Intersectoral Linkages in the BRICS

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Abstract
The paper examines the interlinkages among the three sectors (agriculture, industry and services) of the leading emerging economies of the World – BRICS (Brazil, Russia, India, China and South Africa) for the period 1991 to 2013. Methodology used in the study includes panel unit root, panel cointegration, Granger causality test, OLS, FMOLS and DOLS. Findings show that all the three variables are cointegrated and that agricultural sector output and services sector output causes industrial sector output in the long run. Findings reveal that agricultural sector output and industrial sector output causes services sector output in the long run. Additionally short run bidirectional Granger causality is observed between services sector output and industrial sector output as well as between agricultural sector output and services sector output. Short run unidirectional causality is also observed from agricultural sector output to industrial sector output. The study concludes that there is a strong intersectoral linkages in the BRICS which will be helpful in building awareness of each other's economic potential, business environment, legal frameworks and facilitate mutual trade and better sectorial integration.

Keywords: *Intersectoral linkages, Panel Data, Unit Root, Cointegration, Causality*

JEL classifications: O11,C33

Introduction

The BRICS (Brazil, Russia, India, China and South Africa) have acquired a vital role in the world economy as producers of goods and services, receivers of capital and as potential consumer markets. They have been identified as some of the fastest growing countries and the engines of the global recovery process, which very well defines the changed role of these economies. Each of the BRICS countries has multiple and different attributes and thus each has a huge potential to develop. Brazil is extremely rich in its agricultural and industrial products such as coffee, soya beans, sugar cane, iron ore, crude oil etc.Russia is noted for its massive deposits of oil, natural gas, and minerals. India is a strong service provider with a rising manufacturing base, while China is seen as the manufacturing work-shop of the world with a highly skilled workforce and relatively low wage costs. South Africa is the world's largest producer of platinum and chromium and holds the world's largest known reserves of manganese, platinum group metals, chromium, vanadium, and alumino-silicates. South Africa generates 45 per cent of Africa's electricity and the South African power supplier provides the 4th cheapest electricity in the world.

Table 1: Sectoral Value Added (% of GDP) of the BRICS

		1993	1995	2001	2005	2008	2010	2013
Brazil	Agriculture	7.6	5.8	6	5.7	5.9	5.3	5.7
	Industry	41.6	22	26.9	29.3	27.9	28.1	25.0
	Service	50.8	72.2	66.3	65	66.2	66.6	69.3
China	Agriculture	19.7	19.7	14.4	12.2	11.6	10.1	10
	Industry	46.6	40.6	45.2	42.2	42.8	46.7	43.9
	Service	33.7	39.7	40.5	45.6	45.7	43.2	46.1
India	Agriculture	28.7	26.8	22.9	18.9	19.0	18.2	18
	Industry	25.5	23.2	25.1	21	21.0	27.2	30.7
	Service	45.8	50	52	60	60.0	54.6	51.3
Russia	Agriculture	8.3	7.6	6.6	5.4	4.9	3.9	3.9
	Industry	44.6	27.9	35.7	32.9	29.7	34.7	36.3
	Service	47.1	64.6	57.7	61.6	65.6	61.4	59.8
South Africa	Agriculture	4.2	3.9	3.5	2.7	3.2	2.6	2.3
	Industry	35.5	34.8	32.4	31.2	32.5	30.2	29.9
	Service	60.3	61.3	64.1	66.2	64.3	67.2	67.8

