Liberalizing Trade in Services and Economic Growth in India during Post Reform period: A Quantitative Analysis using Granger Causality Test in a Vector Autoregressive Framework

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Abstract: The study seeks to examine the causal relationship, if any, between India's services trade and economic growth, in a Vector Auto Regressive (VAR) framework during the post-liberalization period. A simple regression model is used to predict whether services trade influences economic growth for the time period 1996-97: Q1 to 2014-15:Q2. In order to examine the causal linkages between the variables, the Granger Causality Test has been conducted. Service trade plays a crucial role in developing countries where proportionately higher services export are characteristics of high-growth countries while excessive dependency on imported services is characteristic of low growth countries. Effective development planning must include strengthening of both domestic and international service sectors to reduce relative dependency on imported services while providing incentives for services exports.
Key-words: Trade in services, economic growth, Vector Auto Regressive Framework, Granger Causality.

1. Introduction

The rapid expansion of trade in services contributes significantly to economic growth, both in developed and in developing economies (OECD, 2003). If liberalizing trade in goods, which typically accounts for less than half of the GDP in most countries and even less than a third of output in the industrial economies, can affect *economy-wide* growth, then there should be comparable gains from liberalizing services that are becoming increasingly tradable and that account for a larger and growing share of output in most countries. The competitiveness of firms in open economies is increasingly determined by access to low-cost and high quality producer services – telecommunications, transport and distribution services, financial intermediation, etc. The role of services in economic growth is immense and more emphasis is needed on channels through which openness to trade in services may increase productivity at the level of the economy as a whole, industries and the firm. Growth in services trade is driven by numerous factors including liberalization of goods trade, deregulation of services, advances in information and communication technologies (as in e-commerce and telecommunications services) and increasing reliance on outsourcing by multinational corporations (MNCs). Services are heterogeneous and span a wide range of economic activities. Conceptually, this diversity marks a fundamental function that many services (which are inputs into production) perform in relation to overall economic growth. One dimension of this 'input function' is that services facilitate transactions through space (transport, telecommunications) or time (financial services) (*Melvin*,1989). Another dimension is that services are frequently direct inputs into economic activities, and thus determinants of productivity of the 'fundamental' factors of production – labour and capital – that generate knowledge, goods and other services. Education, R&D and health services are examples of inputs into the production of human capital.

As firm size increases and labour specializes, more activity needs to be devoted to coordinating and organizing the core businesses of companies. This additional activity is partly outsourced to external service providers. The "producer services" that are demanded and supplied as part of this process are not just differentiated inputs into production. Those play an important distinct role in coordinating the production processes needed to generate even more differentiated goods and to realize scale economies. The associated organizational innovations and expansion of "logistics" (network) services yield productivity gains that in turn should affect economy-wide growth performance. The integration of countries through flows of goods and services, financial assets, technology and cultural interaction has reached unprecedented levels (*Stern*, 2001). As the world is becoming more integrated, the trade in goods and services are crossing borders in line with globalization and regionalization processes.

2. Literature Review

Economic theory postulates that aggregate growth is a function of increases in the quantity and productivity of capital and labour inputs with long-run (steady state) growth being driven by technological progress. *Goldsmith* (1969) stresses the role of financial services in channelling investment funds to their most productive uses, thereby promoting growth of output and income. Subsequent works have shown that financial services can affect economic growth through enhanced capital accumulation and/or technical innovation. *Francois* (1990a) notes that the growth of intermediation services is an important determinant of overall economic growth and development because it allows specialization to occur. Some of the theoretical models treat services as goods and producer services and are modelled as intermediate goods (*Robinson etal.*,1999, *Dee* and *Hanslow*, 2000, *Brown*, *Deardorff* and *Stern* 2002) and show that multilateral trade liberalisation of services will increase global income and welfare. *Banga* and *Goldar*(2004) empirically determine the impact of trade liberalisation and find that trade liberalisation and development of the services sector in the 1990s had a significant impact on use of services in the Indian industry, which has further contributed to industrial output and productivity growth.

