

ECONOMIC GROWTH, STRUCTURAL CHANGE AND INTERSECTORAL LINKAGES IN SAARC ECONOMIES

P K MISHRA*

Manmohan MALL

B B PRADHAN

Abstract. In this globalized and liberalized era, studies concerning global economic interdependence have occupied a central place. Specifically, the issue of assessing the extent to which the economic growth of each member nation in a regional cooperation can influence the growth of other members, has recently attracted the attentions of academicians, researchers and policy makers as well. Despite the fact that SAARC (South Asia Association for Regional Cooperation) has been constituted in 1985 for promoting peace, stability and progress in the region, yet it has to produce notable outcomes. On the basis of the argument that structural changes in an economy can foster its economic growth and influence *de facto* economic integration across member nations, this paper investigates the sectoral interdependencies in SAARC economies. This study adds to extant literature by interpreting macroeconomic interdependence in terms of intersectoral linkages. The study found that the partner countries of SAARC demonstrate different trend patterns of economic growth fostered by different patterns of structural transformations. In a panel framework, the study provides the evidence of long-run equilibrium relationship between the agriculture, industry and services sectors among SAARC countries. The analysis found the evidence of causal relationship running from industrial and services sectors to the agricultural sector in the long-run. There is also the evidence of short-run bidirectional causality between agricultural and services sectors, and between industrial and services sectors. Additionally, short-run unidirectional causality is observed running from industrial sector to agricultural sector. The estimation of long-run elasticities concludes the existence of strong positive long-run intersectoral linkages between the three sectors in the SAARC region which would be helpful in utilizing each other's economic potential, business environment, and legal frameworks that may facilitate mutual trade and better sectoral integration.

Key Words: Economic Growth, Structural Change, Intersectoral Linkage, Panel Data, SAARC

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1. Introduction

Economic integration, in the literature, has been considered as an important means of increasing social welfare (Jovanovic, 1998) and achieving efficiency in the use of economic resources (Robson, 1987) for sustainable growth and development. Thus, the goal of economic integration mainly among the developing economies, given their scarce resources, is either to achieve a higher rate of economic growth and increase in social welfare in member countries, or alternatively to optimize the cost of using scarce resources for attaining a given level of economic growth and social welfare

* P K Mishra, Associate Professor in Economics, Central University of Punjab, India-151001. E-Mail ID: pkmishra1974@gmail.com, Manmohan Mall, Assistant Professor in Finance, NERIST, Aurnachal Pradesh, India-791109. E-Mail ID: mallmanmohan79@gmail.com, B B Pradhan, Professor in Finance, Siksha O Anusandhan University, Odisha-751030. E-Mail ID: registrar@soauniversity.ac.in

(Panchmukhi *et al.* 1986). This, in turn, depends on the efficient allocation of economic resources keeping in view the changing patterns of production over years which is often called 'structural transformation' (Pigato & Srinivasan, 1997). Economic integration in a region is often appreciated as an important driving force behind higher level of economic growth and development for reshaping the pattern of structural transformation in favour of non-agricultural activities (Fajgelbaum & Redding, 2014).

Structural transformation is the basic requirement for achieving a higher level of sustainable growth (Bhatta, 2014). Kuznets (1971) considered structural change as an indispensable feature of modern economic development which is mostly associated with promising growth and continuous transformation (Pasinetti, 1981) in a globalized and dynamic economic system. The challenge of structural transformation for sustainable development is that the countries in a region increase their productive capacities through intersectoral interdependencies, and move to catch up the standards of living of industrialized nations. In other words, regional economic integration could be interpreted as the intensification of the macroeconomic interdependencies among member countries which De Lombaerde & Van Langenhove (2005) considers the *de facto* integration. The degree of macroeconomic interdependence can be assessed in terms of product market or trade integration, labour market integration, capital market integration, monetary integration, and integration of government activity and regulation, or cooperation. The authors of this research study propose another way of interpreting macroeconomic interdependence among member countries, i.e., in terms of their intersectoral linkages. Intersectoral linkages may be understood as the mutual association between agriculture, industry and services sectors.

