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Questing Business Cycle Synchronization among South Asia in Pre and Post SAARC Establishment: An Empirical Investigation

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Abstract

For last few decades, regional integration has been increased among several countries. Like other blocs Asian countries also made regional bloc in order to establish economic integration. This study is an attempt to empirically investigate the impacts of business cycle synchronization among South Asia in pre and post SAARC establishment. Panel data set of SAARC countries from 1960 to 2019 has been utilized using structural VAR technique. On the basis of these results it is concluded that Business Cycles across SAARC countries are not synchronous. Inter-regional and intra-regional trade requires to be strengthened among member countries in addition to integration related factors.

Keywords: Business Cycle Synchronization, SAARC, Structural VAR, South Asia, Economic Integration, GDP, Trade

Introduction

Economic integration has been advancing rapidly, driven by growing intra-regional trade, increasing investment and financial integration. In this context, different countries have formed numerous economic blocks, out of which most prominent are the North America Free Trade Agreement (NAFTA), European Union (EU), Common Market of Eastern and Southern Africa (COMESA), East African Cooperation (EAC), Economic Community of West African States (ECOWAS), Caribbean Common Market (CARICOM), Association of Southeast Asian Nations (ASEAN), Australia and New Zealand Closer Economic Relations Trade Agreement (ANZCERTA) and so on.

The South Asian Association for Regional Cooperation (SAARC) is an organization of South Asian nations. It was founded in December 1985 and dedicated to economic, technological, social and cultural development by emphasizing collective self-reliance. Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka are its founding members while Afghanistan joined in 2005. Later on assurance to monetary union was resounded at 18th SAARC summit in 2014. This paper tries to evaluate the intensity of business cycle synchronization in pre and post SAARC establishment excluding Afghanistan, Bhutan and Maldives due to their data shortness. These three dropped states share together less than one percent of SAARC GDP (Khan and Daly, 2018).

Literature Review

According to traditional open currency area theory, among those factors which countries may consider while forming a common currency, synchronization of business cycles is considered a key factor. The large body of research that explored the effects of structural changes on business cycle behavior has produced mixed results. Many studies have reported positive and significant effects of financial sector including banking sector developments for different groups of countries (e.g. Khan et al., 2019). One research had concluded that increasing international trade and financial

market integration has led to an increase in the degree of business cycle synchronization (e.g. Kose et al., 2003, 2008), while another recent evidence suggests that, as the process of international trade and financial market integration deepens, regional business cycle affiliations are superseded by wider business cycle clubs (e.g. Artis, 2008). Yet other studies have found that output correlations among the major industrial countries have even decreased in the recent decades, largely on account of a remarkable cycle of de-synchronization in the late 1980s and early 1990s (e.g. Helbling and Bayoumi, 2003).

Jain (1999) analyzed that establishment of South Asian Free Trade Agreement (SAFTA) is essential in providing mutual benefits for member countries. Subsequently, Hassan (2001) stated that the intra trade SAARC countries were unfavorable in relative to other existing regional unions and yet to achieve trade creation benefit. Khan and Khan (2003) declared that institutional changes for promoting economic development in South Asia are necessary to ensure a dynamic outward oriented development in those countries and agreed on the approach of open regionalism and continent integration in Asia. Moreover, consistent policies are required for handling external shocks to macroeconomic aggregates and associated business cycles (e.g. Anwar et al., 2019).

Spillover benefits of forming a common currency in South Asia would accrued from the peace that economic integration would bring between India and Pakistan (e.g. Saxena, 2005). There is existence of some progressive aspects such as positive shocks and the prospects of increasing trade, which would be very beneficial for the region. In comparison, (e.g. Camacho et al., 2006) indicated that the level of co movement across Euro area economies is not significantly enhanced due to the establishment of the Monetary Union.

Trade is often perceived as the most important transmission channel for business cycles from one country to another. Frankel and Rose (1998) proved the existence of a significant positive relationship between the intensity of international trade and business cycle correlation in the member states of the Organization for Economic Co-operation and Development (OECD). Krugman (1992) concluded that the process of economic integration leads to more asymmetric business fluctuations, which results in lesser synchronization of business cycles.

The results of a survey by Camacho, et al., (2006) also suggest that economic integration causes increased regional concentration of economic activity, which consequently leads to sector and subsector related or regional economic shocks, thus increasing the probability of occurrence of asymmetric shocks or divergent business cycles. However, if countries' trade turnovers are dominated by inter-industry trade, more frequent asymmetric shocks and lesser business cycle synchronization are to be expected (e.g. Kose and Yi, 2005). Shin and Wang (2004) established that intra-industry trade is the major channel through which the business cycles of East Asian economies become more synchronized.

