India's Exports of Software Services: Role of External Demand and Productivity

Rashmi Banga and *Dinesh Kumar*

Abstract: Services sector in India showed a remarkable resilience to global economic crisis and grew at a rate of 9.3% explaining around 88% of the growth rate in real GDP of India in 2008-09. Exports of software services helped considerably in providing the necessary resilience. The main objective of the paper is to examine the role of external demand and productivity growth in exports of software services. Global income elasticity of demand for export of software services is estimated for the period 1970 to 2008. Sources of total factor productivity growth in Indian IT services firms are identified using Data Envelopment Analysis for the period 1994-95 to 2007-08. It is found that high income demand elasticity for India's software services has contributed substantially to its growth. But more importantly, there has been a steep rise in productivity growth in the post 2000 period which is attributable mainly to technological innovation.

JEL Classification: F14; L86
Key Words: India's services exports; productivity in IT services; Income elasticity of demand for services; Economic crisis and India's exports of software services.

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1. Introduction

One of the main drivers of India's growth in the period of global economic crisis has been the services sector, which explained around 88% of the growth rate in real GDP in 2008-09. Services sector grew at a rate of 9.3% even as agriculture and industry recorded a steep decline in their growth rates. India's services-led-growth becomes even more intriguing in the face of the laggard growth of global services sector, which has remained far behind manufacturing sector and is showing few signs of recovery[1]. In less than two decades, India has become one of the top five exporters of services amongst developing countries, with a market share of 2.6 % in 2007 as against 0.6 % in 1995. To demystify this relatively resilient growth of services sector in India in the face of global slowdown, it is important to look closely at the composition of exports of services. Within services sector, the major component of exports is software services which include both information technology enabled services and business processing and outsourcing (ITeS-BPO). This constituted almost 45% of total services exports of India in 2008-09 and has grown at an annual average of 30% during 2005-06 to 2007-08. In 2008-09, exports of this sector increased by 28% from the previous year and reached USD 40.8 billion out of the total services exports of USD 90.1 billion[2]. Limited impact of global crisis on exports of software services needs a close examination.

In this context, the main objective of this paper is to examine the role played by demand side factors and supply side factors in growth of exports of services. To estimate the impact of demand side factors on exports of these services, income demand elasticities of US (which has a share of 60% in India's exports of ITeS-BPO services) have been estimated. To assess the impact of supply side factors contributing to growth of services, we estimate total factor productivity growth (TFPG) in software services. A detailed firm-level analysis using Data Envelopment Approach (DEA) has been undertaken of IT firms to examine the sources of productivity growth in these firms. The paper further discusses the factors that may have affected productivity growth in services sector, including government policies and provides future policy directions for supporting productivity growth in this sector.

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[1] J.P Morgan's Global Services Business Activity Index pointed to a decline in services activity for the thirteenth successive month in June 2009. It also indicated that global manufacturing activity is far stronger than services.

[2] NASSCOM (2009).

The rest of the paper is organized as follows: section 2 examines the over time contribution of India's services sector to GDP growth. An in-depth analysis is undertaken of changing composition within the services sector to draw inferences on the contribution of disaggregated services to GDP growth; section 3 examines composition of India's exports of services.; section 4 assesses the implications of global economic crisis on India's exports of disaggregated services; section 5 estimates global demand for India's disaggregated services by estimating income demand elasticities for India's export of services; section 6 presents the results of Data Envelopment Analysis and discusses the sources of total factor productivity growth (TFPG) in IT services firms; section 7 highlights the role played by global demand and productivity growth and provides recommendations for further improving productivity growth in this sector; section 8 concludes the paper.

2. Contribution of Services Sector to India's Growth

2.1 Changing Sectoral Composition of India and Rising Significance of Services

Amidst the global economic crisis, growth rate of the Indian economy decelerated to 6.7 per cent from an average growth of 8.8 per cent in the preceding five years and 2.3 per cent points lower than the previous year. Table 1 depicts quarterly growth rate of GDP which shows that in the fourth quarter (Q4) of 2007-08, the impact of global economic crisis was felt for the first time when growth rate fell from 9.3% (Q3- 2007-08) to 8.6% (Q4-2007-08). Though the quarterly growth rate of GDP has fallen continuously till Q3 of 2008-09, it stabilized in the last quarter of 2008-09, grossing 6.7% of annual growth rate.

Table 1: Growth Rates of Real GDP@

(Per cent)

Sector	2007-08*	2008-09#	2007-08 Q1	Q2	Q3	Q4	2008-09 Q1	Q2	Q3	Q4
1	2	3	4	5	6	7	8	9	10	11
1. Agriculture and Allied Activities	4.9 (17.8)	1.6 (17.0)	4.3	3.9	8.1	2.2	3.0	2.7	-0.8	2.7
2. Industry	7.4 (19.2)	2.6 (18.5)	8.5	7.5	7.6	5.9	5.1	4.8	1.6	-0.5
2.1 Mining and Quarrying	3.3	3.6	0.1	3.8	4.2	4.7	4.6	3.7	4.9	1.6
2.2 Manufacturing	8.2	2.4	10.0	8.2	8.6	6.3	5.5	5.1	0.9	-1.4
2.3 Electricity, Gas and Water Supply	5.3	3.4	6.9	5.9	3.8	4.6	2.7	3.8	3.5	3.6
3. Services	10.8 (63.0)	9.4 (64.5)	10.8	10.7	10.2	11.3	10.0	9.8	9.5	8.4
3.1 Trade, Hotels, Restaurants, Transport, Storage and Communication	12.4	9.0	13.1	10.9	11.7	13.8	13.0	12.1	5.9	6.3
3.2 Financing, Insurance, Real Estate and Business Services	11.7	7.8	12.6	12.4	11.9	10.3	6.9	6.4	8.3	9.5
3.3 Community, Social and Personal services	6.8	13.1	4.5	7.1	5.5	9.5	8.2	9.0	22.5	12.5
3.4 Construction	10.1	7.2	11.0	13.4	9.7	6.9	8.4	9.6	4.2	6.8
4. Real GDP at Factor Cost	9.0	6.7	9.2	9.0	9.3	8.6	7.8	7.7	5.8	5.8

Memo:		(Amount in Rupees crore)
a) Real GDP at Factor Cost	31,29,717	33,39,375
b) GDP at Current Market Prices	47,23,400	53,21,753

@ : At 1999-2000 Prices.   * : Quick Estimates.   # : Revised Estimates.
Note   : Figures in parentheses indicate shares in real GDP.
Source: Central Statistical Organisation.

