SOFTWARE SERVICES EXPORT AND ITS IMPLICATIONS ON ECONOMIC GROWTH IN INDIA: AN EMPIRICAL STUDY

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ABSTRACT

The structural shift in India's services export since 2003-04 may be attributed to rapid expansion in international trade and investment facilitated by an increased liberalization and the use of technology. The study aims to investigate the possible co-integration and the direction of causality between software services export and non-software miscellaneous services (business, financial, communication and other miscellaneous) export and economic growth during the period 2000-01:Q1-2008-09:Q4. Granger Causality Test conducted in a Vector Error Correction Model (VECM) framework revealed unidirectional causality from software services export to economic growth. To investigate the long and short run dynamics among the variables impulse response analysis is also done.

Keywords: VECM, Cointegration, Granger Causality, Software Services Export.

JEL Classification: F43, O14

1. INTRODUCTION

A striking feature of modern India's growth performance has been the strength of the service sector. The nature of the tax provisions with lighter taxation of services has substantially contributed to the growth of the service sector. The dynamism of services and high-tech sectors contributed to the modernization of the Indian economy and helped in increasing international trade and investment in the 1990s. The services export comprises travel, transport, insurance, government services not included elsewhere (GNIE), and miscellaneous services. The miscellaneous services comprise software services, business services, financial services, communication services, and other miscellaneous services (construction, personal, cultural, recreational, healthcare, education, sports etc.). According to the latest data published by the International Monetary Fund (IMF), India's share in world exports of services more than doubled between 2003 and 2008 to reach 2.7%. Reflecting the positive developments in terms of the comparative advantage and the continued buoyancy of India's services exports, India was ranked at the 10th position in terms of its market share in the world services exports during 2008 which is an improvement compared to its 11th position in 2007. The trade in services has been dominated mainly by software services and non-software miscellaneous services, which include business and professional services.

The Indian information technology and business process outsourcing (IT-BPO) industry is a major contributor to the economy and has a multiplier effect in terms of export earnings, investment, employment, and overall economic and social development. Competitive labour costs, English language skills, technical expertise, political stability, favourable tax rates, and a reputation for high-quality services have driven the sector's rapid growth. The strategy of geographical

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diversification along with a strong focus on productivity, benchmarking, and enhanced operational efficiencies will help the industry to take forward its competitive edge as the global leader in software services exports.

The share of software services in total services exports increased to 45.5% in 2008-09 from 44.6% in 2007-08. Exports of software and IT-enabled services increased to US$ 46.3 billion in 2008-09 as compared to US$ 40.3 billion in 2007 and US$ 31.3 billion during 2006-07 (Table 1.1) and despite a decline in software exports during the first half of 2009-10, its share in total services exports increased to 53.4% during the period when the decline in other categories of services exports was higher.

Table 1.1. Software Services Exports of India

Year	IT Services Exports	ITES-BPO Exports	Total Software Services Exports
1995-96	754	-	754
1999-00	3397	565	3962
2000-01	5411	930	6341
2001-02	6061	1495	7556
2002-03	7100	2500	9600
2003-04	9200	3600	12800
2004-05	13100	4600	17700
2005-06	17300	6300	23600
2006-07	22900	8400	31300
2007-08 *	29400	10900	40300
2008-09**	33600	12700	46300