The macroeconomic interdependence of regional economies in terms of intersectoral linkages can be explicated by the international openness of these economies (Subramaniam & Reed, 2009) which in turn contributes to economic integration. Such intersectoral interdependency can stem from the increase in productive efficiency of nations which emanates from structural transformations (Jayaraman & Choong, 2012). Structural transformation is the reallocation of economic resources between agriculture, manufacturing and services sectors that accompany the process of modern economic growth (Herrendorf *et al.* 2012). The seminal works of Fisher (1935, 1939), Clark (1957), Kuznets (1966, 1971), Chenery (1960, 1979), and Syrquin (1988) conclude that as the economy grows, production and employment shift from agriculture to industry, and then to the service sector. And, also the patterns of growth and structural transformation differ across developed and developing nations (Bah, 2011). Actions towards shielding, nurturing and empowering niches for structural transformation are directly related to the economic integration in a region. Hence, cooperation like South Asian Association of Regional Cooperation (SAARC) is particularly important. Reasons for selecting SAARC for this study are: *first*, studying the intersectoral linkages in a less developed region like SAARC could provide valuable insights for formulating effective policies for the growth of developing countries in general; *second*, the recent World Bank statistics on sectoral composition of GDP growth seem to suggest a potential significant role of structural transformations for stimulating growth in the region; and *third*, the studies concerning

intersectoral linkages in this region is dearth compared to other more developed regions of the world.

It is on the basis of arguments put forward so far, this study theorizes the existence of regional intersectoral linkages among SAARC economies may be due to the existence of similar patterns of their economic growth driven by similar patterns of structural transformations. Thus, the primary objective of this study is to explore the possible intersectoral interdependencies between the member nations of SAARC so as to put forward a new dimension of interpreting regional economic integration. Specifically, the objectives are: to examine the trend patterns of economic growth in SAARC economies; to study the nature and patterns of structural transformations in SAARC nations; and to investigate the nature of intersectoral linkages among SAARC countries.

It is with this backdrop, the rest of the paper is organised as follows: Section 2 examines the trend patterns of economic growth in SAARC economies; Section 3 studies the nature and patterns of structural transformations in SAARC nations; Section 4 explores the nature of intersectoral linkages among SAARC countries; and Section 5 concludes.

2. Economic Growth in SAARC Economies

The Charter establishing the SAARC was signed on December 8, 1985 to promote the welfare of the people of South Asia and to improve their quality of life. At present there are eight member nations of SAARC – Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The region consists of about 21 percent of the world's population, and 9.12% of the global economy as of 2015. The member nations Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka share 0.72, 0.07, 7.32, 77.77, 0.12, 0.78, 10.13 and 3.09 percents of total GDP of the region respectively at current US\$ in 2015. It clearly indicates that some economies are less developed while others are developed. Such a disparity in the region may be due to differences in their patterns of structural transformations. Thus, it is essential to examine the growth pattern of each member nation in the region. The extant literature is quite established in assessing the economic growth in terms of annual growth rates of GDP and per capita GDP. Table-1 presents the average annual growth rates of GDP and per capita GDP during 2002-15.

Table 1: Average Annual Growth Rates in SAARC Region

Country	GDP (%)			GDP Per Capita (%)		
	2002-05	2006-10	2010-15	2002-05	2006-10	2010-15
Afghanistan	6.89	10.47	5.06	2.46	7.51	1.94
Bangladesh	5.09	6.07	6.32	3.36	4.83	5.05
Bhutan	7.85	9.59	4.76	4.81	7.40	3.24
India	7.72	8.10	6.74	5.48	6.53	5.41
Maldives	6.35	8.87	4.78	3.88	5.88	2.52
Nepal	3.06	4.45	4.22	1.65	3.36	2.99
Pakistan	5.78	3.43	4.18	3.63	1.32	2.01
Sri Lanka	5.40	6.39	6.12	4.61	5.59	5.25

Source: World Development Indicators, World Bank, 2016

It is observed that the rates of growth of GDP and per capita GDP for Bangladesh and Pakistan have increased in recent years. For Afghanistan, Bhutan, India, and Maldives, both the rates show a declining trend thereby indicating recession in these economies, and for Sri Lanka and Nepal the rates decreased marginally thereby pointing to their economic slowdowns. Thus, it is inferred that most of the SAARC economies present a similar trend pattern of economic growth which prompted us to presume the existence of similar patterns of structural transformations and possible intersectoral linkages among them.