By analyzing the international trade's impact on the BCS in Poland, the European Union and the Euro zone Misztal (2013) concluded that only increase in trade intensity does not necessarily results in BCS in these economies but the structure of trade gross revenue affects business cycle synchronization more effectively. Business cycle would be synchronized with increase in intra-industry trade rather inter-industry trade in East Asian economies (e.g. Rana et al., 2012). Moktan (2009) examined the impact of trade agreements on exports in the SAARC region for pre SAARC and pre SAPTA periods and found a significant positive impact on exports in post periods rather than pre periods. He also found positive impact on post periods. Some researchers used generalized and non-linear Gravity models by using panel data for Pakistan. Inflation targeting had positive influence on business cycle synchronization (e.g. Flood and Andrew, 2010; Irshad and Anwer, 2019). Single market and single currency intensified bilateral trade across euro area and has increased busi-

ness cycle symmetry (e.g. Guillemineau and Bower, 2006). Inklaar et al., (2005) found that the effect of trade on business cycle synchronization is not driven by outliers and doesn't suffer from parameter heterogeneity in OECD.

Methodology

The present study relates to the methodology used by Forhad (2012), which is based on the study of Bayoumi and Eichengreen (1992). This study has incorporated five variables to construct structural VAR model in order to empirically investigate the BCS in pre-SAARC and post-SAARC establishment. Sims (1980), introduced VAR for the first time which is an alternate to large-scale simultaneous equation models. Vector autoregressive models had become the mainstream of the modern applied macroeconomics (e.g. Negro and Schorfheide, 2011).

To empirically analyze the BCS in SAARC countries Structural VAR model is used and data is tested for stationarity properties. SVAR can't be applied directly, so first reduced form of VAR is used in order to check the stability of the model by investigating the stationarity of the data. Augmented Dickey-Fuller (ADF) test is applied to test the unit root property. Structural VAR modeling technique was first propagated by Sims (1986), Bernanke (1986), Blanchard and Watson (1986). Structural VAR is identified by imposing restrictions which is based on economic theory but these approaches applied only short run restrictions on the structural parameters. Later on Shapiro and Watson (1988), Blanchard and Quah (1989), extended the SVAR modelling by applying long run restrictions to the structural parameters. These approaches assumed that structural shocks were orthogonal and these structural shocks had no long run effect on one of the variables. After SVAR identification and estimation, impulse response analysis is used to trace out the dynamic effects of structural shocks on the endogenous variables. Subsequently, variance decomposition is used.

To demonstrate the SVAR model estimation following model is considered;

$$GDP_t = \beta_0 + \beta_1 INR_t + \beta_2 INF_t + \beta_3 TRD_t + \beta_4 GDI_t + \varepsilon_t \quad (1)$$

Where β′s are parameters, GDP is the gross domestic product growth rate in time t, INR is the real interest rate at time t, INF is the CPI inflation at time t, TRD is the trade which is sum of exports and imports at time t, GDI is the gross fixed capital formation at time t and ε_t is the error term. Investment is proxied by Gross Fixed Capital Formation, as percentage of GDP) as used by Heathcote and Perri (2004); and Darvas and Szapary (2004). Real interest rate and consumer price index (CPI) for inflation as used by Huh et al., (2014).

Data and Construction of Variables

For empirical investigation panel data set is utilized for SAARC based on the pre-SAARC 1960 to 1985 and post-SAARC 1986 to 2019 periods. The data is collected from World development indicators (WDI), World Bank. Source of the data of variables to be estimated are shown in the following table.

Table 1. List of Variables

Variable	Description	Measurement
GDP	GDP growth	Annual Percentage
INR	Real Interest Rate	GDP Deflator
INF	CPI Inflation	Annual Percentage
TRD	Trade	Share of GDP (export plus import)
GDI	Gross fixed capital formation	Percentage of GDP

Source: World Bank, World Development Indicators, 2019

Structural VARs

Structural VAR allows to impose short run as well as long-run restrictions whereas VAR mode doesn't allow, however, vector error correction model (VECM) allows only long-run restrictions (e.g. Narayan et al., 2008). Aarle et al., (2003) viewed the impulse-response function and variance decomposition in SVAR to be most useful tool as they provide information about the macroeconomic shocks and policy advances.

By moving average the economic variables of the SAARC countries may be expressed as:

$\Delta x_t = A_0 e_t + A_1 e_{t-1} + \cdots \ldots \ldots \ldots \ldots \ldots = \sum_{1=0}^{\infty} A_i e_{t-i}$ (2)

Matrix representation of equation (1) is expressed as

$\Delta x_t = A(L)\, e_t$ (3)

By using equation (3), $\Delta x_t = A(L)\, e_t$, equation (1) can be taken as follows;

$\Delta x_t = [\, \Delta y, \Delta r, \Delta i, \Delta t, \Delta I]'$, representing the variables GDP growth (Δy), real interest rate (Δr), inflation (Δi), investment (fixed capital formation ΔI) and trade (Δt) for each country. Where Δ shows first difference, A is 5×5 coefficient matrix which represents the impulse response of the variables to the structural shocks. e_t is a vector of structural shocks, $e_t = [e_t^g, e_t^i, e_t^{in}, e_t^{cf}, e_t^{ei}]$ shows the GDP growth shocks (e_t^g), real interest rate shocks (e_t^i), CPI inflation shocks (e_t^{in}), investment shocks (e_t^{cf}), and trade shocks (e_t^{ei}). The variance-covariance matrix is normalized to the identity matrix.