King and *Levine* (1993) postulate that financial services can affect growth through enhanced capital accumulation and/or technical innovation. They systematically control for other factors affecting long-run growth and construct additional measures of financial sector development such as the ratio of liabilities of the financial system to GDP and the ratio of gross claims on the private sector to GDP, which they use in growth regressions. *Francois* and *Reinert* (1996) have documented that the importance of services for export performance rises with per capita income; business, distribution, and communications services become the most important sectoral elements of overall exports in terms of inter-industry linkages. *Mattoo*, *Rathindran* and *Subramanian* (2006) find that, controlling for other determinants of growth, countries with open financial and telecommunications sectors grew, on an average, about 1 percentage point faster than other countries. *Bayraktar* and *Wang* (2006) show that the asset share of foreign banks has an economically and statistically significant positive effect on the growth rate of GDP per capita, after controlling for other determinants of growth, indicating a direct link between the two variables. *Francois* and *Manchin* (2007) conclude that infrastructure is a significant determinant not only of export levels but also of the likelihood exports that will take place at all. They found that basic infrastructure (communications and transportation) explains substantially more of the overall sample variation in exports than do the trade barriers faced by developing countries.

3. Objective

The study seeks to examine the causal relationship, if any, between India's services trade and economic growth, in a Vector Auto Regressive (VAR) framework during the post-liberalization period.

4. Data

Quarter-wise data from 1996-97:Q1 to 2014-15:Q2 (comprising 58 observations) are taken for GDP at 1999-00 market prices and also for services trade to study the causal relationship between services trade and economic growth. The data are taken from Handbook of Statistics, Reserve Bank of India.

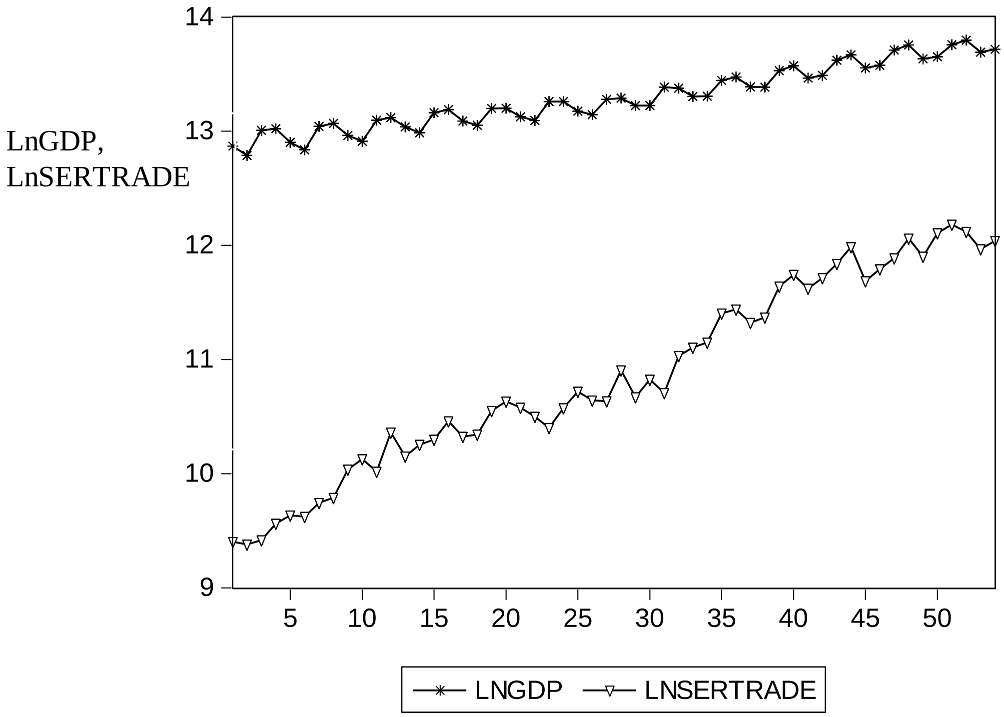
5. Methodology

The bivariate Vector Autoregressive (VAR) framework has been used to test the Granger causality between services trade and economic growth for the time period 1996-97: Q1 to 2014-15: Q2 (**FIGURE 1**). Regression Analysis is also done for the same time period with the same data set. Two methods are used.