Source-United Nations System of National Accounts

The output structures in the BRICS economies have changed significantly when compared to previous decades. The declining share of agricultural in their respective GDPs has been a common trend over the years (Table 1). While there has been considerable stability in agricultural growth in Brazil and Russia during 2000–2005 compared to earlier decades, agricultural performance in India and China has shown greater volatility. However, Russia has experienced a decline in share of agriculture from 7.6 per cent in 1995 to 4.9 per cent in 2008, while Brazil’s share remained relatively stable between 1995 and 2008. Another common trend is the rising share of services in BRICS country GDPs since 1990. In China, industry continues to dominate in GDP at around 42.8 per cent in 2008 (around 35.5 per cent in 1990), while the share of services has increased from 38.5 per cent in 1990 to 45.7 per cent in 2008. Agri-business plays a central role in Brazil’s economic development, engaging 35 per cent of its workforce and contributing to almost 42 per cent of its export dollars. Brazilian agriculture has undergone dramatic changes in the past few decades. From a net importer of food grains until the 1970s, Brazil has emerged as the major net exporter of food products. A similar trend is witnessed in the case of India, where the Green Revolution and developments in biotechnology helped the country become self-reliant in food production. With increasing global demand for food and scarcity of arable land in the world, agronomic conditions will enable Brazil to continue its growth and become a larger supplier of agricultural commodities to nations around the world. In China, especially since 1991 with the introduction of the socialist market economy system, many changes in urban areas were ushered in. The share of primary industry rapidly went down, while that of the secondary and tertiary industries increased. In Russia, there are measures to implement the National Project in agro-industrial complex. Among the BRICS, South Africa has the smallest share of agriculture in GDP, at around 3 per cent and its services sector accounts for more than 60 per cent of the total GDP. In terms of the World Economic Forum ranking on global competitiveness 2014-15 (Table 2) China ranks 28 (out of 144 countries) in 2014-15, while the rest of the BRICS economies are placed at 71 (India), 56 (South Africa), 57 (Brazil), and 53 (Russia), respectively. The better rank of China can be attributed to its large market size (2), macro-economic environment (10), and business sophistication (43). The ranks of various indicators of competitiveness suggest that the BRICS have strong and deep markets, which is also evident in the case of South Africa.

Table 2: Rank of Global Competitiveness (GCI) 2014-15

Country	Global Competitive Index	Infrastructure	Macroeconomic Environment	Higher Education and Training	Market size	Business Sophistication
Brazil	57	76	85	41	9	47
Russia	53	39	31	39	7	86
India	71	87	101	93	3	57
China	28	46	10	65	2	43
South Africa	56	69	89	86	25	31

Source- Global Competitiveness Report, 2014-15, World Economic Forum

The shift in climate pattern like variability of rainfall patterns, disruption of hot and cold weather cycles, and others will disproportionately affect developing countries, which have comparably few resources to adequately aggress them. BRICS, especially India will not be able to adapt to that changes. In order to be prepared to respond to such immense sectoral challenges, BRICS must be able to provide a reasonable base of income growth and wealth distribution, food security and employment. The BRICS nation in addition to R&D and innovation share experiences regarding linkages between industry and services sector through exchange of information regarding intellectual property laws which protect IP and at the same time incentivising the adoption and diffusion of new technologies.

The article is an attempt to analyse the trend in sectoral shares in gross domestic product and interlinkages amongst them in the BRICS. Understanding the inter-sectoral linkages could shed important insights on the transition process and help us in understanding if growth in one sector promotes growth in other sectors through some feedback mechanism. This should assist policymakers to identify the optimal policies to accelerate economic growth in the region.

Literature Review

Several analytical and empirical studies have explored the issue of intersectoral linkages but mostly in country specific studies. The present study focuses how the three main sectors, agricultural, industrial and services are interrelated to each other in the BRICS in an attempt to fill the gap in the literature. The basic question is whether structural change in sectorial composition affects economic growth. Hall and Jones (1999) argue that variation in economic growth are primarily due to differences in total factor productivity. Cristina (1997) and Laitner 2000 argued that sectorial composition changes can explain variation of growth across countries through different income elasticities for agriculture, manufacturing and services sector. Among others, Caselli (2005) and Chanda and Dalgaard (2008) provided evidences that changes in the sectoral composition contribute not only to both output growth and productivity growth without any true technological change. Hence sectorial composition and their linkages are important for comprehensive understanding on their effect on economic growth. Here we explore the linkages within the sectors. Agriculture seems to have direct forward linkages to agricultural processing and backward linkages to input-supply industries (Johnston and Mellor, 1961). Bairoch (1973) showed that its agriculture that paved the way for industrial revolutions in England, France, Germany and USA through lowering input and labour prices for industrial employment. Chen (1979) and Timmer (1988) argued that high productivity growth in agriculture was the backbone behind agricultural surplus that helped to finance industry through reduced price of food and wages for industrial employment in Taiwan and South Korea. Green revolution in underdeveloped nations also played some role in industrialization. It supported import substitution industrialization in India (Ahluwalia, 1991) but failure of green revolution led to difficulties to industrialize in Africa (Mellor, 1986). Adelman (1984) and Vogel (1994) highlighted that agriculture's productivity and institutional links with the rest of the economy encourages industrialization though demand incentives (rural household consumer demand) and supply incentives (agricultural goods without rising prices). Gemmell et al., (2000) showed that a significant proportion of manufacturing sector in developing world is either related or depended on agriculture. Stringer (2001) argued that with increased specialism and automation, we expect employment in agricultural sector to decrease as it sheds it load processing, storing, mechanizing, transporting and others with development of manufacturing and service sectors. Development of processing industries may provide forward linkages to agriculture while development of services sector will lead to backward linkages to the agricultural sector. Bhagwati (1984) recognized the linkages between industrial and services sector on the ground that workers will shift from inefficient sectors to service industries. This linkage is driven by effects of concentration of manufacturing at selected locations (economies of scale) that increase the need for distributive services, expansion of financial services, the expansion of government services (police, sanitation, education) and others. Blunch and Verner (2006) examined growth relationship among agriculture, industry and service sectors using cointegration analysis. They found empirical evidence to support a large degree of interdependence in long-run sectoral growth in Africa and concluded that the sectors grow together or there are externalities or spillovers between sectors.