3. Structural Transformations in SAARC Economies

It has been well accepted that the process of economic growth is the outcome of structural transformations that take place over years in an economy. Thus, it is desirable to examine the sectoral distribution of GDP in SAARC economies over 2002 to 2015. Table-2 presents the contribution of agriculture, industry and services to GDP.

It is deduced that the share of agriculture in GDP has declined over the last fourteen years for all the countries in the SAARC region except for Pakistan. The share of industry has increased for Afghanistan, Bangladesh, India, Sri Lanka, Nepal, and Maldives except for Bhutan, and Pakistan. The share of services to GDP has increased for Afghanistan, Bangladesh, Bhutan, Nepal and Pakistan except for India, Sri Lanka, and Maldives. This shows a major structural change in the economies of SAARC. It can be said that the structural change in SAARC nations is such that economic growth of Afghanistan is mostly service sector oriented, Bangladesh is industrial sector oriented, Bhutan is services sector oriented, Indian economy has recently shifted its focus from services to industry, Sri Lanka is dwindling between industry and service sectors, Nepal is service sector oriented, Maldives is industrial sector oriented, and Pakistan is dwindling between agriculture and service sectors. It is observed from Table-2 that the services sector in most of the nations dominate the agriculture and industry in recent years. This shows the growing importance of services sector in the economic growth and development of the region.

Table 2: Sectoral Contribution to GDP in SAARC Region

Country	Agriculture, Value Added (% of GDP)				Industry, Value Added (% of GDP)				Services, Value Added (% of GDP)			
	2002	2005	2010	2015	2002	2005	2010	2015	2002	2005	2010	2015
Afghanistan	38.47	31.75	27.09	22.60	23.71	27.36	21.86	22.41	37.81	40.89	51.04	54.98
Bangladesh	21.67	19.60	17.81	15.50	24.04	24.59	26.14	28.14	54.29	55.81	56.04	56.34
Bhutan	26.34	23.18	17.49	17.05	38.60	37.29	44.55	42.08	35.06	39.53	37.96	40.86
India	20.70	18.81	18.20	17.39	26.17	28.13	27.15	30.01	53.13	53.06	54.64	52.60
Maldives	6.74	7.83	4.32	3.53	13.67	15.32	15.54	19.35	79.59	76.85	80.14	77.12
Nepal	38.59	36.35	36.53	32.78	18.09	17.70	15.63	15.66	43.32	45.96	47.84	51.55
Pakistan	23.35	21.46	24.29	25.46	23.86	27.10	20.58	18.99	52.78	51.43	55.13	55.54
Sri Lanka	14.28	11.82	9.46	8.68	28.01	30.19	29.68	30.71	57.71	57.99	60.86	60.61

Source: World Development Indicators, World Bank, 2016

In Afghanistan, Bangladesh and Nepal, the decrease in the share of agriculture to gross domestic product has been absorbed by an increase in the share of both the industrial as well as services sectors. However, there has been a greater increase in the share of services in Afghanistan relative to industry, whereas in Bangladesh the relative increase in the share of industry is greater. In Nepal, the increase in the share of services is relatively more than that of industrial sector. In Bhutan, the decrease in

the shares of agriculture and industry to GDP has been absorbed by an increase in the share of services. In India, Sri Lanka and Maldives, there has been a major change in the structure of contribution to gross domestic product with the fall in the shares of agriculture and services, and rise in the share of industrial sector in recent years. Pakistan demonstrates a peculiar type of structural change such that the share of industry in GDP has decreased and that of both agriculture and services has increased. Such a diverse pattern of structural transformation in regional economies often brings about challenges for the complete economic integration.