i. Statistical Method

ii. Econometric method

Figure 1: Logarithmic Values of GDP and Services Trade



i. Statistical method

A simple regression model is used to predict whether services trade influences economic growth for the time period 1996-97: Q1 to 2014-15:Q2.

$$LnGDP = \alpha_1 + \beta_1 LnSERTRADE + \varepsilon_1 \qquad \ldots(1)$$

where in equation (1) α_1 is the constant term, LnGDP represents logarithmic value of GDP and LnSERTRADE represents logarithmic value of services trade and ε_1 is the error term.

ii. Econometric method

Tests for Stationarity

The first step in the methodology is to test the stationarity of the variables (used as regressors in the model). *Augmented Dickey Fuller (ADF)* [1979], *Phillips-Perron (PP)* [1988] and *Kwiatkowski*, *Phillips*, *Schmidt* and *Shin (KPSS)* [1992] *Tests* have been conducted to investigate into the stationarity property of the series.

Tests for Cointegration

After examining the stationarity of the variables involved in the study, an attempt is made to figure out the level of cointegration between the examined variables, i.e., those tied in a long-run relationship. In this study, the Error-correction Cointegration technique of *Johansen* (1988) and *Johansen* and *Juselius* (1990) has been applied to identify the cointegration relationship between the variables. According to *Johansen* (1988), a p-dimensional VAR model, involving up to k-lags, can be specified as below.

$$Z_t = \alpha + \prod_1 Z_{t-1} + \prod_2 Z_{t-2} + \ldots\ldots\ldots \prod_k Z_{t-k} + \varepsilon_t \ldots(2)$$

where Z_t is a $(p \times 1)$ vector of p potential endogenous variables and each of the Π_i is a $(p \times p)$ matrix of parameters and ε_t is the white noise term. Equation (2) can be formulated into an Error Correction Model (ECM) form as below.

$$\Delta Z_t = \alpha + \prod_k Z_{t-k} + \sum_{i=1}^{k-1} \theta_i \Delta Z_{t-i} + \varepsilon_t \qquad \ldots(3)$$

where Δ is the first difference operator, and Π and θ are p by p matrices of unknown parameters and k is the order of the VAR translated into a lag of $k-1$ in the ECM and ε_t is the white noise term. Evidence of the existence of cointegration is the same as evidence of the rank (r) for the Π matrix. The rank of Π can be zero. This takes place when all the elements in the matrix Π are zero. This means that the sequences are unit root processes and there is no cointegration. The variables do not share common trends or move together over time. In this case, the appropriate model is a VAR in first differences involving no long-run elements.

Johansen and *Juselius* (1990) have developed two Likelihood Ratio Tests. The first test is the Likelihood Ratio Test based on the maximal Eigen value which evaluates the null hypothesis of ‘r’ cointegrating vector(s) against the alternative of ‘r+1’ cointegrating vectors. The second test is the Likelihood Ratio Test based on the Trace Test which evaluates the null hypothesis of, at most, ‘r’ cointegrating vector(s) against the alternative hypothesis of more than ‘r’ cointegrating vectors. If the two variables are I(1), but cointegrated, the *Granger Causality Test* will be applied in the framework of ECM in which long-run components of the variables obey equilibrium constraints while the short-run components have a flexible dynamic specification.

Tests for Granger Causality

In order to examine the causal linkages between the variables, the *Granger Causality Test* has been conducted. The direction of the impact of each of the variables is also determined from the analysis. In order to capture the impact of variables observed in the past time period in explaining the future performance, the optimal lag length p (which is 4 in the present study) is chosen (see **TABLE 1**) and the criteria used in selecting the VAR model and optimal lag length require the combination of information criterion (minimum of AIC or SBIC or HQIC or FPE value).