Empirical research on the issue have made useful contributions to understand the associations between different sectors in the economy. However inter sectoral linkages have received attention on some country specific study. Similar studies at the global or regional level have not received comparable attention. We contribute to the literature by focusing on the intersectoral linkages that characterize the economic dynamics of the BRICS.

Empirical Study

Empirical Data

Annual data have been collected from World Bank. The time period of the study is 1991 to 2013. The variables agricultural value added, industry value added and services value added are taken at constant 2005 US$. The variables agricultural value added, industry value added and services value added represent respectively agricultural sector output (AGR), industrial sector output (IND) and services sector output (SER) respectively.

A multivariate model is used to examine the nexus between the three variables. All the variables are initially transformed into natural logs and the panel version of the equation is

$$AGR_{it} = \alpha_{i0} + \alpha_{i1} IND_{it} + \alpha_{i2} SER_{it} + \varepsilon_{it} \quad \text{..} \quad (1)$$

Here subscript i (equation 1) denotes each of the BRICS countries respectively

Panel Unit Root Test

To ascertain the integrational properties of the data series, four types of panel unit root test has been performed at both the level and first difference of the three variables. They are Levin et al. (2002), Im et al. (2003), Fisher type tests using ADF and PP Tests as proposed by Maddala and Wu (1999). We computed the panel unit root test using individual fixed effect as regressors, chose lag difference by the Schwarz criterion. We used bandwidth selection procedure as described in Newey and West (1994). The results for the panel unit root test are presented below:

Table 3: Panel unit root test of AGR, IND and SER

Panel unit root test:						
Automatic lag length selection based on SIC						
Newey-West automatic bandwidth selection and Bartlett kernel						
Balanced observations for each test						
	At Level			**At First Difference**		
Method	**Variable**	**Lag**	**Statistic**	**Variable**	**Lag**	**Statistic**
Levin, Lin & Chu t stat *Null: Unit root (assumes common unit root process)*	AGR	0	6.82406 (1.0000)	D(AGR)	0	-6.76856 (0.0000)
	IND	0	2.08443 (0.9814)	D(IND)	0	-4.52364 (0.0000)
	SER	0	5.43311 (1.0000)	D(SER)	0	-1.54910 (0.0607)
Im, Pesaran and Shin W-stat *Null: Unit root (assumes individual unit root process)*	AGR	0	6.34554 (1.0000)	D(AGR)	0	-9.97257 (0.0000)
	IND	0	3.14114 (0.9992)	D(IND)	0	-4.89902 (0.0000)
	SER	0	6.91183 (1.0000)	D(SER)	0	-1.99007 (0.0233)
ADF - Fisher Chi-square *Null: Unit root (assumes individual unit root process)*	AGR	0	2.51749 (0.9906)	D(AGR)	0	90.7874 (0.0000)
	IND	0	2.06578 (0.9958)	D(IND)	0	45.5711 (0.0000)
	SER	0	0.05033 (1.0000)	D(SER)	0	24.7274 (0.0059)
PP - Fisher Chi-square *Null: Unit root (assumes individual unit root process)*	AGR	0	3.63864 (0.9622)	D(AGR)	0	338.558 (0.0000)
	IND	0	2.47009 (0.9913)	D(IND)	0	49.0981 (0.0000)

	SER	0	0.12032 (1.0000)	D(SER)	0	28.4272 (0.0015)
#Probability values are in parentheses. ##Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.						