India's GDP growth in 2008-09 was one of the highest in the world. It reflected the relative resilience of the country's growth impulses to a severe external shock as well as the impact of the policy response to contain the adverse effects of the global economic crisis on domestic growth

Figure 1 depicts the changing sectoral composition of Indian economy and sectoral growth rates since 1990-91. Share of agriculture in total GDP declined from 31.4% in 1990-01 to 17% in 2008-09 and share of industry fell from 19.8% in 1990-01 to 18.5% in 2008-09, while <u>share of services increased substantially from 48.8 % in 1990-01 to 64.5% in 2008-09</u>. During the ongoing global economic crisis, services sector's share in real GDP has further increased from 63% in 2007-08 to 64.5% in 2008-09, while that of agriculture and industry has declined. Services sector in India experienced the lowest fall in its growth rate compared to other two sectors. The growth rate fell from 10.8% in 2007-08 to 9.3% in 2008-09, a decline of 1.4 per cent point as compared to 3.3 per cent point in agriculture and 4.7 per cent points in industry.

**Figure 1: Change in Sectoral Composition of India's GDP**
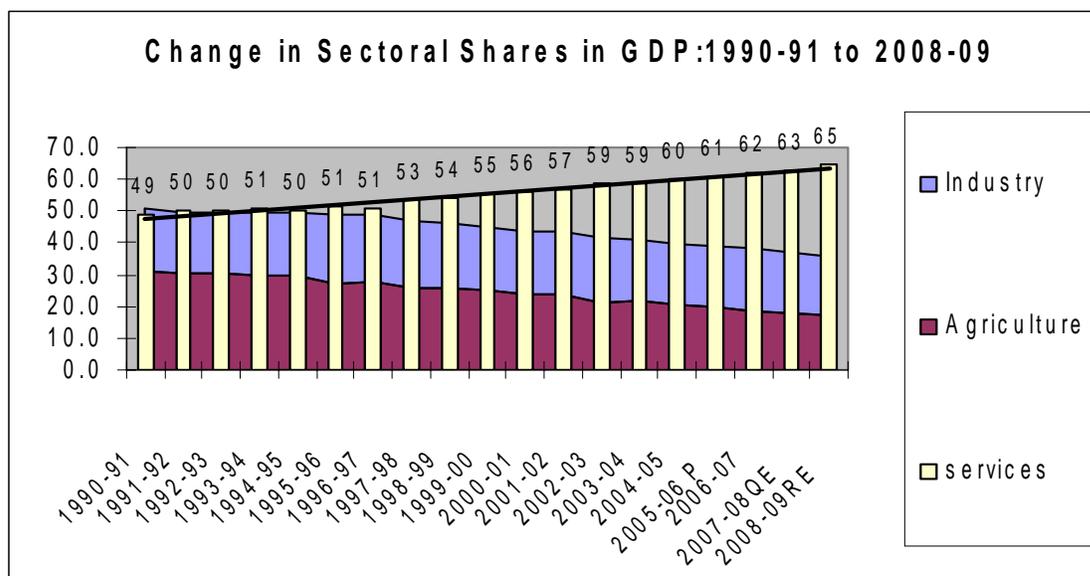
Source: CSO

A close look at the composition of services sector brings out some very interesting facts (Figure 2). Within India's services sector, the highest share in services GDP has been of **domestic trade** (retail and wholesale trade), which average around 23.2% of total services GDP in the period FY 1990-FY 1999 and further increased to 23.4% in period FY 2000-2007, remaining the most significant sector in terms of its share in total services output. This has been followed by the share of **real estate,** with an average of 13.7% which fell by a percentage point to 12.7% in the subsequent period. Next in importance in terms of share in services output have been **public administration** and **construction services** with shares of 12% and 11.2% in the earlier period (FY 1990- FY1999) which fell marginally to 10.8% and 10.2% in the subsequent period (FY 2000-FY 2007). What is interesting is that the top five services categories remained the same over time in terms

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of their share in total services sector output. These are also the services which have low tradability in India's context. These services are followed by **banking and insurance and transport services** which consistently averaged 10% and 8.5% in these periods.

What is most striking is the rise in the average share of **communication services,** which rose from 2.4% to 7.0%. There has been a consistent rise in the share of communication services in total services output but it must be noted that the share has remained less than 10 % of total output of services at all times.

Figure 2: Composition of India's Services Sector: 1990-91 to 2007-08
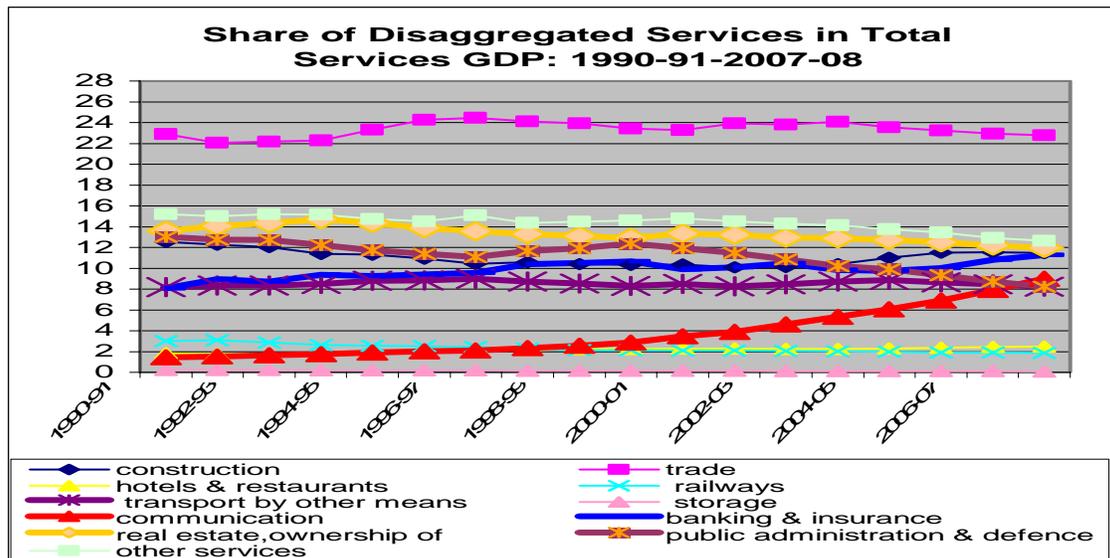
Source: Reserve Bank of India (RBI)

2.2 Decomposition of India's GDP Growth Rate: Contribution of Communication Services

Decomposing GDP growth into growth in the three sectors of the economy (Table 2), we find that in the 2007-08, India recorded a growth rate of 6.7%, of which higher than 7.5 percentage point was of which more than 5.9 percentage points was contributed by services sector. Manufacturing sector contributed 0.5 percentage points while contribution of agriculture in GDP growth rate was 0.3 percentage points In fact, in 2008-09, almost 88% of GDP growth was explained by the services sector growth. Contribution of services to GDP growth over the years clearly shows that the main momentum to growth of real GDP has come from the services sector, especially in the period of global economic crisis.