Table 1: VAR Lag Order Selection

[D(LnSETRADE),D(LnGDP)]

Lag	LL	LR	FPE	AIC	SIC	HQIC
0	74.41239	NA	0.000178	-2.955608	-2.878391	-2.926312
1	81.23648	12.81257	0.000159	-3.070877	-2.839225	-2.982988
2	121.5593	72.41650	3.62e-05	-4.553441	-4.167355	-4.406961
3	155.9177	58.90018	1.05e-05	-5.792561	-5.252041	-5.587488
4	178.5539	36.95693	4.93e-06*	-6.553219*	-5.858265*	-6.289554*

*indicates lag order selected by the criterion.

LL: Log Likelihood

LR: Sequential Modified LR Test Statistic (each test at the 5% level of significance)

FPE: Final Prediction Error

AIC: Akaike Information Criterion

SIC: Schwarz Information Criterion

HQIC: Hannan-Quinn Information Criterion

D: represents the first difference of logarithmic values of the concerned variables

The model used for testing Granger causality in a VAR framework at first difference form:

$$\Delta LnGDP_t = \sum_{j=1}^{p} \alpha_{11,j} \Delta LnGDP_{t-j} + \sum_{j=1}^{p} \alpha_{12,j} \Delta LnSERTRADE_{t-j} + \varepsilon_{t1} \qquad \ldots(4)$$

$$\Delta LnSERTRADE_t = \sum_{j=1}^{p} \alpha_{21,j} \Delta LnSERTRADE_{t-j} + \sum_{j=1}^{p} \alpha_{22,j} \Delta LnGDP_{t-j} + \varepsilon_{t2} \qquad \ldots(5)$$

where LnGDP and LnSERTRADE are the time series of GDP and Services trade respectively which are in the logarithmic and first difference form. ε_{t1} and ε_{t2} are white noise. p is the lag length of VAR and Δ the first difference operator.

Parameter Stability Tests

CUSUM test and CUSUM of squares (CUSUMSQ) test are used to check whether the parameters of the model are stable or not. The CUSUM test (*Brown*, *Durbin* and *Evans*, 1975) is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. In case of CUSUM of squares test, similar to CUSUM test, movement outside the critical lines is suggestive of parameter or variance instability. If the cumulative sum of squares is outside the 5% significance lines, it would suggest that the residual variance is somewhat unstable.

Impulse Response Analysis

Impulse responses are the changes in the future predicted values due to a change in the current period values. Instead of static interpretation of the effects of changes in any of the variables in the system, Impulse Responses (IR) provide a dynamic response curve that depicts the effects of a change in one of the variables, considering the effects of the other variables in the system. IR analysis is a dynamic multiplier analysis among the variables in the VAR system, measuring how a standard deviation shock to a variable in the system is transmitted to others over time. The IR function can trace the response of the endogenous variables to a shock in another variable. In the present study, the orthogonalized IR analysis is done by changing the order of the equations to see whether any change in the IR function is revealed.

6. Findings

Time Series Properties of the Variables

TABLE 2 reports the results of the ADF and PP Tests of unit root by lag length chosen based on SIC. The tests are performed on both the level and the first difference of the lagged variables.

Table 2: Test of Unit Root Test Hypothesis (1996-97: Q1 – 2009-10: Q2) without trend

		ADF Statistic		PP Test		KPSS	
Series		Test Statistic	Lags	Test Statistic	Lags	Test Statistic	Lags
LnGDP	Level	0.688338	4	-0.329862	4	1.16681 ***	4
	First Difference	-2.765359*	3	-64.57951***	3	0.275288	3
LnSERTRADE	Level	1.333826	3	-1.366488	3	1.4194***	4
	First Difference	-6.751363***	2	-35.31384***	2	0.0815314	3

(a)The critical values are those of *McKinnon* (1991).