$E(e_t e_t) = I_n$ (4)

And $E(e_t e_{t+i}) = 0 \qquad _i \neq 0$ (5)

Representing system of equations (2) in matrix form we get;

$$\begin{bmatrix} \Delta y_t \\ \Delta r_t \\ \Delta i_t \\ \Delta t_t \\ \Delta I_t \end{bmatrix} = \begin{bmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) & A_{14}(L) & A_{15}(L) \\ A_{21}(L) & A_{22}(L) & A_{23}(L) & A_{24}(L) & A_{25}(L) \\ A_{31}(L) & A_{32}(L) & A_{33}(L) & A_{34}(L) & A_{35}(L) \\ A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) & A_{45}(L) \\ A_{51}(L) & A_{52}(L) & A_{53}(L) & A_{54}(L) & A_{55}(L) \end{bmatrix} \begin{bmatrix} e_t^y \\ e_t^r \\ e_t^i \\ e_t^t \\ e_t^I \end{bmatrix} \quad (6)$$

The theoretical construction is that the structural VAR can't be estimated directly. Starting from reduced form VAR model for Δx_t, which may be written as;

$\Delta x_t = C_1 \Delta x_{t-1} + C_1 \Delta x_{t-2} \ldots \ldots \ldots \ldots \ldots \ldots + C_p \Delta x_{t-p} + u_t$ (7)

From equations (3) and (7) after solving and simplifying we get;

$A(L) = D(L)\, A_0$ (8)

In VAR(1) process the equation (8) can be expressed as;

$A(1) = D(1)\, A_0$ (9)

A(1) becomes a matrix which shows the long run effects of structural shocks equation (3), and D(1) becomes a matrix which shows the long run coefficients of reduced form shocks which is obtained from reduced form estimates.

Unit Root testing and Lag Length Selection Criteria

If variables in the model are non-stationary then normal "t-ratios" will not follow t-distribution. So, data generally has unit root, there are several procedures employed to explore unit root but present research utilizes Augmented Dickey Fuller (ADF) test.

There are several criterion employed in economic studies for the selection of lag length. According to (e.g. Liew, 2004) comparing small sample AIC and FPE are better as both generate lowest likelihood of under estimation amongst all criteria.

Impulse Responses and Variance Decomposition

Impulse response analysis consists of tracing the dynamic effect of structural shocks on the endogenous variables. It requires to transform out structural autoregressive vector into a sum of shocks which is called Wold representation:

$$AX_t = \mu + \sum_{t=0}^{\infty} c\, u_{i-t} \quad (10)$$

Then, a pair-wise correlation matrix is computed for each type of shock to examine their symmetry across the SAARC countries. The higher the correlation of shocks among the member countries, the more suitable the currency union is (e.g. Blaszkiewicz and Wozniak, 2003; Soffer, 2007). A positive correlation of supply shocks indicates that countries would require a synchronous policy response Saxena (2005). Impulse response function has used the period of ten. Period means, how far into future one want to check the reaction to each other.

Variance decomposition is a tool which explains the percentage variation of each variable in the model for next period that resulted by a shock in variable. It breaks down the proportion of the variability of each variable on the part of the variability that resulted from the shock of the variable and the variability that is the result of shocks in other variables (e.g. Ravnik and Zilic, 2011).

Results

Pre-SAARC Analysis (1960-1985)

Table 2. Unit Root Findings for Pre-SAARC (1960-1985)

Variables	Test Statistics
Country 1	
GDP	-5.527**
INR	.22.955**
INF	-3.072(1)**
TRD	-3.055(1)**
GDI	0.002(1)**
Country 2	
GDP	-6.014(1)**
INR	-18.242(1)**
INF	-4.054**
TRD	-3.689(1)**
GDI	-7.892(1)**
Country 3	
GDP	-5.213**
INR	-6.625**
INF	-5.110**
TRD	-5.510(1)**
GDI	-6.526**
Country 4	

Variables	Test Statistics
GDP	-5.129**
INR	-20.021(1)**
INF	-4.290(1)**
TRD	-4.720(1)**
GDI	-3.728(1)**
Country 5	
GDP	-3.971**
INR	-5.539**
INF	-5.754(1)**
TRD	4.033(1)**
GDI	-4.222(1)**

Note: ** represents 5% level of significance.