Table 3 represents the panel unit root test results, organized both by null hypothesis as well as maintained hypothesis concerning the type of unit root process. The results of Levin et al. (2002), Im et al. (2003) and ADF - Fisher Chi-square and PP - Fisher Chi-square indicate the presence of unit root at level series of all the three variable AGR, IND and SER and thus fail to reject the null of a unit root. Findings of panel unit test performed at the first difference form of all the three variables viz., AGR, IND and SER indicates rejection of the null hypothesis of unit root at 1% level of significance according to ADF - Fisher Chi-square and PP - Fisher Chi-square methods and at 5% level of significance according to Levin et al. (2002), Im et al. (2003) in case of SER, and at 1% level of significance according to Levin et al. (2002), Im et al. (2003) in case of AGR and IND, indicating that all the three variables are stationary at first difference form.

Panel Cointegration Test

With the evidences of existence of a panel unit root we explore whether there exists a long run equilibrium relationship between the variables. Since all the three concerned variables are integrated on order one, we perform cointegration test amongst the variables using Pedroni (1999, 2004), Kao (1999) and Fisher-type test using Johansen Methodology (Maddala and Wu, 1999). Pedroni and Kao tests are based on Engle and Granger (1987) and two step (residual based) cointegration tests. The Fisher test is a combined Johansen test. Seven tests derived for cointegration as per Pedroni (2004) was done that allow for heterogeneous intercepts and trend coefficients across cross-sections. We tested for null hypothesis of no cointegration (i.e., error term from the cointegrating regression is I (1)) against two alternative hypotheses: the homogenous alternative (which Pedroni terms the within dimension test or panel statistics test) and the heterogeneous alternative (referred to as the between dimension or group statistic test). The seven tests include of the panel v-statistic, panel rho statistic, panel PP statistic (non parametric), panel ADF statistic (parametric), group rho statistic, group PP statistic (non parametric), group ADF statistic (parametric). Kao (1999) test follows the same basic approach as the Pedroni tests, but specifies cross section specific intercepts and homogenous coefficients on the first stage regressors. Fisher (1932) derived a combined test that uses the results of the individual independent unit root tests. Maddala and Wu (1999) use Fisher’s (1932) result to propose an alternative approach to test for cointegration in panel data by combining tests for individual cross sections to obtain a test statistic for the full panel.

Table 4: Pedroni Residual Cointegration Test

Pedroni Residual Cointegration Test					
Series: AGR IND SER					
Sample: 1991 2013					
Null Hypothesis: No cointegration					
Automatic lag length selection based on SIC with a max lag of 4					
Newey-West automatic bandwidth selection and Bartlett kernel					
Alternative hypothesis: common AR coefs. (within-dimension)					
				Weighted	
		Statistic	Prob.	Statistic	Prob.
Panel v-Statistic		-0.635525	0.7375	-0.346112	0.6354
Panel rho-Statistic		0.584565	0.7206	-1.157383	0.1236
Panel PP-Statistic		-0.538866	0.2950	-4.490017	0.0000***
Panel ADF-Statistic		-0.457741	0.3236	-2.135703	0.0164***
Alternative hypothesis: individual AR coefs. (between-dimension)					
		Statistic	Prob.		
Group rho-Statistic		-0.576825	0.2820		
Group PP-Statistic		-6.656878	0.0000***		
Group ADF-Statistic		-4.224008	0.0000***		

******,** and * denotes statistical significance at 1%, 5% and 10% level.***

The Pedroni panel cointegration test statistics (Table 4) evaluate the null against both the homogenous and heterogenous alternatives. In this case seven of the eleven statistics do not reject the null hypothesis of no cointegration at the conventional size of .05 Evidence of cointegration is found in Panel ADF statistic, Panel PP statistic , Group PP statistic and Group ADF statistic where the null hypothesis of no cointegration can be rejected at 1% level.