Table 2: Sectoral Decomposition of GDP Growth: 1990-91 to 2008-09

	Growth of GDP at factor cost	Agriculture	Industry	Services
1991-92	**1.4**	-0.6	-0.1	**2.1**
1992-93	**5.4**	2.0	0.6	**2.7**
1993-94	**5.7**	1.0	1.4	**3.2**
1994-95	**6.4**	1.4	2.0	**3.0**
1995-96	**7.3**	-0.2	2.6	**4.8**
1996-97	**8.0**	2.7	1.7	**3.6**
1997-98	**4.3**	-0.7	0.4	**4.6**
1998-99	**6.7**	1.6	0.7	**4.3**
1999-2000	**6.4**	0.7	0.7	**5.0**
2000-01	**4.4**	-0.1	1.3	**3.2**
2001-02	**5.8**	1.5	0.5	**3.8**
2002-03	**3.8**	-1.7	1.3	**4.3**
2003-04	**8.5**	2.1	1.2	**5.2**
2004-05	**7.5**	0.0	1.7	**5.8**
2005-06	**9.5**	1.2	1.6	**6.7**
2006-07	**9.7**	0.8	2.1	**6.9**
2007-08	**9.0**	0.9	1.4	**6.7**
2008-09	**6.7**	0.3	0.5	**5.9**

Source: Authors' calculations

Figure 3 depicts the contribution of disaggregated services to GDP growth. Within services sector, decomposing GDP growth rate, shows that the maximum contribution to GDP growth rate in 2007-08, which was 6.7%, has come from domestic **trade sector (retail and wholesale),** which contributed 1.42 percentage points out of 6.7 percent growth rate. This was followed by **communication services** (which include telecommunication and software services) and **banking & financial services** contributing 1.25 and 1.03 percentage points respectively. Construction services, other services and real estate services 0.72, 0.68 and 0.65 percentage points respectively. This was followed by transport and public administration services. Contribution of hotels and restaurant and railways to services growth has been less than 0.2 percentage points.

The above analysis shows that the main drivers of GDP growth have been domestic trade, communication services and banking and insurance.

Figure 3: Decomposition of Services Sector's Growth Rate

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3 Composition of India's Exports of Services

Within services exports, we find that India's export basket has not diversified much over time. Only few services in India comprise its export basket, with the share of software services being the maximum, i.e., around 41% since 2005-06 and 47% in 2008-09. Together with software services, non-software services which comprise business and professional services, account for around 70% of India's exports (Figure 4).

Figure 4: Composition of India's Export Basket: 2005-06 to 2008-09
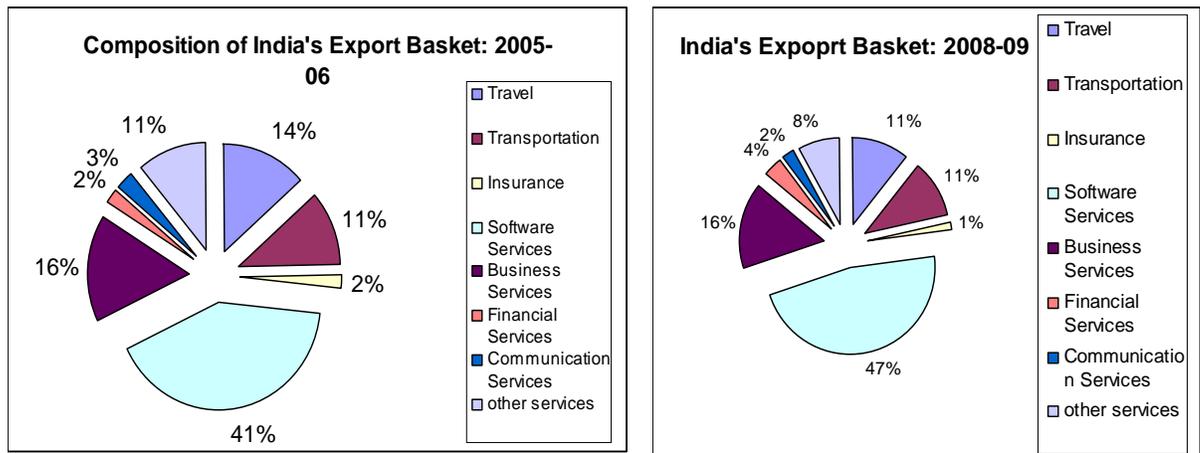
4 Implication of Global Economic Crisis on Exports of India's Software Services

The global economic crisis arrested the stupendous growth of India's exports of services. Growth of exports of total services declined from 28% in 2006-07 to less than half, i.e., 12.4% in 2008-09. To analyse the extent to which global economic crisis affected the growth of services, we examine the annual and quarterly trends in exports of services, especially those which have been identified with high income elasticity for exports.

Examining the growth of exports of disaggregated services (Table 3) we find that in the period 1993-2000, the fastest growing exports of services was of Government services (not included elsewhere) followed by miscellaneous services (including both software and non-software services). However, in the period 2000-08, there has been a substantial rise in the compound annual growth rate of exports of travel services (15.8%); transportation services (21.96%); Insurance services (25.29%) and software services (26.01%).