Table-3 exhibits the pattern of average annual sectoral growth rates in SAARC economies. The average annual growth rate of agriculture has increased in Bhutan, Nepal, and Maldives, but has decreased in Afghanistan, Bangladesh, India, Sri Lanka, and Pakistan. The average annual growth rate of industrial sector has increased in Bangladesh, Nepal and Maldives, but decreased in Afghanistan, Bhutan, India, Sri Lanka, and Pakistan. Similarly, the average annual growth rate of services has increased in Bangladesh, Sri Lanka, and Pakistan, but has decreased in Afghanistan, Bhutan, India, Nepal, and Maldives. Thus, there is relatively slow pace of growth of agricultural sector in all SAARC countries; of industrial sector in Afghanistan, Bhutan, India, Nepal, Maldives and Pakistan; and of services sector in Bhutan, Nepal, Maldives and Pakistan.

Table 3: Average Annual Sectoral Growth Rates in SAARC Region

Country	Agriculture, Value Added (%)			Industry, Value Added (%)			Services, Value Added (%)		
	2002-05	2006-10	2010-15	2002-05	2006-10	2010-15	2002-05	2006-10	2010-15
Afghanistan	-0.58	6.57	1.71	13.57	7.88	4.62	NA	17.12	6.77
Bangladesh	3.31	5.27	3.53	6.84	7.96	9.18	5.31	5.89	5.95
Bhutan	2.06	1.51	2.15	8.04	14.35	4.47	10.55	8.85	5.55
India	1.94	4.56	1.73	8.51	8.49	4.92	8.45	9.42	9.04
Maldives	5.99	-2.85	0.65	15.55	4.09	8.93	4.25	11.28	3.52
Nepal	3.68	2.72	2.99	2.10	2.71	3.75	2.55	5.75	4.96
Pakistan	3.29	3.05	2.76	8.83	3.70	3.15	6.13	4.27	4.56
Sri Lanka	1.47	5.48	4.44	4.72	6.86	5.78	6.68	6.36	6.89

Source: World Development Indicators, World Bank, 2016

Table 4: Sectoral Value Added (as % of Total Value Added) in SAARC Region

Country	Agriculture, Value Added (% of Total Value Added)				Industry, Value Added (% of Total Value Added)				Services, Value Added (% of Total Value Added)			
	2002	2005	2010	2015	2002	2005	2010	2015	2002	2005	2010	2015
Afghanistan	NA	31.70*	27.09	22.87	NA	26.33*	21.86	21.57	NA	41.96*	51.04	55.55
Bangladesh	19.36	18.69	17.81	15.51	23.18	24.19	26.14	29.71	57.45	57.11	56.04	54.78
Bhutan	28.73	25.11	17.49	15.64	37.85	36.38	44.55	44.56	33.41	38.50	37.96	39.79
India	23.71	21.61	18.20	15.03#	26.08	26.76	27.15	25.38#	50.20	51.61	54.63	59.58#
Maldives	8.07	7.61	4.31	3.63	14.59	20.62	15.54	18.88	77.34	71.77	80.14	77.49
Nepal	38.98	39.05	36.53	34.67	17.37	16.72	15.63	15.40	43.64	44.22	47.84	49.93
Pakistan	27.05	25.23	24.29	23.06	18.65	20.80	20.57	19.88	54.31	53.98	55.13	57.05
Sri Lanka	11.39	9.89	9.46	8.66	29.08	29.07	29.68	28.90	59.52	61.03	60.85	62.44

* Figures are for 2006 (Afghanistan# Figures are for 2014 (India). NA: Not Available

Source: World Development Indicators, World Bank, 2016

The structural change in an economy can also be judged by observing changes in value added in a specific sector as a percentage of total value added. As shown in Table-4, there is strong evidence of the decreasing contribution of agricultural sector to total value added in the economies of all SAARC countries. The contribution of industrial sector to total value added has declined in all economies except for Bangladesh, Bhutan, India, and Maldives where there has been increase in value added by the industrial sector. Similarly, the contribution of services sector to total value added has increased in all economies except for Bangladesh and Maldives where there has been some decline. This infers us that there has been structural transformations in most of the SAARC nations over years from agriculture to services sectors.