1 % ADF-critical values = -3.571310, 5% ADF-Critical values = -2.922449, 10% ADF-Critical values = - 2.599224 in case of LnGDP (logarithmic value of Gross Domestic Product) and first difference of LnGDP

1 % ADF-critical values = -3.568308, 5% ADF-Critical values = -2.921175, 10% ADF-Critical values = -2.598551 in case of LnSERTRADE (logarithmic value of services trade) and first difference of LnSERTRAD.

1 % PP-Critical value = -3.560019, 5% PP-critical value =-2.917650, 10% PP-critical value =-2.596689 in case of *LnGDP and LnSERTRADE*

1 % PP-Critical value = -3.562669, 5% PP-critical value =-2.918778, 10% PP-critical value =-2.597285 in case of first difference ofLnGDP and LnSERTRADE

1 % KPSS- critical values = 0.739, 5% KPSS-Critical values = 0.463, 10% KPSS-Critical values = 0.347 in case of LnGDP and LnSERTRADE and first difference of LnGDP and LnSERTRADE

(b)***, ** and * represents the rejection of null hypothesis at 1%, 5% and 10% levels of significance respectively.

The variables economic growth and services trade are I(1) processes according to ADF, PP and KPSS tests.

Table 3: Johansen -Juselius Cointegration Test Results

[no deterministic trend (restricted constant)]

H_0	H_1	λ_{trace}	$CV_{(trace,5\%)}$	Prob.**
$r = 0$	$r \geq 1$	15.73734	20.26184	0.1870
$r \leq 1$	$r \geq 2$	5.334333	9.164546	0.2487
H_0	H_1	$\lambda_{\max}$	$CV_{(\max,5\%)}$	Prob.**
$r = 0$	$r = 1$	10.40301	15.89210	0.2991
$r \leq 1$	$r = 2$	5.334333	9.164546	0.2487

(a) r is the number of cointegrating vectors.

(b) Trace test indicates no cointegrating equations at the 5% level of significance.

(c) Max-Eigen value test indicates no cointegrating equation at the 5% level of significance.

(d)** denotes rejection of the null hypothesis at the 5% level of significance.

(e) The critical values (i.e., CVs) are taken from *Mackinnon-Haug-Michelis* (1999).

Johansen Cointegration Test

Johansen Cointegration Test results for the cointegration rank r have been presented in **TABLE 3**. Going by the results of the *PP Test* and the *KPSS Test*, it has been observed that the variables have the same order of integration, i.e., I(1) and the *Johansen Cointegration Test* has been employed to find out the cointegration rank and the number of cointegrating vectors. The null hypothesis of $r = 0$ (i.e., there is no cointegration) cannot be rejected against the alternative hypothesis of $r = 1$ at the 5% level of significance in case of the Max-Eigen value statistic. Again the null hypothesis of $r \leq 1$ cannot be rejected against the alternative hypothesis of $r = 2$ at the 5% level of significance in case of Max-Eigen value statistic. Similarly, going by the result of the Trace statistic, the null hypothesis of $r = 0$ cannot be rejected against the alternative hypothesis of $r \geq 1$. Again the null hypothesis of $r \leq 1$ cannot be rejected against the alternative hypothesis of $r \geq 2$ at the 5% level of significance. The results suggest that there is no long-run relationship among the variables considered for the study.

Granger-Causality Test

Although it has been concluded that there is no cointegration between GDP and services trade, it does not mean absence of causality or relationship in the short run. In cases where GDP and services trade do not move together in the long run (i.e., there is no cointegration), it is possible for the variables to affect each other in the short run. The null hypothesis is accepted or rejected based on F statistic to determine the joint significance of the restrictions under the null hypothesis. A unidirectional causality is observed from services trade to economic growth.

Table 4: Granger Causality Test (Time Period: 1996-97: Q1 to 2009-10:Q2)

Null Hypothesis	Obser	F-Statistic	Prob.
D(LnSERTRADE) does not Granger Cause D(LnGDP)	49	2.14079	0.0935*
D(LnGDP) does not Granger cause D(LnSERTRADE)		1.43097	0.2415

D(LnSERTRADE) ⟶ D(LnGDP)

*denotes rejection of the null hypothesis at 10% level of significance.