Source NASSCOM. * Revised, ** Partially revised estimate

2. LITERATURE REVIEW

The rapid expansion of trade in services contributes significantly to economic growth, both in developed and in developing economies (OECD, 2003). Goldsmith (1969) stressed the role of financial services in channelling investment funds to their most productive uses, thereby promoting growth of output and incomes. Francois (1990) observed that the growth of intermediation services contributes to overall economic growth and development because they allow specialization to occur. Some of the theoretical models treat services as goods and producer services and are modelled as intermediate goods (Dee & Hanslow, 2000; Brown et al., 2003) and show that multilateral trade liberalisation of services will increase global income and welfare. Banga & Goldar (2007) empirically determine the impact of trade liberalisation and find that trade liberalisation and development of 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 & Levine (1993) postulate that financial services can affect growth through enhanced capital accumulation and/or technical innovation. Francois & Reinert (1996) have documented that the importance of services for export performance rises with per capita incomes – business, distribution, and communications services become the most important sectoral elements of overall exports in terms of inter-industry linkages. Bayraktar & Wang (2004) 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. Mattoo et al. (2006) find that by controlling for other determinants of growth, countries with open financial and telecommunications sectors grew, on average, about 1 percentage point faster than other countries. Francois & Manchin (8) conclude that infrastructure is a significant determinant not only of export levels, but also of the likelihood exports that will take place at all. The mid-1990s saw two seemingly separate but related developments: the revolution in information and communication technology; and rapid developments in those global forces often referred to as the 3Ts-technology, transportability, and tradability (Ghani et al., 2).

3. DATA AND METHODOLOGY

Quarterly data (2000-01:Q1 to 2008-09:Q4) of GDP at (1999-00) market prices and miscellaneous services export (software services export [SOFTWARE] and non-software miscellaneous services [OTHERS]) are obtained from Reserve Bank of India website and has been used in the study. After employing unit root test to check the stationarity of the variables, cointegration test is performed followed by VECM analysis and the Granger Causality test. Impulse response analysis is also done. Regression analysis is done with quarter wise data (2004-05:Q1 to 2008-09:Q4) of GDP, software services (SOFTWARE), business services (BUS), financial services (FIN), communication services (COMM) and other miscellaneous (construction, personal, cultural, recreational, healthcare, education, sports, etc.) services export (MIS). CUSUM and CUSUMSQ test is performed to check the parameter stability of the variables.

3.1 Econometric Analysis

3.1.1 Stationarity Test

Augmented Dickey Fuller (ADF) (1979), Phillips-Perron (PP) (1988) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992) tests have been conducted to investigate the stationarity property of the variables.

3.1.2 Cointegration Test

After examining the stationarity of the variables, cointegration test is conducted to determine the long-run economic relationship between the variables. In this study, the Error correction Cointegration technique of Johansen (10) and Johansen & Juselius (1990) has been applied to identify the cointegration relationship between the variables. A p-dimensional VAR model, involving up to k-lags, can be specified as below.

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

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 (1) can be formulated into an Error Correction Model (ECM) form as below.

$$\Delta Z_t = \prod_k Z_{t-k} + \sum_{i=1}^{k-1} \theta_i \Delta Z_{t-i} + \varepsilon_t \qquad \ldots (2)$$

where Δ is the first difference operator, and $\prod$ 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. Johansen & Juselius (1990) have shown that the rank of r of Π in equation (2) is equal to the number of cointegrating vectors in the system. When the rank of Π is reduced i.e. $[1 \le Rank\Pi \le (p-1)]$, in this case, even if all the variables are individually I(1), the level-based long-run component would be stationary. In this case, there are $(p-1)$ cointegrating vectors. The appropriate modelling methodology here is the Vector-Error Correction Model (VECM). Johansen & 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.

3.1.3 Granger Causality with VECM

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 3 in the present study) is chosen. According to Engle & Granger (1987), if two series, say X and Y, are integrated of order one [i.e., I(1)] and cointegrated, then there is a possibility of a causal relationship in at least one direction. The direction of a causal relationship can be detected in the VECM. Engle & Granger (1987) have found that, in the presence of cointegration, there always exists a corresponding error correction representation, captured by the error correction term (ECT). This means that changes in the dependent variable are a function of the level of disequilibrium in the cointegrating relationship as well as changes in other explanatory variable(s). The ECT captures the long-run adjustment of cointegration variables. As such, in addition to the direction of causality, the incorporation of ECT in the VECM allows to detect both short- and long-run causal relationships between the variables. The VECM is specified as follows:

$$\Delta LnGDP_t = \sum_{j=1}^{p-1} \beta_{11,j} \Delta LnGDP_{t-j} + \sum_{j=1}^{p-1} \beta_{12,j} \Delta LnSOFTWARE_{t-j} + \sum_{j=1}^{p-1} \beta_{13,j} \Delta LnOTHERS_{t-j} + \alpha_1 ECT_{t-1} + \varepsilon_{1t} \quad \ldots\ldots 3(a)$$