4. Intersectoral Linkages in SAARC Economies

From the aforesaid discussion, it is learned that the output structure across the SAARC nations have changed considerably over years. The declining share of agriculture in their respective gross domestic products has been a common trend over years. Another common trend is the increasing share of services in their GDPs. However, the contribution of industrial sector to respective GDPs show a varying pattern. In this context, it is worth to investigate the intersectoral linkages focusing on whether these three sectors evolve interdependently across the region. It helps understanding not only the evolution and progression of intersectoral relationships, but also the inter-sectoral adjustments over time. The basic question here is whether structural change in sectoral composition affects economic growth across the region. Cristina (1997) and Laitner (2000) argued that changes in sectoral composition can explain variations in economic growth across countries through different income elasticities for agriculture, manufacturing and service sectors. Caselli (2005) and Chanda & Dalgaard (2008) provided the evidence that changes in the sectoral composition contribute not only to output growth, but to productivity growth also. Blunch & Verner (2006) provided the empirical evidence for a large degree of interdependence in long-run sectoral growth and concluded the existence of spillovers between sectors.

Thus, this study is expected to help us in understanding if the growth in one sector in an economy promotes growth in other sectors, and affect the sectoral growth across economies in the region through some kind of feedback mechanism. This would definitely assist the policy makers to formulate the optimal policies to accelerate the pace of economic growth in the region in line with the objectives identified in the Charter. Precisely, a clear perspective on identifying the main lines of causality and the intersectoral dynamics could be useful for a better understanding of the process of economic growth, and to formulate a conducive and appropriate development strategy for the region.

Therefore, to identify the intersectoral linkages, the following endogenous model is constructed:

$G_i = f(AGR, IND, SER)$ where G_i represents the logarithm growth of the sector i ; AGR is the logarithm of agricultural value added; IND is the logarithm of industrial value added; and SER is the logarithm of services value added. This model has been estimated in a dynamic panel framework on the basis of the annual data

collected from the World Development Indicators provided by World Bank. The time span of the study is 2002 to 2015. This time frame has been chosen on the basis of the availability of comparable data sets for all the partner countries of SAARC. The variables of the study are Agriculture Value Added, Industry Value Added and Services Value Added taken at constant 2010 US\$ representing respective sectors output. All the variables are transformed to their natural logarithmic form, and denoted by AGR, IND and SER respectively as stated above.

First, the stationary properties of the variables using panel unit root tests were examined; second, the long-run equilibrium relationship between variables using panel cointegration tests was studied; third, the short-run and long-run Granger causal relationships between variables in a panel vector error correction framework were investigated; and finally, the dynamic long-run relationships between variables in terms of elasticities were estimated using Fully Modified Ordinary Least Square (FMOLS) and Dynamic Ordinary Least Square (DOLS) methods.

4.1 Stationary Properties of Variables

The Breitung (2000), Im *et al.* (2003), ADF-Fisher, and PP-Fisher (Maddala & Wu, 1999; Choi, 2001) unit root tests were used for observing the stationary properties of variables. Non-stationarity or unit root in the variable is the null hypothesis in all these tests. The results in level and first difference forms with individual effects and individual linear trends are reported in Table-5. It is clear that all the variables are non-stationary panel in levels, but stationary in their first differences. Thus, all variables are I(1).

Table 5: Results of Panel Unit Root Tests

Method: Individual Effects and Individual Linear Trends	AGR	IND	SER
Breitung Unit Root Test: H_0 : Unit Root/Non-Stationarity (Common Unit Root Process)			
Level Form	-0.476 (0.317)	1.094 (0.863)	0.248 (0.598)
First Difference Form	-6.324 (0.000)*	-3.733 (0.0001)*	-4.971 (0.000)*
IPS Unit Root Test: H_0 : Unit Root/Non-Stationarity (Individual Unit Root Process)			
Level Form	-0.491 (0.312)	1.339 (0.909)	-0.893 (0.186)
First Difference Form	-4.456 (0.000)*	-2.345 (0.009)*	-2.353 (0.009)*
ADF-Fisher Chi-Square Unit Root Test: H_0 : Unit Root/Non-Stationarity (Individual Unit Root Process)			
Level Form	19.824 (0.228)	9.672 (0.883)	13.802 (0.613)
First Difference Form	46.373 (0.0001)*	29.958 (0.018)*	46.156 (0.0001)*
PP-Fisher Chi-Square Unit Root Test: H_0 : Unit Root/Non-Stationarity (Individual Unit Root Process)			
Level Form	17.972 (0.325)	6.130 (0.986)	9.670 (0.883)
First Difference Form	69.991 (0.000)*	37.472 (0.002)*	36.102 (0.003)*