From above results of the Table 2, it is concluded that some variables are stationary at level while others are made stationary at first difference.

Table 3. Lag Selection Findings

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1742.32	NA	10840121	30.38	30.51	30.43
1	-1582.72	302.54*	1043822*	28.04*	28.76*	28.34*
2	-1562.65	36.29	1140103	28.13	29.44	28.66

Note: * indicates lag order selected by the criterion

Table 3 shows different criterion for the optimal lag selection. All criterion including AIC and FPE suggested lag length of order 1 so maximum 1 lag is selected for analysis.

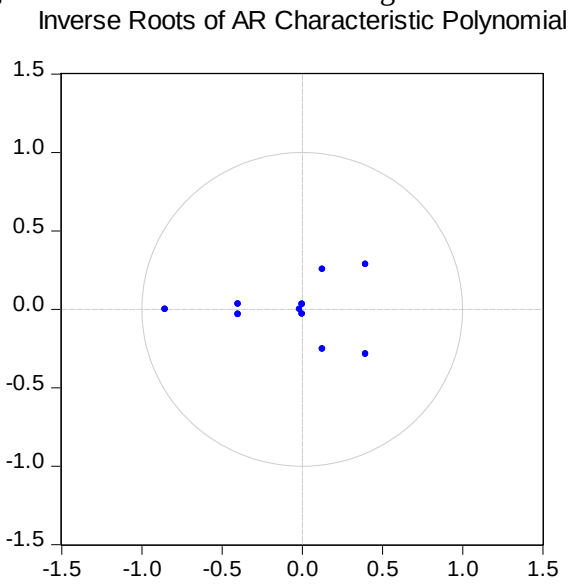

Figure 1. Inverse Roots of AR Characteristic Polynomial (1960-1985)

In order to check the stability of the model the study utilizes inverse root of the characteristics AR polynomial. AR root graph shown in Figure 1 indicates that inverse roots of AR characteris-

tic polynomial are all inside the unit circle, which means that VAR model is stationary as all roots lie inside the unit circle. This is important in the sense that if the VAR is not stationary than the impulse response is not valid.

Residuals Diagnostic Test

Residuals autocorrelation in a VAR model can tested by using autocorrelation LM test, which is applied in VAR model in level with unknown cointegration rank. This is represented below in table 4. In order for stationary VARS to be correctly specified, residuals need to be white noises. This is shown by plot in the following figure 2.There are number of test that allows us to examine the properties of residuals more systematically.