$$\Delta LnSOFTWARE_t = \sum_{j=1}^{p-1} \beta_{21,j} \Delta LnSOFTWARE_{t-j} + \sum_{j=1}^{p-1} \beta_{22,j} \Delta LnGDP_{t-j} + \sum_{j=1}^{p-1} \beta_{23,j} \Delta LnOTHERS_{t-j} + \alpha_2 ECT_{t-2} + \varepsilon_{2t} \quad \ldots\ldots 3(b)$$

$$\Delta LnOTHERS_t = \sum_{j=1}^{p-1} \beta_{31,j} \Delta LnOTHERS_{t-j} + \sum_{j=1}^{p-1} \beta_{32,j} \Delta LnGDP_{t-j} + \sum_{j=1}^{p-1} \beta_{33,j} \Delta LnSOFTWARE_{t-j} + \alpha_3 ECT_{t-3} + \varepsilon_{3t} \quad \ldots\ldots 3(c)$$

$$LnGDP_i = \alpha_i + \beta_1 LnBUS_i + \beta_2 LnFIN_i + \beta_3 LnCOMM_i + \beta_4 LnSOFTWARE_i + \beta_5 LnMIS_i + \varepsilon_i \quad \ldots\ldots (4)$$

where Δ is the first difference operator and $\varepsilon_{1t}, \varepsilon_{2t}$ and ε_{3t} are white noise. ECT is the error correction term, and p is the order of the VAR, which is translated to lag of p-1 in the ECM. α_1, α_2 and α_3 represent the speed of adjustment after the GDP, SOFTWARE, and OTHERS deviate from the long-run equilibrium in period t-1.

3.1.4 Impulse Response Analysis

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 variable 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. 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 at both the level and first difference form.

3.2 Statistical Analysis

The regression equation used formula (4); where ε_i is the noise or error term, α_i the constant and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ represent coefficients of regression.

3.2.1 Parameter Stability Tests

CUSUM and CUSUM of squares test are used to check whether the parameters of the model are stable or not. The CUSUM test (Brown et al., 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 the 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

4. FINDINGS

4.1 Econometric Analysis

ADF, PP and KPSS Tests are performed on both the level and first differences of the lagged variables using the lag length chosen based on minimum values of SIC. The variables LnSOFTWARE, LnOTHERS are I(1) processes according to ADF, PP and KPSS tests. The variable LnGDP is an I(1) process according to PP and KPSS test, but is an I(2) process according to ADF test.

4.1.1 Johansen Cointegration Test

The null hypothesis is rejected in the cases of both the Trace statistic and Max-Eigen value statistic at 5% level of significance respectively. Table 4.1 shows that the number of statistically significant cointegration vectors is equal to 1 for both the Trace statistic and Max-Eigen value statistic.

Table 4.1. Cointegration Test Results

H_0	H_1	λ_{trace}	$CV_{(trace,5\%)}$
$r = 0$	$r \geq 1$	49.49797**	35.19275
$r \leq 1$	$r \geq 2$	19.41123	20.26184
H_0	H_1	λ_{max}	$CV_{(max,5\%)}$
$r = 0$	$r = 1$	30.08674**	22.29962
$r \leq 1$	$r = 2$	12.69703	15.89210