Note: Values within parentheses are p-values; * rejection of null hypothesis at 1% level of significance

Source: Authors Own Calculations

4.2 Cointegration Properties of Variables

Since all variables are I(1), panel cointegration test was used to understand the dynamics of the long-run equilibrium relationship between them. In this study, Pedroni (1999, 2004) test and Fisher-type test using an underlying Johansen methodology (Maddala & Wu, 1999) were used. Pedroni (1997, 1999, 2004) has developed a

method of panel cointegration based on residuals that takes into account the heterogeneity in individual effects, the slope coefficients and individual linear trends between nations in the SAARC region. Pedroni (1999, 2000) suggests the panel tests based on pooling the residuals of the regression along the within-dimension of the panel, and computes panel- v , panel- ρ , panel- pp and panel ADF-statistics. Pedroni further suggests group tests based on pooling the residuals of the regression along the between-dimension of the panel, and computes group- ρ , group- pp , and group ADF-statistics. In both the cases, the hypothesized cointegrating relationship is estimated separately for each panel member and the resulting residuals are then pooled in order to conduct the panel tests. In cases where these seven statistics lead to different outcomes, the literature (e.g. Bottasso *et al.* 2013; Lee & Chang, 2008; Narayan *et al.* 2007) suggests to reject the null hypothesis of no cointegration if at least four statistics yield the evidence of cointegration. Moreover, the literature considers that the panel-ADF and group-ADF tests have better small-sample properties than other tests; so they are more reliable (Pedroni, 1999). If the null hypothesis cannot be rejected, there is no long-run relationship between the variables.

Table 6: Results of Panel Cointegration Tests
Pedroni (1999, 2004) Residual Cointegration Tests

Method	With Individual Intercept	With Individual Intercept and Individual Trend
Within Dimension Pedroni (1999) Statistic		
Panel v -Statistic	-1.475 (0.930)	-3.186 (0.999)
Panel ρ -Statistic	-0.672 (0.251)	0.367 (0.643)
Panel PP-Statistic	-10.300 (0.000)*	-13.844 (0.000) *
Panel ADF-Statistic	-4.851 (0.000)*	-8.566 (0.000) *
Within Dimension Pedroni (2004) weighted Statistic		
Panel v -Statistic	-1.313 (0.905)	-2.755 (0.997)
Panel ρ -Statistic	-0.100 (0.460)	0.676 (0.750)
Panel PP-Statistic	-6.986 (0.000) *	-9.723 (0.000) *
Panel ADF-Statistic	-5.437 (0.000) *	-6.960 (0.000)*
Between Dimension		
Group ρ -Statistic	1.396 (0.918)	1.618 (0.947)
Group PP-Statistic	-8.128 (0.000)*	-10.277 (0.000)*
Group ADF-Statistic	-4.738 (0.000)*	-5.535 (0.000)*
Johansen Fisher Panel Cointegration Test		
Hypothesized No. of Cointegrating Equations	Fisher Statistic (from Trace test)	Fisher Statistic (from max-eigen test)
None	199.8 (0.000)*	148.1 (0.000)*
At most 1	71.59 (0.000)*	59.28 (0.000)*
At most 2	27.47 (0.016)*	27.47 (0.016)*

Note: Out of the seven tests, the panel v -Statistic is one-sided test where large positive values reject the null hypothesis of no cointegration whereas large negative values for the remaining test statistics reject the null hypothesis of no cointegration. The values in the parentheses are p -values.

Source: Authors Own Calculations

Table-6 presents the results of Pedroni's cointegration tests as elaborated above. It is seen that four out of seven Pedroni statistics, p-values are closer to zero which rejects the null hypothesis of no cointegration. Thus, the long-run equilibrium relationship exists between the agriculture, industry and services sectors among the SAARC economies. However, as a confirmatory test, Fisher-type test was employed. Maddala & Wu (1999) use Fisher (1932) results to propose an alternative approach to test cointegration in panel data by combining tests from individual cross-sections to obtain a test statistic for the full panel. The results of this test are reported in the lower part of the Table-6 which indicates the rejection of null hypothesis of no cointegration at 1% level of significance. Thus, the existence of long-run equilibrium relationship between the variables is hereby confirmed.