Table 3: Growth of India's Exports of Disaggregated Services

Invisibles by Service Export of Transactions										
	CAGR 1993-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	CAGR 2000-2008
Travel	4.56%	3,497	3,137	3,312	5,037	6,666	7,853	9,123	11,349	15.85%
YoY Growth		*15.18%*	*-10.29%*	*5.58%*	*52.08%*	*32.34%*	*17.81%*	*16.17%*	*24.40%*	
Transportation	2.53%	2,046	2,161	2,536	3,207	4,683	6,325	7,974	10,014	21.96%
YoY Growth		*19.86%*	*5.62%*	*17.35%*	*26.46%*	*46.02%*	*35.06%*	*26.07%*	*25.58%*	
Insurance	9.29%	270	288	369	419	870	1,062	1,195	1,639	25.29%
YoY Growth		*16.88%*	*6.67%*	*28.13%*	*13.55%*	*107.64%*	*22.07%*	*12.52%*	*37.15%*	
G.N.I.E	52.75%	651	518	293	240	401	314	253	330	-8.14%
YoY Growth		*11.86%*	*-20.43%*	*-43.44%*	*-18.09%*	*67.08%*	*-21.70%*	*-19.43%*	*30.43%*	
Miscellaneous of which:	31.99%	9,804	11,036	14,253	17,965	30,629	42,105	55,235	66,745	27.09%
YoY Growth		*-3.44%*	*12.57%*	*29.15%*	*26.04%*	*70.49%*	*37.47%*	*31.18%*	*20.84%*	
Software		6341	7556	9600	12800	17700	23600	31300	40,300	26.01%
YoY Growth			*19.16%*	*27.05%*	*33.33%*	*38.28%*	*33.33%*	*32.63%*	*28.75%*	
Total	16.91%	16,268	17,140	20,763	26,868	43,249	57,659	73,780	90,077	23.85%
YoY Growth		*3.56%*	*5.36%*	*21.14%*	*29.40%*	*60.97%*	*33.32%*	*27.96%*	*22.09%*	

*G.N.I.E: Govt. Services not included elsewhere, **Figures in million U.S. $**
Source: *www.rbi.org.in*

Exports of IT and IT-enabled services increased to US$ 40.3 billion in 2007-08 and further to US$ 47 billion in 2008-09 as compared to US$ 6.3 billion in 2000-01. Out of US $ 40.3 billion in 2007-08, US $ 29.4 billion constitutes IT services exports while US$ 10.9 billion constitutes ITES-BPO services (Table 4).

Table 4: Exports of Software Services: 1995-96 to 2007-08

| Software Services Exports of India(US $ million)			
Year	IT Services Exports	ITES-BPO Exports	Total Software Services Exports
1995-96	754	—	754
1999-00	3,397	565	3,962
2000-01	5,411	930	6,341
2001-02	6,061	1,495	7,556
2002-03	7,100	2,500	9,600
2003-04	9,200	3,600	12,800
2004-05	13,100	4,600	17,700
2005-06	17,300	6,300	23,600
2006-07	22,900	8,400	31,300
2007-08	29,400	10,900	40,300

Source: National Association of Software and Service Companies (NASSCOM).

Growth in software services which constitute close to 50% of India's exports of services has shown remarkable resilience to the global slowdown in demand. In fact, the global demand may not have fallen for software services, especially BPO and outsourcing services to the extent that it did for other services. One of the probable reasons for this could be that production cost cutting becomes a top priority in times of the current economic deterioration. This may make outsourcing more attractive.

Banking, Financial and Insurance (BFSI) sector, which has been the epicenter of this global financial crisis accounts for approximately 50% of the revenues of IT & ITeS providers. This makes IT & ITeS highly vulnerable to the current global slowdown in terms of delayed decision making and reduction in IT spending by customers of frontline IT companies. Given these vulnerabilities and heavy dependence on few markets, (US and the UK account for 80 % share), it is remarkable that Indian IT-BPO sector has been able to achieve growth rate of 28.7% in 2007-08, although this is lower than its growth rate of 32.6% in 2006-07.

Figure 5 depicts the year to year growth rate of disaggregated servcies in the period of global economic crisis. Most of the services sector have experienced a decline in their growth rates of exports in 2008-09, except for financial serices, which has experienced rise in its export growth in the this year. Travel, insurance, business services and communication services experienced a negative export growth in this year.

Figure 5: Growth Rate of India's Exports: 2007-08 to 2008-09
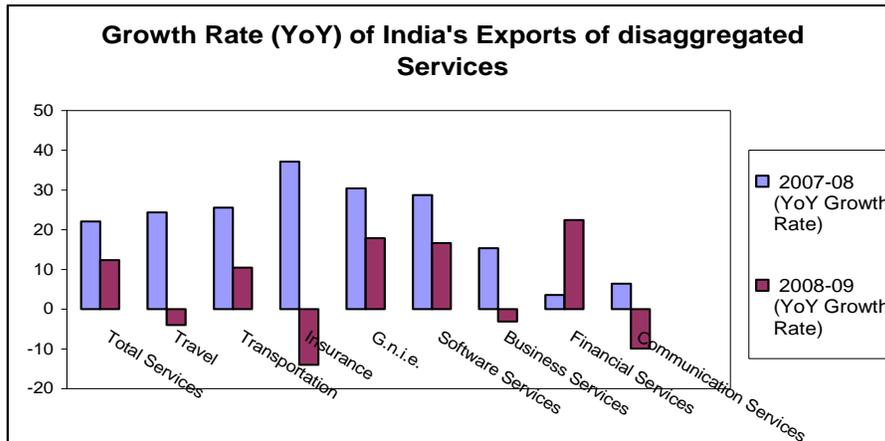
Although the rate of growth of software services declined from 26% in 2007-08 to 16% in 2008-09, it continues to remain positive and relatively high. A positive annual growth in India's export of software services reflects that the global economic crisis has led to a fall in the export growth of software services but the growth has still remained at around 16% in 2008-09. Quarterly trends (Figure 6) bring out the fall in export growth more clearly. Comparing the quarterly growth of 2008-09 to the same quarter in the earlier year we find that, since Q3 of 2008-09, the decline in exports of services has been sharp. Growth rate in total services exports became negative in the fourth quarter of 2008. Most of the services exports experienced a negative growth rate, with highest decline being in communication services followed by insurance and travel services. Decline in software services has not been as high as in other services.