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

4.1.2 Analysis of VECM

Johansen's λ_{max} and λ_{trace} statistics (as per Table 4.1) reveal that the variables under study stand in a long-run relationship among them, thus, justifying the use of ECM for showing short-run dynamics. In Table 4.2 below, the cointegrating equations are given along with the equation for changes in GDP (*first* column), changes in SOFTWARE (*second* column), changes in OTHERS (*third* column). The coefficients of ECT contain information about whether the past values affect the current values of the variable under study. A significant coefficient implies that past equilibrium errors play a role in determining the current outcomes. The information obtained from the ECM is related to the speed of adjustment of the system towards long-run equilibrium. The short-run dynamics are captured through the individual coefficients of the difference terms. The adjustment coefficient on ECT_{t-1} in equation 3(a) is negative and statistically significant (at 1% level), which means that the error term contributes in explaining changes in GDP and a long-term relationship exists between the independent variables and GDP. In equation 3(a) the estimates of lagged coefficients $\Delta\text{LnSOFTWARE}_{t-1}, \Delta\text{LnSOFTWARE}_{t-2}$ are negative and statistically significant (at 5% level and 10% level respectively), implying that higher software services export has a negative impact on GDP in the short-run. The estimates of lagged coefficients $\Delta LnGDP_{t-1}$ in equation 3(b) is positive and statistically significant at 10% level implying that a higher GDP has a positive impact on software services export in the short run. The adjustment coefficient on ECT_{t-3} in equation 3(c) is negative and statistically significant (at 10% level), which means that the error term contributes in explaining changes in OTHERS and a long-term relationship exists between the independent variables and OTHERS. The

estimates of lagged coefficients $\Delta LnGDP_{t-1}$ in equation 3(c) is positive and statistically significant at 10% level implying that a higher GDP has a positive impact on non-software miscellaneous services export in the short run.

Table 4.2. Vector Error Correction Estimates

Cointegrating Eq:	**CointEq1**		
LnGDP(-1)	1.000000		
LnSOFTWARE(-1)	-0.349109		
	(0.09677)		
	[-3.60763]		
LnOTHERS(-1)	0.001827		
	(0.06829)		
	[0.02675]		
C	-10.11215		
	(0.41153)		
	[-24.5723]		
Error Correction:	**D(LnGDP)**	**D(LnSOFTWARE)**	**D(LnOTHERS)**
CointEq1	-0.31427	-0.295410	-1.020407
	(0.05167)	(0.32225)	(0.57099)
	[-6.081]***	[-0.91672]	[-1.78708]*
D(LnGDP(-1))	0.096575	0.857690	1.593613
	(0.08112)	(0.50588)	(0.89638)
	[1.19053]	[1.6954]*	[1.77784]*
D(LnGDP(-2))	-0.629579	-0.199733	0.962454
	(0.09465)	(0.59028)	(1.04592)
	[-6.65153]	[-0.33837]	[0.92020]
D(LnSOFTWARE(-1))	-0.100918	-0.317929	-0.633051
	(0.03874)	(0.24157)	(0.42804)
	[-2.6052]**	[-1.31610]	[-1.47896]
D(LnSOFTWARE(-2))	-0.101829	-0.282059	-0.171550
	(0.03549)	(0.22135)	(0.39221)
	[-2.8689]*	[-1.27428]	[-0.43740]
D(LnOTHERS(-1))	-0.030902	0.130761	-0.463986
	(0.01832)	(0.11425)	(0.20245)
	[-1.68672]	[1.14449]	[-2.29190]
D(LnOTHERS(-2))	-0.017959	0.034204	-0.262417
	(0.01895)	(0.11815)	(0.20935)
	[-0.94791]	[0.28949]	[-1.25346]
R-squared	0.859906	0.262273	0.249839
Adj. R-squared	0.827576	0.092028	0.076725
F-statistic	26.59819	1.540562	1.443202

***, ** and * denotes statistical significance at 1%, 5% and 10% level of significance respectively. Standard errors in ( ) & t-statistics in [ ].

4.1.3 Causality Test with VECM

Uni-directional causality is observed from software services export to economic growth. (Table 4.3).

Table 4.3. VEC Granger Causality Test Dependent variable: D(LnGDP)

Excluded	***Chi-square***	**df**	**Probability**
D(LnSOFTWARE)	10.58579	2	0.0050
D(LnOTHERS)	3.152220	2	0.2068
All	10.69570	4	0.0302

4.1.4 Impulse Response Analysis

The shock to any one of the three variables considered in the study affects all other variables in the system. The shocks are orthogonalized by using the Choleski decomposition method. The IR function for the VAR system is calculated in the following order – LnGDP, LnSOFTWARE, LnOTHERS. The VAR is estimated at the level of the variables and the optimal lag length is chosen to be 3. The initial response of GDP to a unit

shock in SOFTWARE (Fig. 1) is positive and more or less constant during the first three quarters and then starts increasing. The response of SOFTWARE to a unit shock in GDP is positive and increases in the second quarter and then starts falling. The response of GDP to a unit shock in OTHERS is negative in the first three quarters. The response of OTHERS to a unit shock in GDP is more or less constant over the period.

