service sector is very weak from both demand and production side and it has declined in post reform period.

Singh and Kaur (2014) examined the determinants of growth of services sector in India by using VAR methodology for time-series data from 2000-01 to 2012-13. He observed that the share of service sector in total GDP has increased over the years because of growth of per capita GNP. Growth of service sector has been primarily due to increase in FDI in Telecommunications, Construction and Hotels and Restaurants. Domestic investment and open policy have also led to the positive effect on the share of services sector in GDP but the effect of net FDI inflows is negative and insignificant as increase of FDI inflows in manufacturing sector reduce the share of services sector in total proportion.

### III. DATA AND METHODOLOGY

#### 3.1 Data

The study uses the annual series during the period 1960-1961 to 2015-2016. The variables used in the study are Gross Domestic Product values of agriculture, industry, services.

Data is taken from Hand Book of Statistics on the Indian economy by the Reserve Bank of India (RBI).

#### 3.2 Methodology

We divide this section in four sub-sections: sub-section 1 deals with the univariate unit root test, cointegration is reported in sub-section 2, whereas in sub-section 3, given the results of cointegration test, we present the error-correction models and finally we perform Granger Causality Test.

##### 3.2.1 Univariate Unit Root Tests

To begin with the analysis, we first test the stationarity property of all the series. The univariate unit root tests provide time series information about the stationarity properties of the individual series. We have performed the augmented Dickey-Fuller (ADF) unit root tests. we estimate the following equation

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \delta t + \sum_{k=1}^m \gamma_k \Delta Y_{t-k} + \varepsilon_t \dots\dots\dots (3.1)$$

Where  $Y_t$  is the series in question. Here null hypothesis is presence of unit root. We determine the lag length by following the AIC criteria. We have also included a intercept and trend term in the ADF equation

##### 3.2.2 Cointegration Test

Two series are said to be cointegrated if both the series are integrated of same order and their linear combination is stationary. To test the cointegration, Engle-Granger test is most commonly used. In this test the following regression model is estimated.

$$Y_t = \alpha_t + \beta X_t + u_t \dots\dots\dots (3.2)$$

Where  $\alpha_t$  denotes a deterministic term which may be either an intercept or an intercept and linear trend. In order to determine the potential cointegration, order of integration of estimated residual is analysed using augmented dickey fuller test. If the residuals are stationary then there exists cointegration between the variables.

We apply the cointegration methodology of Johansen and Juselius (1990). These methods have been shown to have sound large and finite-sample properties.

Johansen derives two tests of the hypothesis that there are at most  $r$  cointegrating relationships, namely the maximum eigenvalue statistics and the trace statistics. In case of trace statistics, the null hypothesis that there is at most  $r$  cointegrating relationship is tested against a general alternative that it is greater, whereas in the maximum eigenvalue test the alternative is defined explicitly (at most  $r$  cointegrating relationship is tested against an alternative that it is  $r + 1$ ).

##### 3.2.3 Error-Correction Models (ECM)

If the series are cointegrated, then the relationship between the two can be expressed as ECM to focus on short run dynamics. We can also use the error-correction model to test for the direction of causality either in short run or long run. The error-correction model for the two variables  $Y_t$  &  $X_t$  can be expressed as

$$\Delta Y_t = C_1 + \sum_{i=1}^{k-1} \beta_{11i} \Delta Y_{t-i} + \sum_{i=1}^{k-1} \beta_{12i} \Delta X_{t-i} + \theta_1 ect_{t-1} \dots\dots\dots (3.3)$$

$$\Delta X_t = C_2 + \sum_{i=1}^{k-1} \beta_{21i} \Delta Y_{t-i} + \sum_{i=1}^{k-1} \beta_{22i} \Delta X_{t-i} + \theta_2 ect_{t-1} \dots\dots\dots (3.4)$$

Where  $k$  denotes the lag-length in the original VAR model,  $C_1$  &  $C_2$  are constants,  $ect$  denotes the estimated error-correction term.