Figure 6: Quarterly Growth in Exports of Services: 2008-09
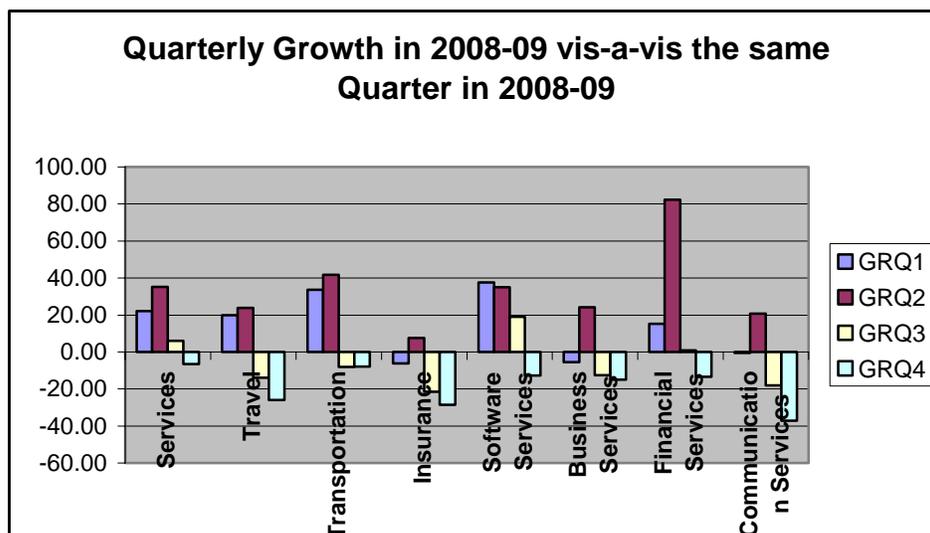
Within software services, according to NASSCOM (March, 2009), Indian IT-BPO grew by 12 per cent in FY2009 to reach USD 71.7 billion in aggregate revenue. Another probable reason for the growing demand for India IT-BPO services is that though US (60 per cent) and the UK (19 per cent) remain the largest IT-BPO export markets in FY2008, the industry footprint is steadily expanding to other geographies - with exports to Continental Europe in particular growing at a CAGR of more than 51 per cent over FY2004-2008. The industry's vertical market exposure has been well diversified across several mature and emerging sectors, mainly because of the support of updated technology. Banking, Financial Services and Insurance remained the largest vertical market for Indian IT-BPO exports, followed by Hi-tech/Telecom which together accounted for 61 per cent of the Indian IT-BPO exports in FY2008. All this contributed to external demand for software services, which led to limited impact of global economic crisis on exports of India's software services sector.

5. Income Elasticity of Demand for Export of India's Software Services

To assess the implication of global economic crisis on external demand for services we estimate income elasticity of export demand for aggregated services and some of the disaggregated services for which the data are available.

5.1 Existing Literature

Global demand plays an important role in determining export growth of a sector. With rise in global incomes, demand for normal and luxury products/services rise while for inferior products/services it may decline. Income elasticity of demand[3] for luxury products is expected to be greater than one, while for normal goods it is expected to be between 0-1. The kind of products/services a country exports, i.e., income elasticity of demand of the product/services, is an important factor which determines the impact of external demand shocks like global economic crisis on the country's exports. Along with income elasiticity, price competitiveness may also determine the impact of global economic crisis on exports. If the services exported are less price sensitive, then in case of a slowdown the option of lowering prices to maintain market shares may not be feasible.

There exists a vast literature estimating income/price elasticities for exports of goods but very few studies exist, especially for developing economies, which estimate the income elasticity for export of services. Even fewer studies exist that estimate income elasticity for services exports for India. The small number of empirical time series studies that exist on the determinants of US exports of services largely model export volumes in terms of foreign income and the real exchange rate. All show that conventional models of merchandise trade can be applied successfully to trade in services, as argued by van

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[3] the income elasticity of demand measures the responsiveness of the demand of a good to the change in the income of the people demanding the good. It is calculated as the ratio of the percent change in demand to the percent change in income. For example, if, in response to a 10% increase in income, the demand of a good increased by 20%, the income elasticity of demand would be 20%/10% = 2.

Welsum (2003a). Recent examples include Huang and Viana (1995), Wren-Lewis and Driver (1998), Deardorff *et al* (2000), Ansari and Ojemakinde (2003) and Mann (2004).

Most of these studies find that the income elasticity of demand is above unity, while relative price effects are comparatively small to those typically found for merchandise trade. For example, Wren-Lewis and Driver (1998) use a number of different estimation techniques and find that the income elasticity of demand for the aggregate volume of exports of services in U.S. lies in the range 1.50-1.95 percent, while the relative price elasticity lies in the range –0.21 to –0.40 per cent. The findings of Huang and Viana (1995), Deardorff *et al* (2000) and Mann (2004) raise the possibility of heterogeneous income and price elasticities for different categories of exports of services, although none of these studies seeks to test this explicitly. Huang and Viana (1995) and Deardorff *et al* (2000) both find much higher income and price elasticities of demand for passenger fares and other travel-related exports, than for other categories of service exports. In a panel data analysis of sub-categories of business and technical services Mann (2004) reports that relative price elasticities are typically insignificant and, in some cases, do not have the expected negative sign.

Empirical evidence of low price elasticity and high income elasticity of export demand in general has important implications for exports of developing countries. Firstly, this suggests that the export growth of developing countries is highly dependent on the economic performance of developed countries. Secondly, it implies that the developing countries may have limited feasibility of using lowering prices to maintain or increase exports.

It has been recognized in the literature that the higher the income elasticity of export demand, the more powerful will exports be as an engine of growth[4]. Sehadji and Montenegro (1999) found that the Asian countries had the highest estimated values for income elasticity among the developing and industrial countries. This advocated the view that exports had been a powerful engine of growth in the Asian region. This has an important implication: the higher the income elasticity of export demand the more severe will be the impact of slowdown of incomes/GDP on developing countries exports and growth.

To estimate the likely impact of slowdown of global GDP growth on export demand for India's services, we estimate income elasticities for aggregate services exports; and exports of travel services, transportation services, financial services, and software services in order to estimate the extent to which services exports can be affected in case of a decline in growth of global GDP[5]. We use time series data for the period 1970 to 2008,

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[4] See Huuthaskker and Magee (1969), Goldstein and Khan (1985)
[5] The choice of services sectors was governed by the availability of data.

5.2 Methodology and Data

For assessing the impact of slowdown on India's exports, we estimate the standard export demand equation for India using data for 1970 to 2008. According to the standard export demand function, exports depend on price competitiveness as measured by the real exchange rate and global income as measured by global GDP. A similar export demand function has been estimated for exports of goods by UNCTAD-India (May, 2009).