The Impulse Response Analysis is also done by estimating the VAR at first difference of the variables and the optimal lag length is chosen to be 2 (Fig. 2). The response of GDP to a unit shock in software is negative in the first three quarters. The response of SOFTWARE to a unit shock in GDP is positive and increases from the first quarter onwards. The response of GDP to a unit shock in OTHERS is negative in the first three quarters. The response of OTHERS to a unit shock in GDP is positive in the first quarter, starts falling in the second quarter, and becomes negative in the third quarter.

4.2 Statistical Analysis

Table 4.4. Regression results (2004-05:Q1 to 2008-09:Q4)

LnGDP	Coefficient	Std. Error	t-Statistic	Prob.
LnBUS	0.07573	0.05130	1.47609	0.1621
LnFIN	-0.05689	0.02614	-2.17625	0.0471
LnSOFTWARE	0.27790	0.07252	3.83181	0.0018
LnCOM	0.11096	0.02372	4.67623	0.0004
LnMIS	0.04615	0.02201	2.09633	0.0547
C	9.13996	0.51423	17.7740	0.0000
R^2 =0.89051, F-statistic = 22.77430,				

The results (Table 4.4) reveal that LnFIN and LnMIS are each significant at 5% level and LnSOFTWARE, LnCOM, are each significant at 1% level in explaining LnGDP. The R^2 value (0.890515) implies that the model explains 89% and reveals the goodness of fit of the regression model. The small p value (0.000) of the F statistic (22.77430) reveals that the regression is significant.