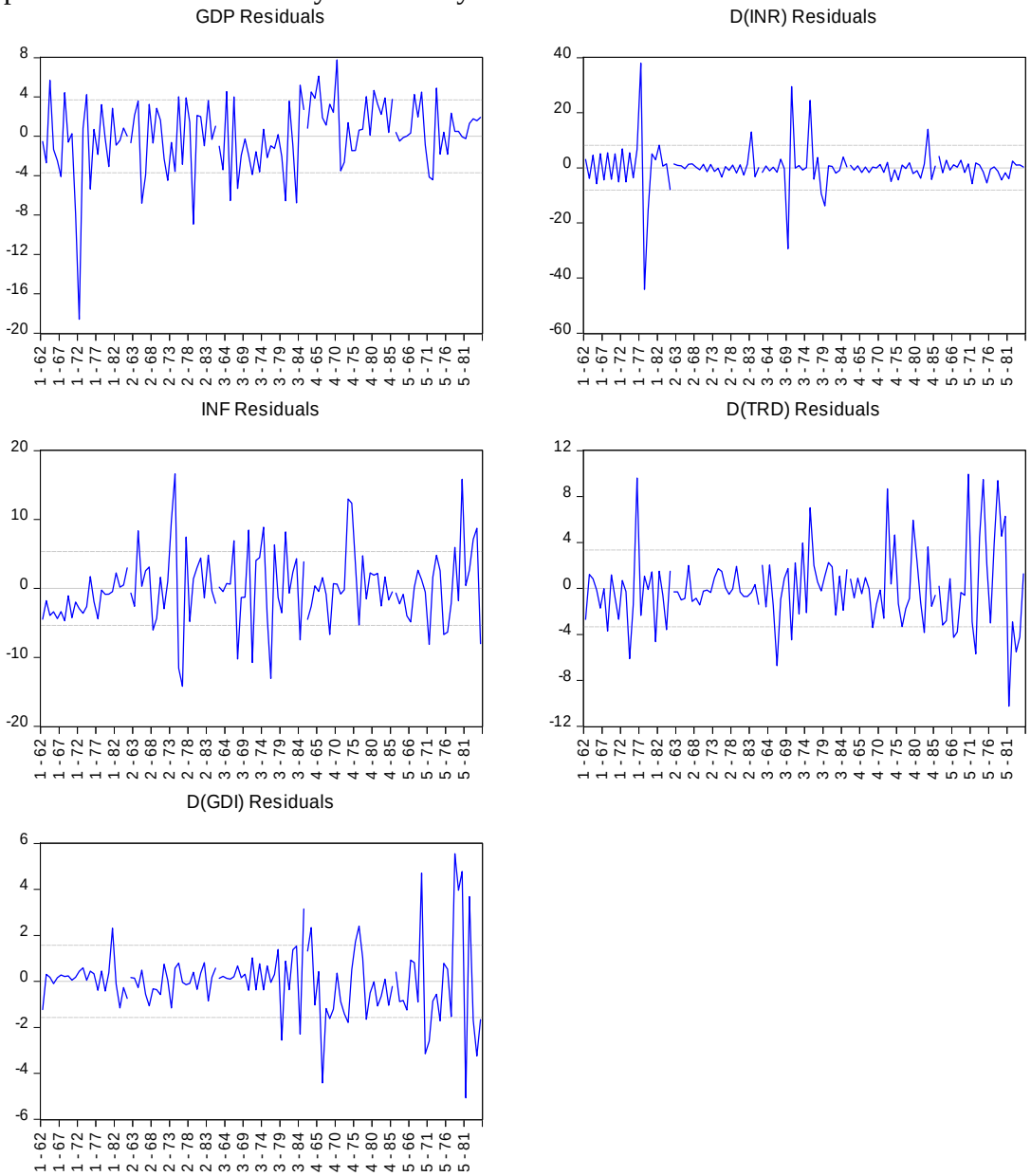

Figure 2. Plot of residual white noises test

Table 4. VAR Residual Serial Correlation LM Test

Lags	LM-Stat	Prob.
1	28.123	0.302

Note: * shows significance at 5%

The null hypothesis is that there is no serial correlation. From the table it can be concluded that at lag one null hypothesis can't be rejected which means that there is no serial correlations in residuals.

The above figures allow to check that residuals seem to be white noises. Although there are some large residuals in certain period which is due to the crisis episodes so there isn't inherent problem in the data.