To measure relative price, it is necessary to look at price and exchange rate data. The volume of exports depends on nominal exchange rates after adjusting for the domestic level of inflation[6] by which we arrive at real effective exchange rate (REER). Real exports of services are arrived at by deflating nominal exports with GDP deflator. World GDP in real terms captures the income effect. The model estimated is therefore as follows:

$$LNEXPSER_{INDIAt}^{d} = \alpha_1 + \alpha_2 LNGDP_{WORLDt} + \alpha_3 LNREER_t + u_t \ldots\ldots\ldots\ldots(1)$$
t = 1970 to 2008

Where $LNEXPSER_{INDIA}$ is log of real exports of services of India to the world; $LNGDP_{WORLD}$ is log of real world GDP; and $LNREER$ is a product of effective exchange rate and relative prices. The data world GDP at current and constant prices is taken from World Development Indicators; exchange rate is taken from ERS International Macroeconomic Data Set; and India's export of services is taken from Reserve BANK OF India (RBI).The same equation is estimated for aggregate services exports; exports of travel services, transportation services, financial services, and software services. However since data for software services to the world for this period is not available, the estimations are undertaken for imports of US of software services. Data has been extracted from OECD database for services. The equation estimates income elasticity of exports of software services to US. These results are indicative as 60% of total exports of India's software services are directed towards U.S.

We have followed the standard procedure in the literature to check for unit roots in each series before estimating a model that involves time series data. If there is a unit root, then that series is considered to be non-stationary. The stationarity of each series is tested by the following unit root tests: (a) Augmented Dickey-Fuller test (ADF test); and (b) the Phillips-Perron test (PP test). Since regressions have been run for aggregate exports as well as sector-specific exports, we have undertaken tests separately. The results of these are reported in the Annex I. We find that most of the series used are stationary at levels. Wherever, we found that the series contains the unit root in levels, but no unit roots in first differences, we have used the popular Engle and Granger (1987) method to estimate the export demand functions. According to Engle and Granger (1987), it is possible to have a linear combination of these non-stationary variables that is stationary. Two

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[6] Real exchange rate (R) = nominal exchange rate (e) × foreign price (p*)/domestic price (p). The nominal exchange rate is measured as domestic currencies per unit of foreign currency.

estimation steps are carried out. First, the best possible linear equation - as shown in equation (1) - is estimated and residuals are collected. Then a unit root test is used to test whether residuals are stationary. We find that they are stationary, which implies that there exists a long-run equilibrium relationship and therefore a meaningful regression estimate can be carried out.

5.3 India's Income Elasticity of Total Exports of Services

To examine the likely impact of slowdown of world GDP growth on India's export growth of services, we estimate the above equation (equation 1) for exports of disaggregated services, exports of transportation services, travel services, and financial services to the world; and export of software services to U.S. Table 4 presents the results of the estimations.

Table 4: Income Elasticities of India's Export Demand

Countries	Income demand elasticity for Exports of Services	Price Elasticity for Exports of Services
Aggregate Services	3.22*	-0.56**
Transportation Services	1.98*	-0.57*
Travel Services	3.54*	-0.95*
Financial Services	2.37*	-0.64
Software Services	6.04*	-0.23

Note: * denotes statistically significant

The results show that India's exports of aggregated services to world are much more responsive to income changes as compared to price changes, though both the factors are found to be significant. A 1% decline in GDP growth of world will lead to 3.22% decline in India's growth of exports to world. However, a much higher price competitiveness is required to increase exports. It should be noted that the price elasticity inter-alias captures the effect of depreciation of the currency and lowering of relative prices. This implies that, it will be very difficult to increase India's export growth through improvements in its price competitiveness.

As found by other studies, there exists a large difference in income elasiticities of different services exports. Highest income elasticity of exports to the world is found to be for travel services, which is consistent with other studies (Huang and Viana (1995) and Deardorff *et al* (2000) on U.S. Income elasticity for transportation services is found to be higher than 1 but much lower as compared to travel services exports. Financial services exports have income elasticity of 2.37 which implies that as growth of global GDP rises India's exports of financial services will rise more than proportionately.

Income elasticity of India's exports of software services to U.S. is found to be the highest which is 6.04. Few other studies on exports of IT services have also found very high income elasticities. According to the estimates by Nomura (2009) income elasticity of demand for India's export of business services and ITES-BPO services to OECD countries was as high as 9.6 and 7.1 respectively. The high income elasticity of India's exports of software services explains to a large extent the exponential growth in its exports in the post 2000 period.

6. Role of Productivity Growth in India's Services Sector

The resilient growth of India's services sector and its growing contribution to GDP growth in the period of global economic crisis can be explained to a large extent by the growing domestic demand for services. However, mere presence of demand may not be sufficient for a sector to grow. What also become important are the supply side factors which allow expansion of output to meet the existing demand. Productivity growth of a sector is an important factor which may enable the sector to grow steadily and increase its share in total GDP. Using firm-level data, an attempt has been made to estimate productivity growth in services firms in India in **Software Services.** But it needs to be noted that very limited literature exists that estimates productivity growth in services as identification and measurement of outputs and inputs of services sectors are difficult and beset with conceptual problems.

6.1 The Debate on Productivity Growth in Services vis-à-vis Goods

It has often been argued in the literature that services are less productive than goods. Following Kaldor (1966), who emphasised that labour in non-manufacturing sector is less productive, many studies have attempted to examine the lagging service sector productivity. Baumol (1967) points out that productivity improvement in services are harder to achieve than in goods producing industries. The unbalanced growth models by Baumol and Fuchs (1968) helped in popularising the notion that because of their labour-intensive nature, service-sector activities cannot be made more efficient through capital accumulation, innovation, or economies of scale.

However, some of the studies argue that creation of new ways of satisfying wants, technological changes are as important in service sectors (such as health care) as in commodity sectors, but when it comes to cost reduction for existing products or services, technological change is more frequent and more powerful in its effects in the commodity sector. Therefore, productivity of service sector relative to productivity of commodity sector may vary inversely with income level of the country [e.g. Kuznets (1955), (1966) and Chenery and Syrquin (1975), Bhagwati (1984), Kravis et al (1983)]. In other words, between poor and rich countries the productivity differential in services is found to be lower than that in commodities.