Parameter Stability Tests

The null hypothesis of parameter stability cannot be rejected at the 5% level of significance as the cumulated sum stays inside the 95% confidence band in case of both CUSUM and CUSUMSQ tests. The CUSUM test indicates stability in the equation during the sample period because the line (blue) lies within the 5% critical lines (**Figure 2**). The CUSUMSQ test shows that the cumulative sum of the squares is within the 5% significance lines, suggesting that the residual variance is stable (**Figure 3**).

Figure 2: Diagrammatic representation of CUSUM Test

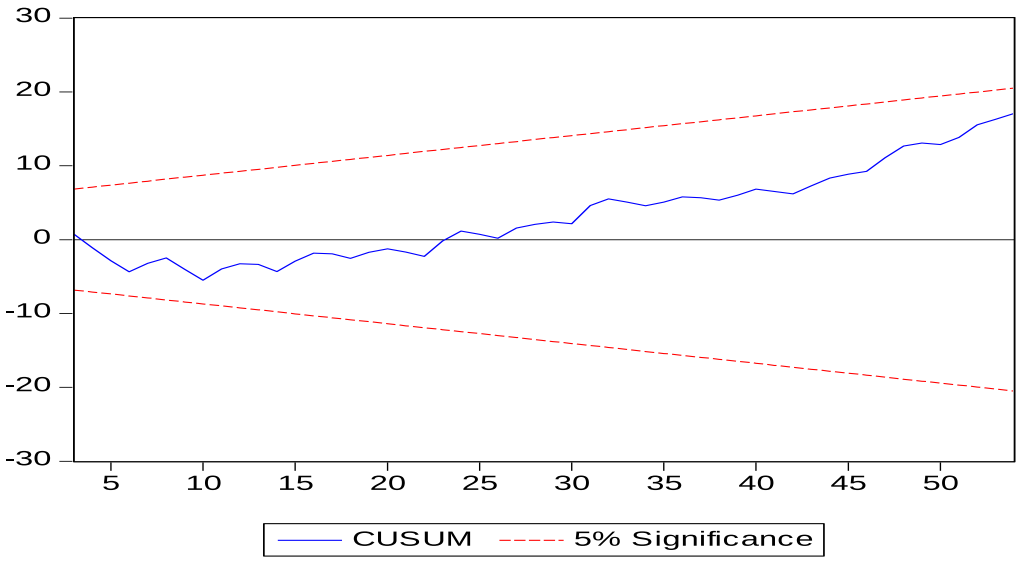
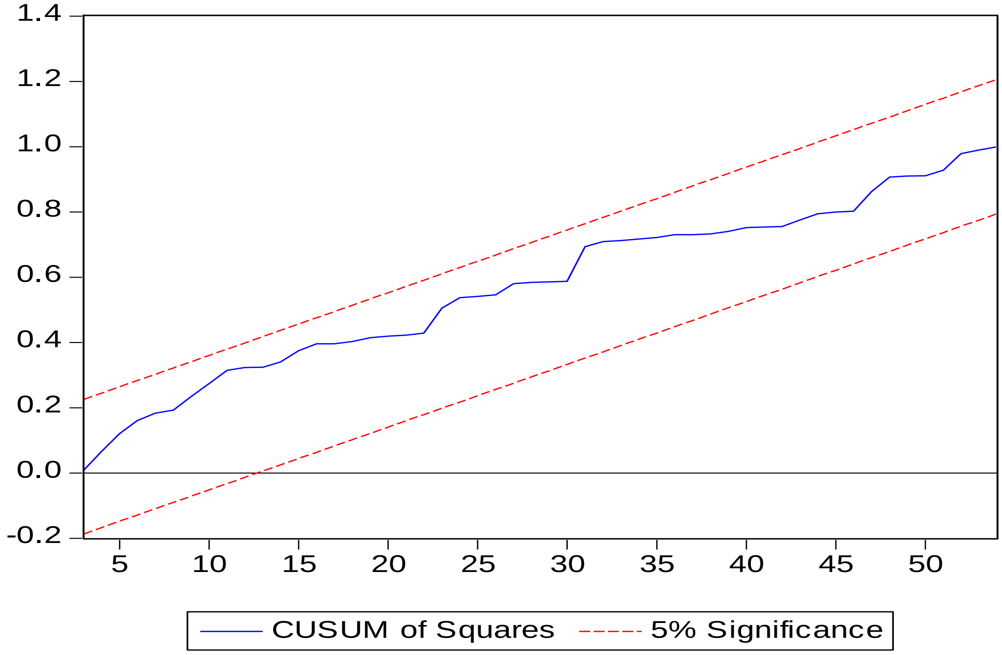