4.3 Panel Granger Causality Test

However, the existence of a long-run equilibrium relationship between variables does not indicate the existence of Granger causal linkages among them. Thus, the panel Granger causality test following the two-step Engle-Granger causality procedure (Engle & Granger, 1987) was performed. In the first step, the long-run equilibrium relationship between the variables by FMOLS method was estimated for each country, and the residuals corresponding to the deviation from equilibrium were saved. In the second step, the parameters related to the short-run adjustments were estimated by defining the lagged residuals as the error correction term (*ECT*). Thus, the following dynamic panel vector error correction model was estimated.

$$\begin{aligned}\Delta AGR_{it} &= \lambda_{1i}ECT_{it-1} + \sum_{j=1}^p \gamma_{11ij}\Delta AGR_{it-j} + \sum_{j=1}^p \gamma_{12ij}\Delta IND_{it-j} + \sum_{j=1}^p \gamma_{13ij}\Delta SER_{it-j} + \varepsilon_{1it} \\ \Delta IND_{it} &= \lambda_{2i}ECT_{it-1} + \sum_{j=1}^p \gamma_{21ij}\Delta AGR_{it-j} + \sum_{j=1}^p \gamma_{22ij}\Delta IND_{it-j} + \sum_{j=1}^p \gamma_{23ij}\Delta SER_{it-j} + \varepsilon_{2it} \\ \Delta SER_{it} &= \lambda_{3i}ECT_{it-1} + \sum_{j=1}^p \gamma_{31ij}\Delta AGR_{it-j} + \sum_{j=1}^p \gamma_{32ij}\Delta IND_{it-j} + \sum_{j=1}^p \gamma_{33ij}\Delta SER_{it-j} + \varepsilon_{3it}\end{aligned}$$

Here, Δ is the first difference operator; p is the lag length set at 2 based on AIC; ECT_i are the residuals derived from the long-run cointegrating relationship; γ_{ij} are the short-run adjustment coefficients; λ_i are the adjustment coefficients which indicate how fast deviations from the long-run equilibrium of each variable are eliminated; ε is the serially uncorrelated disturbance term with zero mean.

The estimation method widely applied in comparable studies in different fields of research (Bashiri & Manso, 2012; Costantini & Martini, 2010; Jaunky, 2012a,b) is Generalized Method of Moments (GMM) proposed by Arellano & Bond (1991), Arellano & Bover (1995) and Blundell & Bond (1998). Based on the above model, short-run causality was determined by the statistical significance of the partial F-statistics associated with the corresponding right hand side variables, and long-run causality is revealed by the statistical significance of the respective error correction terms using t-test.

In line with the literature, these causalities are studied by means of Wald test. Considering the first equation, the short-run Granger causality test assesses the validity of the null hypothesis $H_0 : \gamma_{12ij} = 0$ and $H_0 : \gamma_{13ij} = 0$ for all i and j .

The long-run Granger causality test checks for the significance of the *ECT* coefficient, and in this case the null hypothesis is $H_0 : \lambda_{1i} = 0$ for all i and similar interpretations are for last two equations of the model.

Table-7 reports the results of the Wald tests on the coefficients which provide the evidence of long-run causality running from industrial and services sectors to the agricultural sector. It means growth of industrial and services sectors cause the growth of agricultural sector in the SAARC region.

There is also the evidence of short-run causality running from industrial and services sectors to the agricultural sector. There is also the statistical evidence of the short-run causality running from services sector to the industrial sector. Furthermore, it is inferred that the short-run causality running from the agricultural and industrial sectors to the services sector. Precisely, there exists bidirectional short-run causality between agricultural and services sectors, and also between industrial and services sectors.