But lower productivity in services compared to goods would imply that the shift of the economy towards larger service sector might lead to reduction in the national rate of productivity improvement. However, these notions have led to alternative arguments for

lower productivity in services. Two important arguments put forward are: (a) greater investment has been done in new technology in service sector and this may take time to lead to productivity enhancement and (b) low productivity of services is a product of mis-measurement of output in services since an increasing portion of output is not captured in the basic statistics. *Some studies have also attributed slower productivity in services to lack of competition in the service sector (Fingleton 1995). A higher level of regulation in services, including foreign investment controls and less exposure to foreign trade, are found to be important reasons for lower competition in services.*

6.2 Problems in Measuring Services Productivity

A key problem in measuring productivity relates to obtaining a suitable measure of output of services over time. Griliches (1994) points out that some of the services whose productivity growth rates in the 1947-1973 era were as high or higher than productivity growth in manufacturing industries have experienced a much lower productivity growth since 1973. Additionally, studies have found productivity slowdown particularly intense in services where output is hard to measure-- for example health services has the largest labour productivity slowdown in service and both banking and health services have large multifactor productivity slowdowns. These points to the possible problem of mis-measurement since in both health and banking services, it is very hard to define and measure output.

The problems pointed out in the literature that lead to mis-measurement are:

(a) Market prices are not available for publicly provided services;
(b) It is difficult to identify precisely what constitutes the service activity in a particular industry and to account correctly for the quality changes in services and this is further complicated due to inappropriate deflators that are not able to distinguish quality improvements;
(c) The "quantity" of services is difficult to capture, as it often represents a process by which a user (consumer) or the user's good is changed (Hill 1977);
(d) Compared to goods many services are characterised by a greater degree of heterogeneity (even uniqueness) so it is difficult to aggregate them;
(e) Poor quality of data on services further complicates the problems.

Apart from the above problems in the measurement of output and labour input, it is also recognised that there is no overall theme to measurement problems in different services. Each appears to be a special case, with specific measurement problems unique to the services measured.

6.3 Measurement of Total factor productivity Growth: DEA Approach

Given the role played by productivity growth in services sector, we attempt to estimate total factor productivity growth (TFPG) in software services in India and provide policy recommendations for improving productivity and efficiency of these services. If productivity rise in these services, the potential gains to the economy would be very high as these services in turn will improve productivity growth in other sectors where they are

widely used. For estimating productivity growth in software services, a firm level analysis has been undertaken for 18 IT firms for the period 1994-95 to 2007-08 (18 years).

Productivity growth in most of the services is either estimated using labour productivity estimates, i.e., output measured per unit of labour employed or by constructing multifactor productivity indices. Calculations of multifactor productivity take into account capital inputs as well as employment and hours worked. Many studies find that the multifactor productivity data are broadly consistent with the labour productivity numbers, (e.g., Maclean 1997), but multifactor productivity indices are considered to be superior as they relate to total factor productivity (Worthington 1999).

Most of the studies in the current literature use Data Envelopment Analysis (DEA) approach which is a linear programming methodology that constructs a nonparametric, piecewise-linear, "best-practice" frontier from observable input and output data to measure productivity in different services sector. Using DEA, the Malmquist indices are estimated to arrive at total factor productivity[7]. This index is a valuable tool since it allows for the decomposition of productivity into the two components: *innovation and imitation*. The first component, also called technological change, captures any expansion of the production possibilities frontier. The second component captures the convergence of firms toward the existing technology; this phenomenon is also called efficiency change or "catching up." DEA technique has been most widely used for estimating productivity in services sectors.

Some of the reasons for preferring DEA to other approaches are that DEA does not require a preconceived structure or specific functional form to be imposed on the data in identifying and determining the efficient frontier, error and inefficiency structures of the firms. Hababou (2002) adds that it is better to adopt the DEA technique when it has been shown that a commonly agreed functional form relating inputs to outputs is difficult to prove or find. Such specific functional form is truly difficult to show for the sectors analysed, which are financial services entities, IT firms and hospitals. Finally, Avkiran (1999) acknowledges the edge of DEA by stating that this technique allows the researchers to choose any kind of input and output depending on the objective of the exercise, regardless of different measurement units. There is no need for standardisation. However, the main weakness of DEA is that it assumes data are free from measurement errors. Furthermore, since efficiency is measured in a relative way, its analysis is confined to the sample set used. This means that an efficient firm found in the analysis cannot be compared with other firms outside of the sample

6.4 Empirical Results: Productivity Growth in Indian IT Services firms

Given the significance of IT sector in aggregate services sector, both in terms of domestic and external demand, an attempt has been made to estimate change in TFP growth using a panel of 18 firms for 14 years (1994-95 to 2007-08). Since the objective is to analyse

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[7] We use DEAP: Version 2.1 (Tim Coelli)

whether there has been an improvement in productivity growth over time, a longer time period has been selected. To arrive at a balanced panel, the number of firms for which the data is available for this period was limited[8]. Data has been extracted from *Capital Line* database which provides data for all listed firms in India.

DEA enables examination of sources of productivity growth, i.e., whether total factor productivity has increased due to technological progress (technical change or innovation) and/or due to pure efficiency improvements and/or scale economies. For estimating productivity total income has been used as an output; number of employees, expenditure on plant & machinery and buildings have been used as inputs. The results of the estimations are reported in Table 5.

Table 5 Malmquist Indices for TFPG in IT firms in India (Means across firms)

	Malmquist indices (TFP)	Change in Technology	Change in Pure Efficiency	Change in Scale
1995-96	0.4364	0.0444	1.1203	0.272
1996-97	0.5931	0.0698	0.9746	0.5487
1997-98	0.6108	0.7473	0.9273	0.9363
1998-99	1.0867	0.5411	1.3126	1.233
1999-2000	0.7603	0.8774	0.976	0.9069
2000-01	1.2369	1.2167	0.9273	1.093
2001-02	1.9272	2.2118	0.9341	0.7813
2002-03	1.1584	1.2123	0.9978	0.9483
2003-04	1.2587	0.9545	1.2892	1.015
2004-05	1.7232	1.6808	1.3962	0.6462
2005-06	1.5249	0.4714	1.2354	1.8182
2006-07	1.3189	1.3961	0.9781	0.9448
2007-08	0.5736	0.7905	0.7234	1.0597
Annual Growth (1995-2000)	-33.4%	-74.4%	5.34%	-3.01%
Annual Growth (2000-2008)	27.3%	13.34%	3.92%	-0.42%

Note: 1.000 indicates no change in productivity growth. 1.0188 would indicate 1.8% TFPG

Table 5 summarizes productivity change results. The results show that in the period 1995-98 productivity was declining. Productivity increased by 8.6% in 1998-99. But IT firms experienced a spurt in their productivity after 1999-00. They experienced an annual productivity growth of 27.3 percent during the period 2000-2007.