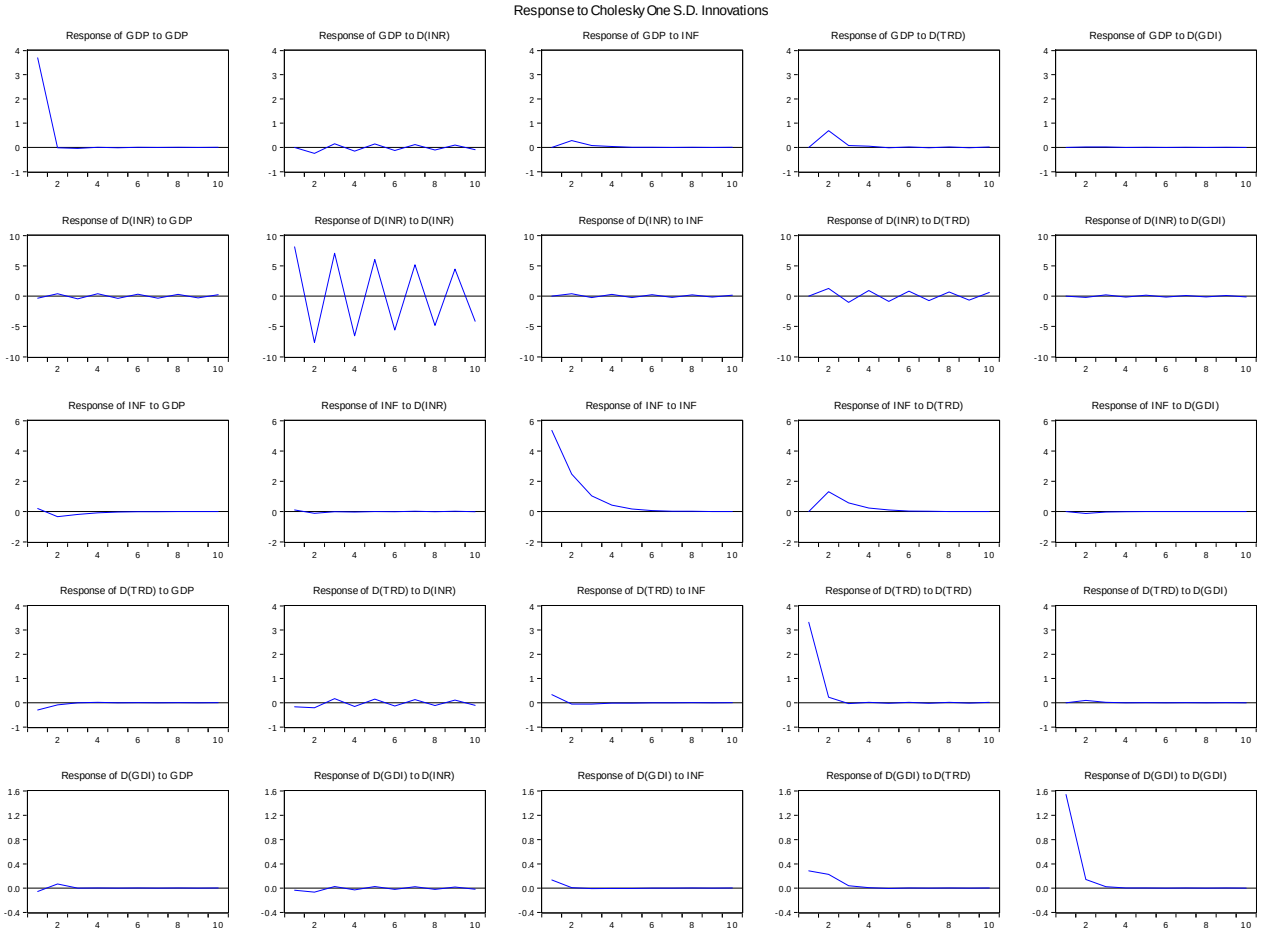

Figure 3. Impulse Response Analysis

The outcome one standard deviation shock is represented in graph in Figure 3. The adjustment process of SAARC countries to the shocks is not similar to each other. The magnitudes of these responses are not similar, which is an indication that business cycles are not synchronous, due to which economic integration is not possible.

Variance decomposition for the basic SVAR model for a ten years period is shown in the table 5 as follows.

Table 5. Cholesky Variance Decompositions

Period	S.E	Structural innovation of y	Structural innovation of r	Structural innovation of i	Structural innovation of t	Structural innovation of I
1	3.69	100.00	0	0	0	0
2	3.779	95.602	0.432	0.565	3.396	0.003
3	3.784	95.365	0.594	0.605	3.427	0.006
4	3.787	95.190	0.753	0.613	3.434	0.006
5	3.790	95.062	0.885	0.613	3.431	0.006
6	3.792	94.949	0.999	0.613	3.430	0.006
7	3.794	94.854	1.097	0.612	3.427	0.006
8	3.795	94.772	1.180	0.612	3.428	0.006
9	3.797	94.702	1.251	0.611	3.426	0.007
10	3.798	94.642	1.312	0.611	3.425	0.007

Post-SAARC Analysis (1986-2019)

Table 6. Unit Root Findings for Post-SAARC (1986-2019)

Variables	Test Statistics
Country 1	
GDP	-4.54(1) **
INR	-3.43**
INF	-3.63**
TRD	-5.51(1) **
GDI	-4.17(1) **
Country 2	
GDP	-4.29**
INR	-4.93**
INF	-2.98**
TRD	-6.20(1) **
GDI	-4.83(1) **
Country 3	
GDP	-6.31**
INR	-8.20(1) **
INF	-3.88**
TRD	-4.06(1) **
GDI	-4.97(1) **
Country 4	
GDP	-3.11**
INR	-4.93**
INF	-6.28(1) **
TRD	-7.09(1) **
GDI	-4.51(1) **
Country 5	
GDP	-3.88**
INR	-10.72**

Variables	Test Statistics
INF	-4-24**
TRD	-4.43(1) **
GDI	-4.90(1)**

Note: ** represents 5% level of significance.

From above results of the Table 6, it is concluded that some variables are stationary at level while others are made stationary at first difference.

Table 7. Lag Selection Findings

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1942.08	NA	70309.70	29.95	30.06	30.00
1	-1536.62	773.51	20186.81	24.10	24.76*	24.37*
2	-1507.98	52.42*	19121.85*	24.04*	25.26	24.53
Note: * indicates lag order selected by the criterion						

Table 7 shows different criterion for the optimal lag selection. All criterion including AIC and FPE suggested lag length of order two so maximum two lag is selected for analysis.

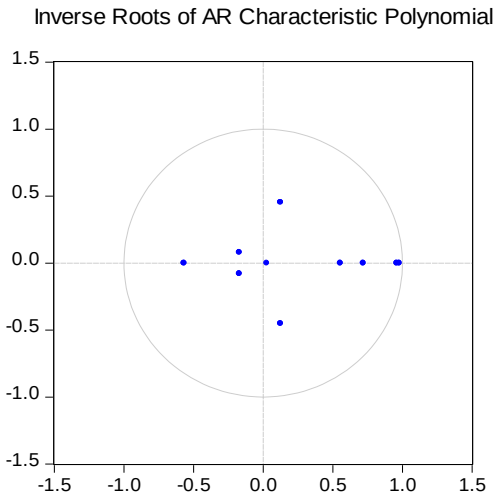

Figure 4: **Inverse Roots of AR Characteristics Polynomial (1986-2019)**

AR root graph shown in Figure 4 indicates that inverse roots of AR characteristic polynomial are all inside the unit circle, which means that VAR model is stationary as all roots lie inside the unit circle.