##### 3.2.4 Granger Causality test

Finally we perform the Granger causality test where we did not obtain evidence of cointegration. Granger Causality test states that the dependent variable( $Y$ ) is not only influenced by lagged value of it but also lagged values of the independent variable ( $X$ ), then  $X$  cause  $Y$ . On the other hand if  $X$  is influenced by lagged values of  $Y$  in addition to lagged values of  $X$ , then  $Y$  cause  $X$ . If  $X$  causes  $Y$  and  $Y$  causes  $X$  then it is known as bi-directional causal relationship between  $X$  and  $Y$ . Further if  $X$  doesn't cause  $Y$  and  $Y$  doesn't cause  $X$  then it is known as an independent relationship between  $X$  and  $Y$ .

### IV. EMPIRICAL ANALYSIS

In order to find out the long run relationship between the sectors like Services, Industry, and Agriculture, the following endogenous model is constructed:

- G = g (Ser, Ind, Agr)
- Ser = log of Services GDP
- Ind = log of Industry GDP
- Agr = log of Agriculture GDP

As we all know that the economic reforms in India had played an important role, because of which there were many changes in the Indian economy. The major change or developments as part of the reforms have taken place in the services sector.

Since the services sector got much influenced due to the reforms, here in our empirical analysis is we want to assess that how far this services sector production has affected or influenced by the other sectors. The other sectors are like Industry and Agriculture.

Table 4.1 Unit root Tests

Variables( Log of Series)	At Levels	1st Difference
Agriculture	0.951	0.0000***
Industry	0.925	0.0000***
Services	0.9965	0.0005***

Note: - The values which we are seen with \*\*\* indicates that values are significant at 1 percent level of significance

From the above table we can see the unit root tests for all the three variables i.e. Agriculture, Industry, and Services. We can see the test statistics for the three variables. From the table we can see that the three series are non-stationary at levels. According to the theory we know that for the co-integration method we should have I (1). Since the null hypothesis of unit root could not be rejected for the all the three series (Agri, Ind, Ser). Therefore the first difference is taken for each of the series, where they are found stationary. Thus we can proceed for the further analysis.

Table 4.2 Results of Co-integration Tests for Services, Industry and Agriculture

Ho	H1	Trace Test Statistics	95 Percent Critical	Decision
$r_0$	$r=1$	40.68*	29.79	Reject Ho
$r \leq 1$	$r=2$	15.36	15.49	Accept Ho
$r \leq 2$	$r=3$	1.09	3.84	Accept Ho

After running the Johansson test we found that there exists only one co-integrating vector. The assumption made for our test statistic is the values are of a constant term and a linear trend.

Case 1: From the above table we can see that the value of trace statistics ( $\lambda$  trace) under the null hypothesis  $H_0: r_0$  is 40.68 which is much higher than the corresponding critical value of 29.79. Thus we conclude saying that the null of co-integration is rejected.

Case 2: We can see that the value of trace statistic statistics ( $\lambda$  trace) under the null hypothesis  $H_0: r_1$  is 15.36 which is lower than the corresponding critical value of 15.49. Thus we conclude saying that the null of co-integration is accepted.

Case 3: We can see that the value of trace statistic statistics ( $\lambda$  trace) under the null hypothesis  $H_0: r_2$  is 1.09 which is lower than the corresponding critical value of 3.84. Thus we conclude saying that the null of co-integration is accepted. Therefore we found that there is presence of at most one co-integrating equation.

After testing the co-integration among the variables then we went on to do the long run relationship among the variables and we did the vector error correction model to see whether there exists any short run dynamics among the variables.

For this to be done we had checked the statistical significance for the variables for each vector. Then we also checked the statistical significance of the error correction term for the vector which explains about the long run relationship.

Finally after normalizing with respect to services we got the following long run co-integration relation

$$D(\text{Services}) = 6.99 + 2.88D(\text{Industry}) - 3.49D(\text{Agriculture})$$

(6.84\*) (-4.1\*)

Note: The values in the brackets are the t statistic values and \* denotes that the values are significant at 5 percent level of significance.