Table 5: Kao Residual Cointegration Test

Kao Residual Cointegration Test				
Series: AGR IND SER				
Sample: 1991 2013				
Null Hypothesis: No cointegration				
Automatic lag length selection based on SIC with a max lag of 5				
Newey-West automatic bandwidth selection and Bartlett kernel				
			t-Statistic	Prob.
ADF			-1.751702	0.0399**
Residual variance			1.01E+19	
HAC variance			1.01E+19	

******,** and * denotes statistical significance at 1%, 5% and 10% level.***

The null hypothesis of no cointegration is rejected at 5% level of significance in Kao's test (Table 5). Here the long run covariance is estimated using the Kernel Estimator.

Table 6: Johansen Fisher Panel Cointegration Test

Series: AGR IND SER				
Sample: 1991 2013				
Lags interval (in first differences): 1 1				
Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)				
Hypothesized	Fisher Stat.*		Fisher Stat.*	
No. of CE(s)	(from trace test)	Prob.	(from max-Eigen test)	Prob.
None	45.21	0.0000	48.16	0.0000***
At most 1	8.047	0.6242	9.239	0.5096
At most 2	4.448	0.9249	4.448	0.9249

**** Probabilities are computed using asymptotic Chi-square distribution.***
*****MacKinnon-Haug-Michelis (1999) p-values***

The results of the Johansen Fisher Panel Cointegration Test (Table 6) indicate that the null hypothesis of zero cointegration vector is rejected at 1% level of significance, which implies that the variables are cointegrated with at least one cointegrating vector.

From the above three tests conducted we can conclude that the variables in our study have a long run relationship amongst themselves.

Panel Granger Causality Test

Now we examine the direction of causality between the variables in a panel context. Engle and Granger (1987) suggested that if two nonstationary variables are cointegrated a VAR in first differences will be misspecified. Therefore, to find a long run equilibrium relationship between AGR, IND and SER, when testing for Granger causality we specify a model with dynamic error correction representation. This means that the traditional Vector Auto Regressive model is augmented with one period lagged error correction term that is obtained from the model based on OLS. The Granger causality test is based on the following regressions:-

$$\Delta AGR_t = \sum_{j=1}^{p-1} \beta_{11} \Delta AGR_{t-j} + \sum_{j=1}^{p-1} \beta_{12} \Delta IND_{t-j} + \sum_{j=1}^{p-1} \beta_{13} \Delta SER_{t-j} + \alpha_1 ECT_{t-1} + \varepsilon_{1t} .....2(a)$$

$$\Delta IND_t = \sum_{j=1}^{p-1} \beta_{21} \Delta IND_{t-j} + \sum_{j=1}^{p-1} \beta_{22} \Delta AGR_{t-j} + \sum_{j=1}^{p-1} \beta_{23} \Delta SER_{t-j} + \alpha_2 ECT_{t-2} + \varepsilon_{2t} .....2(b)$$

$$\Delta SER_t = \sum_{j=1}^{p-1} \beta_{31} \Delta SER_{t-j} + \sum_{j=1}^{p-1} \beta_{32} \Delta AGR_{t-j} + \sum_{j=1}^{p-1} \beta_{33} \Delta IND_{t-j} + \alpha_3 ECT_{t-3} + \varepsilon_{3t} .....2(c)$$

Where Δ is the first difference operator and $\varepsilon_{1t}, \varepsilon_{1t}, \varepsilon_{3t}$ are white noise. Error correction term is denoted by ECT and the order of the VAR is represented by p, which is translated to lag of p-1 in the ECM. α_1, α_2 and α_3 represent the pace of adjustment after AGR, IND and SER deviate from the long run equilibrium in period t-1. The significance of the first differenced variables provides evidence on the direction of short run causality, while the coefficients α_1, α_2

and α_3 are expected to capture the adjustments of the three variables towards long run equilibrium. The optimal lag length is chosen based on Schwarz Information Criteria.