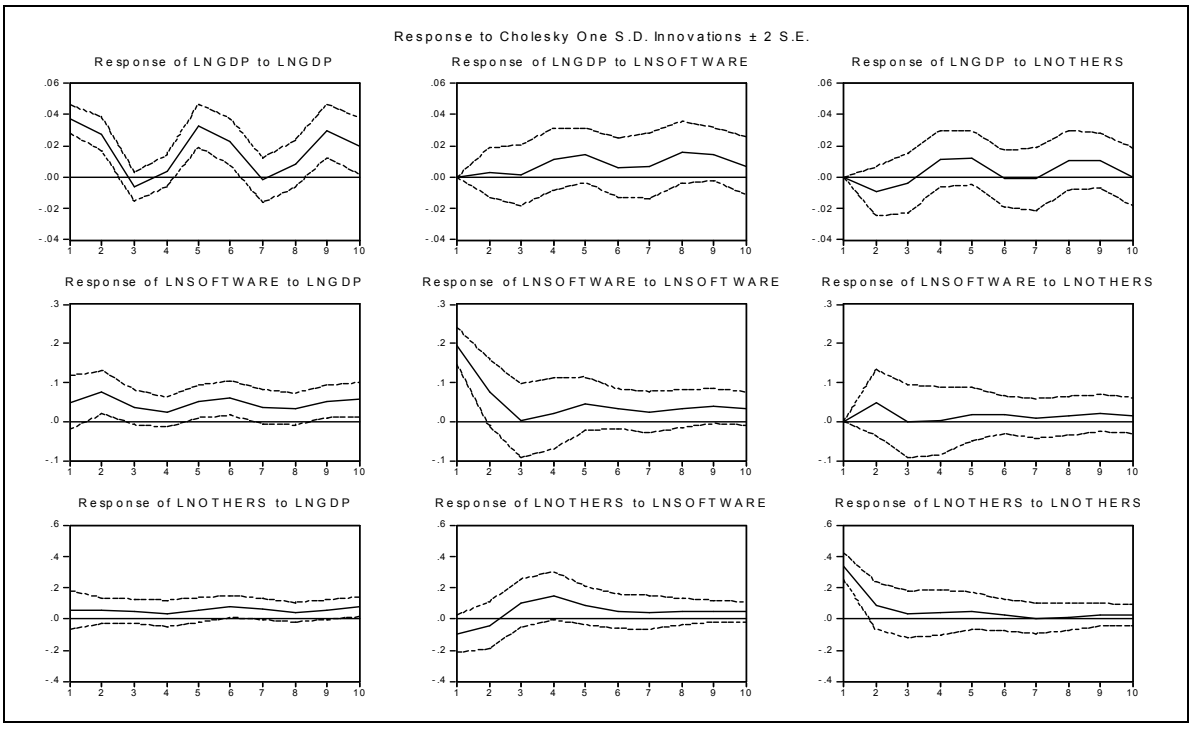

Figure 4.1. Impulse Responses Analysis

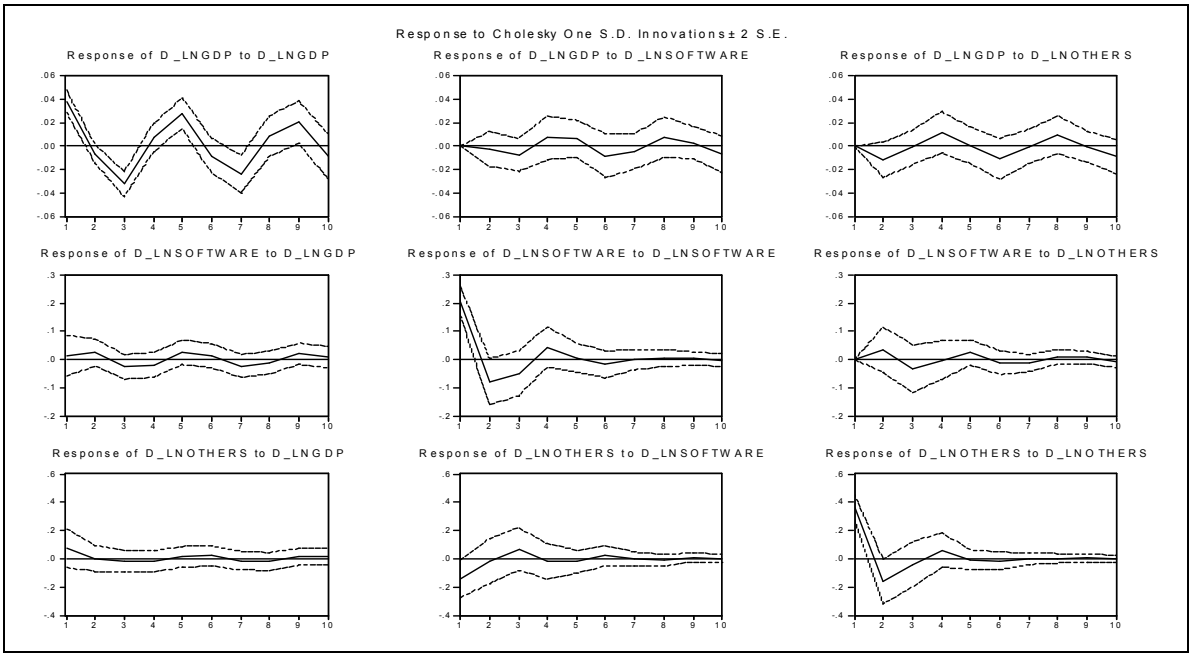

Figure 4.2. Impulse Responses Analysis

4.2.1 Parameter Stability Tests

The null hypothesis of parameter stability cannot be rejected at 5% level of significance as the cumulated sum stays inside the 95% confidence band in case of both CUSUM and CUSUMSQ tests. (Fig. 3 and Fig. 4)