Table 7: Results of Panel Granger Causality Test

Dependent Variable	Short-Run Causality (F-Statistic)			Long-Run Causality(t-statistic)
	ΔAGR	ΔIND	ΔSER	ECT
ΔAGR	-	34.623 (0.00)*	179.049 (0.00)*	-2.370 (0.02)**
ΔIND	1.739 (0.18)	-	20.664 (0.00)*	0.827 (0.41)
ΔSER	3.1005 (0.05)**	18.314 (0.00)*	-	-0.649 (0.52)

values in the parentheses are p-values of respective test statistic * significant at 1% level; ** significant at 5% level. Source: Authors Own Calculations

4.4 Panel Cointegration Estimation

The existence of long-run cointegrating and causal relationships between the three sectors in the SAARC region, however, does not speak about the long-run dynamics of the variables. Therefore, we have used FMOLS and DOLS methods of estimating the long-run elasticities of the impact of the outputs of industrial and services sectors on the output of agricultural sector in a heterogeneous cointegrated panel (Pedroni, 2000, 2001a, 2001b).

The results of panel FMOLS and DOLS estimations are reported in Table-8.

Table 8: Results of Panel FMOLS & DOLS Long-Run Estimates

Variable	Coefficient	t-Statistic (p-value)	R-squared	Adj. R-squared
FMOLS Estimates [AGR as Dependent Variable]				
Panel Method: Weighted Estimation		Null Hypothesis: Slope Coefficient is Zero		
IND	0.2417	11.879 (0.000)*	0.999	0.999
SER	0.2173	14.653 (0.000)*		
DOLS Estimates [AGR as Dependent Variable]				
Panel Method: Weighted Estimation		Null Hypothesis: Slope Coefficient is Zero		
IND	0.2964	2.744 (0.007)*	0.999	0.998
SER	0.1700	1.803 (0.075)***		

Source: Authors Own Calculations

The results indicate the rejection of null hypothesis at 1% and 10% levels of significance. In other words, the estimated coefficients of the two variables are positive and statistically significant. This shows that there exists a positive long-run relationship between the outputs of agricultural, industrial and services sectors output in the SAARC region. It is evident from FMOLS estimation that 10% increase in industrial output increases agricultural output by 2.42% in the SAARC region in long-run. Similarly, 10% increase in services sector output increases agricultural output by 2.17% in the long-run. Kao and Chiang (2000) pointed out that FMOLS estimator often exhibits small sample bias while DOLS estimator appears to outperform it. It is evident from DOLS estimation that 10% increase in industrial output increases agricultural output by 2.96% in the long-run. Similarly, 10% increase in services sector output increases agricultural output by 1.70% in the long-run. Overall, it is observed that there is a strong positive long-run relationship between the three sectors in the SAARC region.

5. Conclusion

Structural transformation is a key feature of economic development. It has long been believed by the economists that the process of economic development requires significant structural change. In the initial stages of economic development, most of the economic resources are allocated to the agricultural sector; but as the economy develops, resources are reallocated from agriculture into industry and services; as the economy develops further, resources are again reallocated from both agriculture and industry into services. This pattern of structural transformation may have some feedback mechanism through which intersectoral linkages among member countries of cooperations such as SAARC can be established for the long-run growth of the region. On the basis of the argument that structural changes in an economy can foster its economic growth and influence *de facto* economic integration across member nations, this paper investigates the sectoral interdependencies in SAARC economies. Interpreting of macroeconomic interdependence in terms of intersectoral linkages is the contribution of this study to extant literature. It is observed that the partner countries of SAARC demonstrate diverse trends of economic growth fostered by different patterns

of structural transformations. In a panel framework, the study provides the evidence of long-run equilibrium relationship between the agriculture, industry and services sectors among SAARC countries. The analysis found the evidence of causal relationship running from industrial and services sectors to the agricultural sector in the long-run. There is also the evidence of short-run bidirectional between agricultural and services sectors, and between industrial and services sectors. Additionally, short-run unidirectional causality is observed to run from industrial sector to agricultural sector. The estimation of long-run elasticities concludes the existence of strong positive long-run intersectoral linkages between the three sectors in the SAARC region which would be helpful in utilizing each other's economic potential, business environment, and legal frameworks that may facilitate mutual trade and better sectoral integration.

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