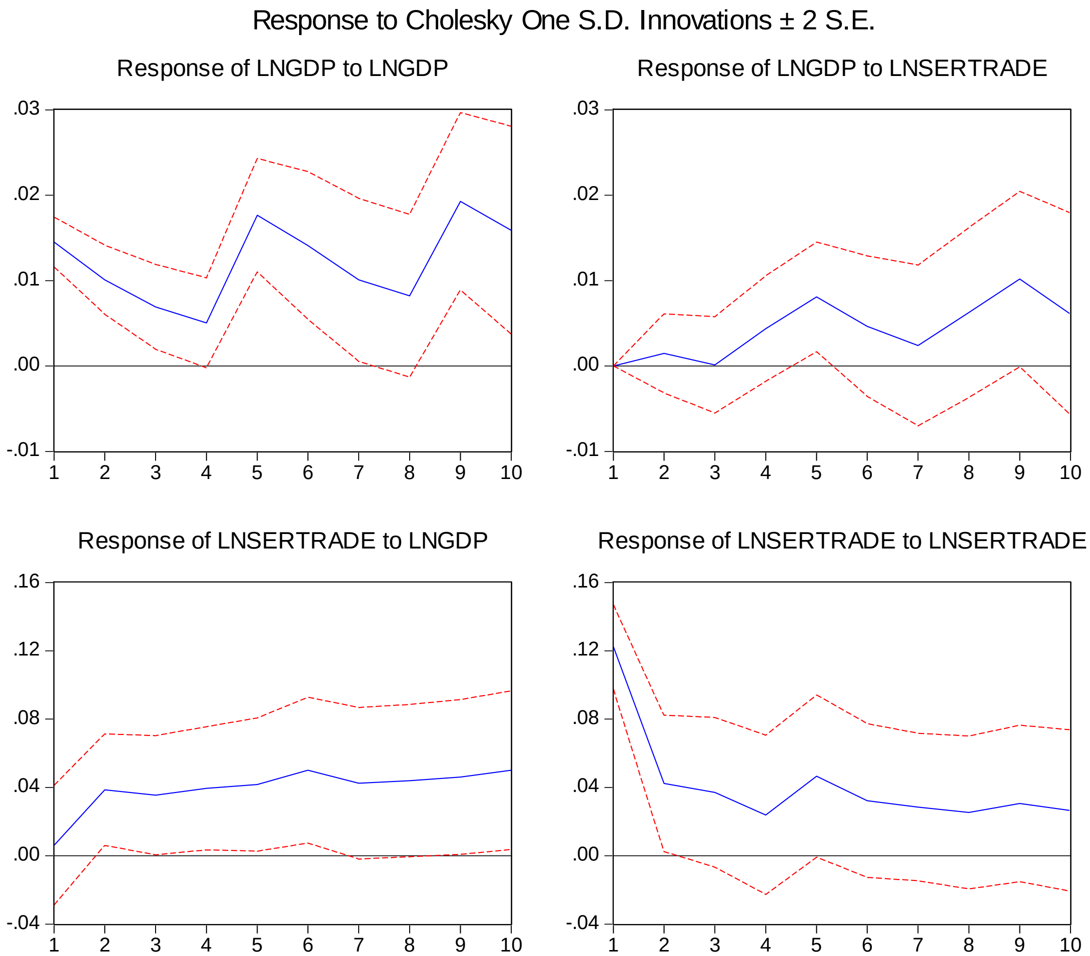
Figure 3: Diagrammatic representation of CUSUMSQTest