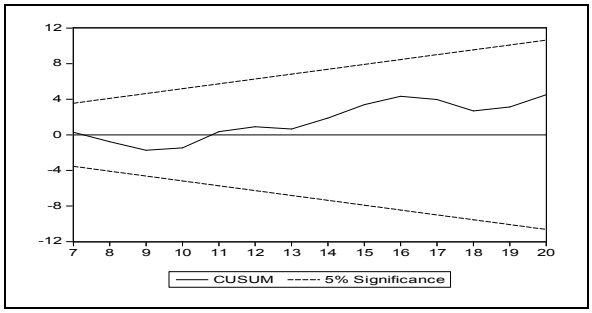

Figure 4.3. Representation of CUSUM Test

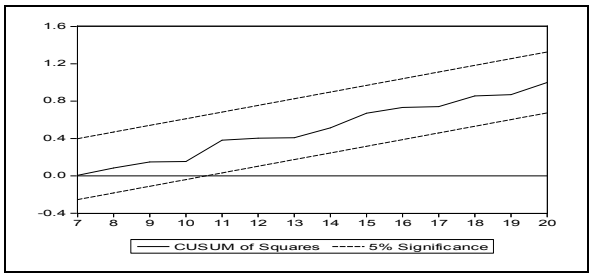

Figure 4.4. Representation of CUSUMSQ Test

5. CONCLUSION AND RECOMMENDATION

India's non-software services constituted almost 31% of total services exports in 2008-09, which also in turn, supported steady growth in invisibles receipts. With increasing competitive pressures, India IT-BPO industry continues to remain an attractive source due to its low cost of operations, high quality of product and services, and readily available skilled manpower. Furthermore, a favourable time zone difference with North America and Europe helps Indian companies achieve round the clock international operations and customer service. India's software exports have been offsetting trade deficit significantly in recent years, which has helped in containing current account deficit at a comfortable level. Despite the global economic and financial crisis and the related pressures on external demand, exports of software and IT-enabled services exhibited growth of 15 % during 2008-09. Although India's software exports remained strong over the years, slowdown in global demand due to the crises did affect the export performance to some extent. According to NASSCOM, while the US (60%) and the UK (22%) remained India's largest markets for IT-BPO exports in 2008-

09, the industry has also been steadily expanding to other regions - with exports to continental Europe, in particular, growing significantly in recent years. NASSCOM projects IT services to grow by 2.4% in 2010, and 4.2% in 2011 as companies coming out of the recession tend to harness the need for information technology to create competitive advantage. Moreover, the government has taken several favourable steps like formulating incentive policy for deployment of multinational IT industries, encouraging investments in infrastructure. The Software Technology Parks of India program (STPI), created in 1991, exempts eligible firms from taxes on export profits, customs and excise duties, and service and sales taxes. Unlike India's Special Economic Zones (SEZs), the STPI does not require firms to be based in a particular location to be eligible for benefits.

It is highly recommended that the Indian government should facilitate in increasing the availability of venture capital for small and medium-size businesses, increase incentives for research and development and more public-private partnerships. Although few sectoral regulations are required, it is up to the government to adjust national public policies for authentication, certification, privacy, consumer protection, tax neutrality, movement of professionals, public bids, and commercial practices. The government could be a model for society through deployment of e-government, enabling better and cheaper services. The Indian experience shows that even with a small share of population engaged in service exports, the sector can make a significant contribution to overall growth. The challenge is to sustain the growth pace of the services sector and framing of policies to accelerate the growth rate. A limited number of services sectors like software and telecom have been tapped so far and there is a need to tap other services sectors as well. It is indeed a challenge for the Indian government to ensure that the software sector remains to be a high growth propelling force for years to come with positive spill over effects to other sectors. The software sector is facing international competition, is more exposed to the international shocks in this globalized environment and therefore efforts are needed to make them stable. There are still some open ended questions in Indian service sector related to the initiatives the government may take in future to promote the growth of IT and ITeS industry in order to overcome problems like rising costs in India, infrastructure constraints, currency fluctuations etc. Also, there are problems with availability of sector related data for correct projection of how the skilled employment in the IT and ITeS sector will increase over the years and how it will affect the economic growth of the country. However there is little doubt on the need to build on specialization and sophistication in service exports as a potential route to economic growth.

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