From the above long run co-integration equation we can see that there coefficients of services and industry are significant at 5 percent level of significance.

In India in the process of transition, the services sector established a positive relation with the Industry sector and the agriculture had a negative relationship with the services.

From this we conclude that an increase in the Industrial sector will affect the services sector positively.

As we know that according to the theory after running the vector error correction model that at least one of the error correction terms must be negative and significant. If this is seen then the co-integration will hold good.

Table 4.3 Results of VECM for Services, Industry and Agriculture

	D(SER(-1))	D(SER(-2))	D(IND(-1))	D(IND(-2))	D(AGRI(-1))	D(AGRI(-2))	C	ECM(-1)
D(SER)	0.517	0.227	-0.149	-0.042	0.0934	0.0151	0.010537	-0.0538
	(3.373)	(1.382)	(-1.541)	(-0.480)	(1.210)	(0.271)	(2.88085)	(-2.106*)
D(IND)	0.874	-0.366	0.0666	-0.1188	-0.0142	-0.0334	0.01253	0.0093
	(3.339*)	(-1.305)	(0.403)	(-0.784)	(-0.108)	(-0.352)	(2.00841)	(0.21508)
D(AGR)	0.249	-0.7541	0.0011	-0.1361	-0.1321	-0.0991	0.031351	-0.2345
	(0.567)	(-1.603)	(0.004)	(-0.536)	(-0.598)	(-0.6231)	(2.99786)	(-3.208*)

Note: - The values which we are seeing in the brackets are the t statistic values and \* indicates that values are significant at 5 percent level of significance. ECM (-1) is the error correction term

The above table estimates the coefficients attached to ECM(-1) called the speed or loading of the parameter denoted by  $\alpha$  and the coefficients of the ECM 1 and ECM 3 are found to be significant.

We also observe that in the same, the VECM reveals that there exists a highly significant unidirectional relationship between the Industry and services.

We can conclude saying that the services acts as an input to Industrial sector. The positive effect of the services is because of the fact that the increase in demand and supply of Industrial sector. As the results of VECM shows that there exists a positive relationship between Services and Industry, this is also seen when we did the granger causality.

Table 4.4 Granger Causality results

Null Hypothesis	F Statistic	Probability
DIND does not Granger Cause DSER	0.835	0.439
DSER does not Granger Cause DIND	7.069	0.002*
DAGR does not Granger Cause DSER	0.926	0.403
DSER does not Granger Cause DAGR	0.874	0.423
DAGR does not Granger Cause DIND	0.687	0.507
DIND does not Granger Cause DAGR	0.762	0.472

From the results we found that services granger causes Industry.

The services sector has expanded very largely and because of which there is growth in Indian services. These services led growth made all the countries look at our Indian economy for investments. Services sector had benefitted largely the industrial sector in number of ways.

The growth which took place in the Indian services had also effect on the Industrial sector in demand for many manufactured goods such as optical linkages, digital scanners, cell phones, computers etc. Finally, the dual relationship between the services and industry puts an economy on a higher growth.

## V. CONCLUSION

In our empirical analysis we did a detailed study on India's services sector which has become the growth engine for our country compared with other sectors. We attempted to assess whether or not the services sector in India has acted as engine of growth in its structural transformation and its linkages with different sectors and invariably we found that it acted as engine of growth. In the paper we estimated the linkages between the series of the three broad sectors namely, agriculture, Industry, and services, in India for the duration of 1961-2015. The results which we got through a Co-integration and Vector Error Correction method showed that the different sectors like agriculture, Industry and services had long run relationship together over the selected time period and for this reason, their growth rates are interdependent. The long relationship between agriculture, industry and services showed that the services sector has absolutely contributed to the industrial sector and the actual fact is that services acted largely as input to the industrial sector; however the services didn't absolutely influence agriculture. After performing the Granger Causality test the results showed that there exists a unidirectional relationship from services to industries.

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