The above equation 2(a) is used to test the causation from industrial sector output and services sector output to agricultural sector output. It all the $\beta_{12}=0$, change in industrial sector output does not Granger cause agricultural sector output. If all the $\beta_{13}=0$, change in services sector output does not Granger cause agricultural sector output. Similarly equation 2(b) is used to test the causality from agricultural sector output and services sector output to industrial sector output. It all the $\beta_{22}=0$, change in agricultural sector output does not Granger cause industrial sector output. If all the $\beta_{23}=0$, change in services sector output does not Granger cause industrial sector output. Similarly equation 2(c) is used to test the causality from agricultural sector output and industrial sector output to services sector output. It all the $\beta_{32}=0$, change in agricultural sector output does not Granger cause services sector output. If all the $\beta_{33}=0$, change in industrial sector output does not Granger cause services sector output. As we use stationary variables for testing causality, a standard F test is used to test the null hypothesis

By testing whether the coefficients of the error correction term in each of the above equations i.e. $\alpha_i=0$ where i=1,2,3, we test the null hypothesis of long run causality.

Table 7: Panel Granger Causality Test

Source of Causation →	AGR	IND	SER	Coefficient of ECT
AGR		1.25783 (0.2935)	5.17556 (0.0024)***	-1.89029 (-0.1366)
IND	9.73107 (0.000)***	-	2.74176 (0.0476)**	-2.81295 (-0.0436)**
SER	6.35422 (0.0006)***	6.46040 (0.0005)***	-	-2.39356 (-0.0734)*

******,** and * denotes statistical significance at 1%, 5% and 10% level.***

The results are reported above in Table 7. There is long run causality running from agricultural sector output and services sector output to industrial sector output at 5% level of significance. There is long run causality running from agricultural sector output and industrial sector output to services sector output at 10% level of significance Services sector output causes industrial sector output at 5% level of significance. Industrial sector output causes services sector output at 1 % level of significance. So a short run bidirectional Granger causality is observed between services sector output and industrial sector output.

Services sector output causes agricultural sector output at 1% level of significance. Agricultural sector output causes services sector output at 1 % level of significance So a short run bidirectional causality is also observed between agricultural sector output and services sector output.

Short run unidirectional causality is also observed from agricultural sector output to industrial sector output at 1% level of significance. After having established the cointegration as well as the direction of causality in the long run, we now examine the long run elasticity's of the impact of industrial sector output and services sector output on agricultural sector output. We use three long run estimators for this purpose, and they are FMOLS estimator, DOLS estimator and OLS estimator. The results are reported in the below Table 8.

Table 8: Panel long run estimators

	FMOLS	**DOLS**	**OLS**
IND	0.020813 (0.0718)*	0.102064 (0.0000)***	0.126586 (0.0000)***
SER	0.095038 (0.0000)***	0.040482 (0.0611)*	0.093938 (0.0010)***

******,** and * denotes statistical significance at 1%, 5% and 10% level.***

Since the variables are expressed in natural logs, the coefficients on the IND and SER can be interpreted as elasticities. We find that 1% increase in IND increases AGR by 0.02%-0.12%. We also find that 1% increase in SER increases AGR by 0.04% -0.09%.

Conclusion

A large degree of interdependence is observed among the sectors in case of most of the BRICS countries. Short run bidirectional Causality between industrial sector output and services sector output in our study. This shows that income of the economy is largely depended on the income generating from the services sector and the income of the services sector in turn depends on the growth of the industrial sector.

Short run bidirectional causality is also observed between service sector output and agricultural sector output. This shows that despite the fluctuations and volatility in the share of the agricultural sector in GDP this sector has not lost its importance in overall economic growth in most of the countries.

Short run unidirectional causality is also observed from agricultural sector output to industrial sector output. It is found that the agricultural growth is contributed by its industrial sector.
An economy with a stagnant agricultural sector will not reveal any industrial development. Increase in agricultural productivity will increase the demand for domestically manufactured goods and increase savings, which in turn will increase capital investment in the industrial sector.

Although services sector has emerged as the growth driver of the economy but this growth needs a more careful re-examination for its sustainability and other macroeconomic implications. If liberalized measures are directed simultaneously at all the three sectors than it would go a long way in expanding the markets for goods and services produced in the economy. Therefore for fostering quick, sustained and extensive growth the agricultural and industrial sector remains the key priority for government policies. Two-third of the BRICS population is in rural areas with agriculture being the main source of income and employment, hence reforms in the agricultural sector needs policy consideration to be able to harness the export potential of agro products. A relatively faster growth of the services sector vis-a vis other sectors is not at all desirable and needs a correction in terms of enhancing the growth synergies among sectors.

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