Much of the change in total factor productivity growth in the post 2000 period can be explained by technological change or innovation. Productivity due to efficiency improvement increased by an average annual growth rate of 3.92% while productivity

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[8] Most of the big IT firms are I the sample, e.g., Hewlett-Packard, Wipro, Satyam, etc

due to technical change or technological progress increased by 13.3%. Productivity change due to scale effect has been relatively less important for improving productivity in this period.

Overall the results indicate that productivity growth has been an important factor contributing to the growth of software services in India, especially post 2000. The global economic crisis has led to a fall in productivity in the year 2007-08, which may have arisen due to excess capacity because of fall in external demand.

7. Recommendations for Improving Productivity Growth in Software Services

Software services sector has shown a remarkable resilience with relatively lesser support as compared to other sectors. Efforts are required on improving both demand side and supply side factors. <u>On the demand side, specific policies are required to improve domestic and external demand and on the supply side targeted policies are required to boost productivity growth in these services sectors.</u>

One the key features of this service sector is its wide use across other services sectors and manufacturing industries. This provides a strong domestic demand for the sector. The revenue earned by software services from the domestic market is estimated to be US$ 11.7 billion in 2007-08 as compared to US$ 8.2 billion in 2006-07, a growth of about 42.7 per cent. Along with existence of a strong domestic demand, the sector has a steadily rising external demand. Indian IT-BPO services in India are characterized by low cost of operations, high quality of services, and English speaking readily available skilled manpower. Further, a favorable time zone difference with US and Europe has added to its advantage. This has led to a double digit growth in exports of IT-BPO services.

Estimations of productivity growth undertaken for 18 firms for the period 1994-95 to 2007-08 is indicative of high growth of total factor productivity (TFP) in this sector. If the sample can be taken as representative of the sector, it indicates that productivity growth started from the year 2000-01 on a sustained basis. However in the year 2008-09 there was a marked decline in productivity growth, probably because of excess capacity with lowering of external demand. Most of the productivity growth in the sector can be explained by improvements in technology and efficiency, while change in scale does not seem to have added to the productivity growth.

To sustain the growth of software services, targeted policies and strategies are needed. The sector is already at the frontier of the world and there is a need to capitalize the gains that growing domestic and external demands offer. Some of the recommendations for sustained improvements for productivity growth are:

I. With the changing global scenario, especially after the slowdown in the growth rate of advanced countries, the nature of demand for software services (especially IT-BPO) is also changing. A recent NASSCOM-Everest Research Report shows that the outsourcing needs of buyers are changing with companies focusing on value drivers (integrated delivery models offering scale and value and speedy implementation); minimising risks; and re-evaluating the sourcing model (re-thinking captive versus supplier mix, evolving risk-reward relationships with vendors and opting for outcome-based pricing). It is important for the IT-BPO services providers to build a strong and unmatched value proposition for themselves in specific, focused niche segments. Super-specialisation segments now need to be explored. Policy incentives need to be built for encouraging IT-BPO services to enter such specialty segments.

II. IT-BPO services are not only increasing their depth by entering super specialty segments, they are also increasing in width by bringing new areas into their ambit, e.g., legal process outsourcing, clinical research outsourcing (CRO), mobile applications, and energy efficiency and climate change. These are new areas which require massive investments and knowledge creation. It is recommended that the government takes initiative and encourages IT firms into entering these areas by making creating policy incentives.

III. Along with entering new segments and climbing up the value-chain, what is also needed for the sustained productivity growth of the sector is innovation. In line with providing incentives for R&D activities to the manufacturing sector, the government should also focus on developing incentives for innovations in IT services. Collaborative research between industry, academia and government needs to be encouraged.

IV. A direct support that can be given by the government is by greater outsourcing and a move away from low-value, high volume back-office jobs and customer support activities to higher value offerings by BPO services providers. The government role in expanding the domestic BPO industry is expected to be critical, as it can boost domestic business by taking forward programmes such as e-governance, connectivity, etc. This will increase the growth of domestic market further and inject productivity growth in the economy.

V. Indian software services sector has the potential to emerge as an IT hub in the region. But for that to happen, it is important for the government to provide the opportunities within its various bilateral Free Trade Agreements (FTAs). Concessions for IT service providers in these countries can be negotiated to increase their exports as well as investments in other countries. Low-value end services can be outsourced to these countries and attempts can be made to develop supply chains.

8. Summary and Conclusions

Onset of global economic crisis has posed many new challenges to Indian economy and has also initiated a re-look at the growth strategies that the economy had been following. Cautious, calibrated but steady approach to liberalization of key sectors has improved the economy's resilience towards external shocks. The impact of global economic crisis on Indian economy was relatively less severe due to lower dependence on exports and the fact that sizeable contribution to GDP came from services sectors which continued to grow at a steady rate contributing more than 80% to India's growth rate of 6.7% in 2008-09.

In this context, the paper attempts to demystify the services-led growth of India in the face of falling external demand. It examines the contribution of disaggregated services to total GDP, and decomposes growth of GDP with respect to the disaggregated sectors of the economy. Software services have been identified as making an important contribution to India's export of services. It is found that though external demand played an important role in growth of exports of software services, at the time of crisis, the fall in external demand for these services was not as high as for other services. A probable reason for this is that the nature of the services is such that to lower production costs, countries may demand more of these services, especially off-shoring services. Further, there has been diversification in destination of exports which has helped in sustaining the external demand for India's software services.

To asses the impact of supply side factors in the growth of software services, total factor productivity growth (TFPG) has been estimated for Indian IT services firms using Data Envelopment Analysis. It is found that average annual growth rate in TFPG increased substantially in the post 2000 period. Most of this can be explained due to technology change, indicating that technology played an important role in growth of software services in India. Efforts need to be made for further boosting productivity growth in this sector. Higher productivity in this sector will enhance productivity growth in other sectors of the economy as well, particularly manufacturing sector and has the potential to lead to a sectorally-linked productivity spiral.

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