Residuals Diagnostic Test

Residuals autocorrelation in a VAR model for post-SAARC is tested by using autocorrelation LM test. It is shown below in table 8.

Table 8. VAR Residual Serial Correlation LM Test

Lags	LM-Stat	Prob.
1	26.490	0. 019
2	41.746	0. 381

Note: * shows significance at 5%

The null hypothesis is that there is no serial correlation. From the table one can conclude that at lag 2 null is accepted which means there is no serial correlation between residual.

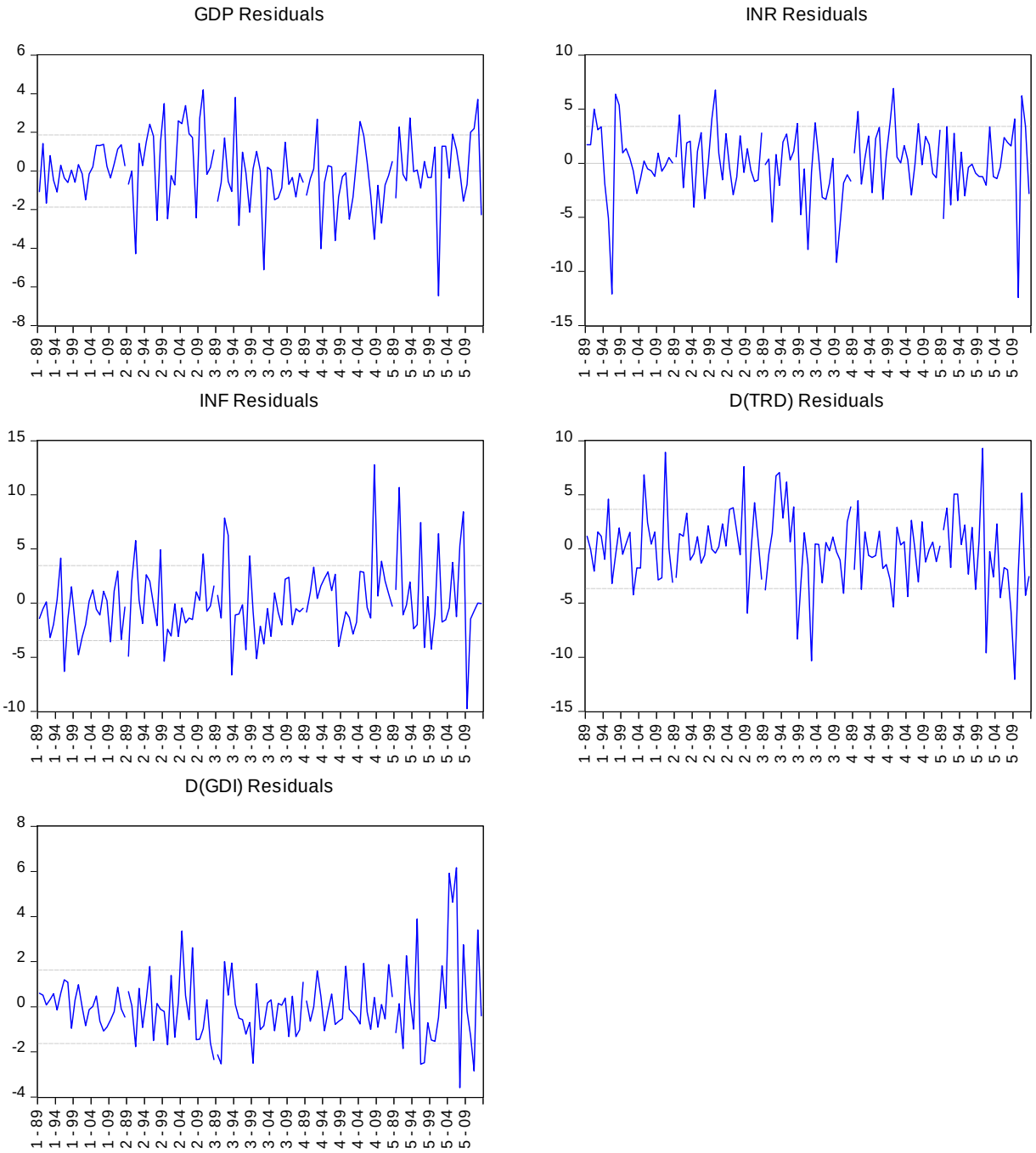

Figure 5. Plot of Residual White Noises Test

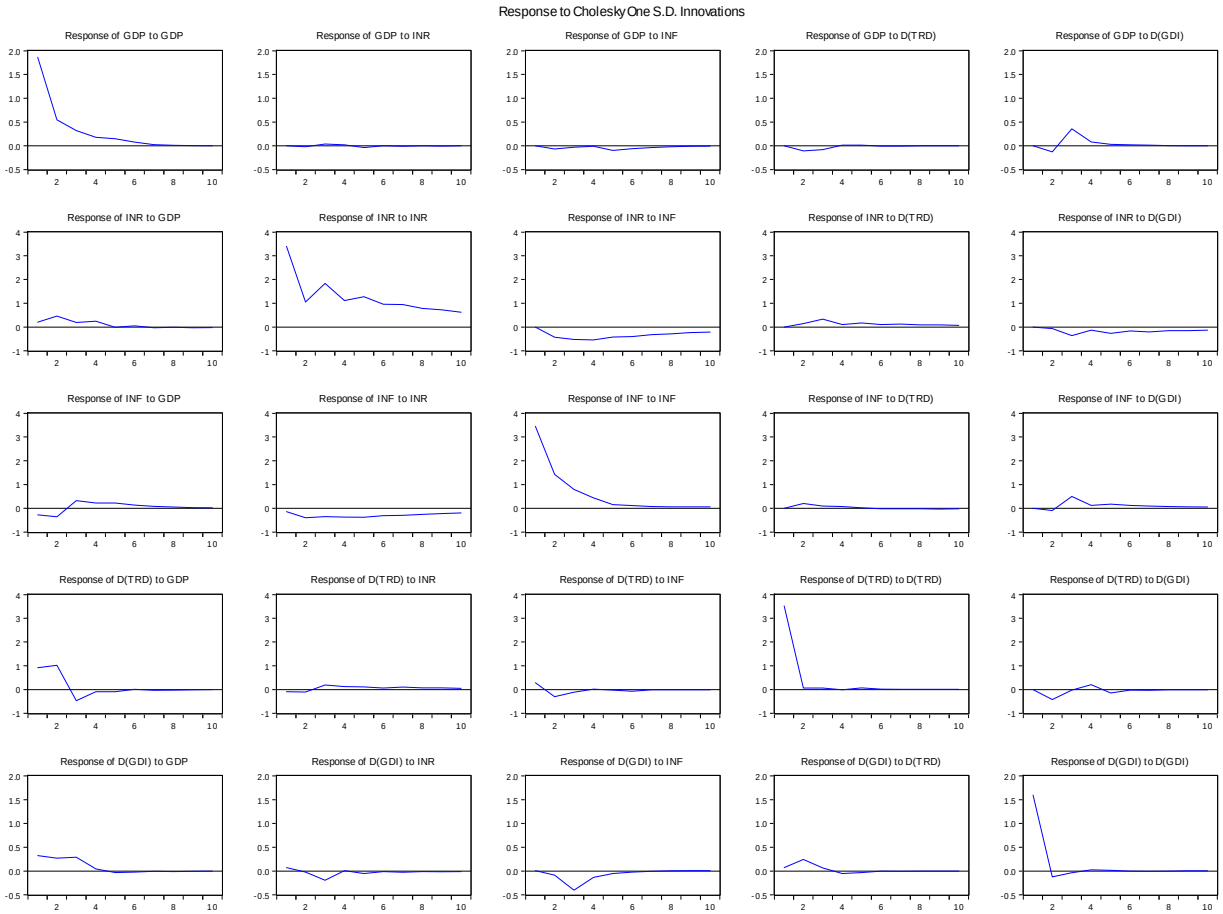

Figure 6. Impulse Response Analysis

The impulse response function is a shock to a VAR system. The outcome one standard deviation shock is represented in the plotted figure 6. The above figure suggests the differences in the magnitude of responses of variables to the shocks. In such circumstances the cost of forming the common monetary policy would be high. So, it can be concluded that the business cycles are not synchronized in this period across SAARC countries.

Conclusion and policy Implications

Employing the criteria for Business Cycle Synchronization to analyze the economic integration across SAARC countries, the study found that GDP growth rate is most effective variable followed by other variables. Shocks across the SAARC countries are symmetric and there is difference in their magnitudes of responses to these shocks. The study concludes that Business Cycle across SAARC countries is not synchronous. It is suggested that SAARC countries need to increase trade across the region and intra-regional trade among these countries should be prompt. Such policies should be addressed that strengthen the regional politics and economic integration. It is pertinent not only for a enhanced understanding of the effects of important trading partners on the business cycle fluctuations in the domestic economy but for evaluating the costs and benefits of macroeconomic coordination. Future studies shall focus on exploring the factors responsible for non- synchronousness and their effects on possible integration process to form a potential monetary union.

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