Impulse Response Analysis

The Impulse Response function for the VAR system is calculated in the order – GDP and services trade (**FIGURE 4**). The VAR is estimated at the levels of the variables and the optimal lag length is chosen to be 5. Thus, IR functions are computed to give an indication of the system's dynamic behaviour. The response of GDP to a unit shock in services trade is positive and increases over the quarters with a slight fall in the third and seventh quarter. The response of services trade to a unit shock in GDP is positive over the quarters. The Impulse Response Analysis is done by changing the order of the equations to see whether any change in the Impulse Response Function is revealed at the levels of the variables. The results of the impulse response functions are consistent with the t-statistics of the variables in estimated coefficients.

Figure 4: Impulse Response Analysis of the Variables



B. Statistical Analysis

Table 5: OLS estimates for the time period 1996-97:Q1 to 2014-15:Q2

	Constant	**LnSERTRADE**	R^2	$\bar{R}^2$	**F Statistic**
LnGDP	9.884408 (0.128148) [77.13301]***	0.314039 (0.011767) [26.68899]***	0.9319	0.9306	712.3022 (p-value=0.00001)

*** indicates significant at 1% level.

The results reveal that LnSERTRADE is significant at 1% level in explaining LnGDP. The R^2 value (0.9319) measures the goodness of fit of the regression model and the small p value (0.00001) of the F statistic reveals that the regression is significant.

7. Conclusion

The growth in the service sector is supported by two main factors. Those are technological innovation and increased tradability of services. The role of transnational corporations in this regard is important as FDI is an important channel for capital flows and transfer of technology. There is a beneficial economic effect of investments in services, particularly producer services like finance, distribution and research and development and these services raise economic growth and performance and, when such services are in short supply, all enterprises – both manufacturing and non-manufacturing – will be at a disadvantage.

Service trade plays a crucial role in developing countries where proportionately higher services export are characteristics of high-growth countries while excessive dependency on imported services is characteristic of low growth countries. Effective development planning must include strengthening of both domestic and international service sectors to reduce relative dependency on imported services while providing incentives for services exports. With markets becoming increasingly globalized, comparative advantage theory loses its significance with respect to trade in services since it is valid only if there is no mobility of factors of production. Services such as telefax, electronic mail, aligned databases and data processing in general must be interconnected with a proper telecommunications infrastructure to be marketed internationally. Development in the telecommunications sector is therefore of utmost importance with respect to trade in services. Development of a good infrastructure with adequate transportation facilities and state of the art telecommunications facilities will not only enhance the country's attractiveness to foreign investment but will also improve competitiveness of domestic investment. Services trade draws FDI inflows into the country and further liberalisation of FDI and services trade flows could lead to higher growth and further economic development. In contrast, barriers to FDI or restrictions on cross-border services trade by foreign firms, whether motivated by economic, political, social and cultural reasons, could have a direct negative impact on the economic performance and prospects for development of India. Such market interventions would also distort the allocation of capital between foreign and domestic investment. This could result not only in more costly services but also in less consumer choice, lower productivity and perhaps slower technology transfer.

Services liberalization is different from trade in goods because the former necessarily involves factor mobility and leads to scale effects that are distinctive though not unique. Together these can have important positive effects on long run economic growth. It is possible to construct policy-based rather than outcome-based measures of openness for the services sectors that capture these differences. Unlike in trade in goods, where the policy openness measure needs to capture only the openness to foreign supply, in the case of services,policy openness measures must capture both openness towards inward flows of foreign factors and measures that promote domestic competition. There is some econometric evidence that openness in financial and telecommunications sectors and trade in services in those sectors influence long run growth performance.

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