

The role of services in India's post-reform economic growth

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Abstract

The services have been the driver of India's overall growth since the onset of economic reforms in the 1990s. The value-added share of services increased from 41 percent in 1990 to 53 per cent in 2018. On average, the sector grew at 7.5 percent annually during 1993-2018, contributing to half of the aggregate economic growth. Within services, market services were the largest component. Using the India KLEMS data, we examine the trends in TFP in individual industries within services and their contribution to aggregate TFP growth in the sector during 1993-2018. We observed that transport and storage was the highest contributor among market services industries followed by financial services, while public administration has made a relatively higher contribution to aggregate non-market services TFP growth. Moreover, we examine several factors that drive the TFP growth in the services sector. This includes the role of manufacturing TFP – spillover effect from manufacturing to market services and non-market services. We also introduced sector-specific factors such as the import penetration ratio and TFP index of India's trading partners for market services and infrastructure capital-total capital ratio for non-market services. Our results suggest that TFP growth in manufacturing has a significant positive effect on TFP growth only in the non-market services sector.

Acknowledgments: We thank Mr. Siddhartha Nath, Assistant Adviser, Reserve Bank of India for sharing the series he has prepared on the average rate of total factor productivity growth attained by India's trade partners, which has been used for one of the components of the analysis in the paper.

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1. Introduction

The Indian economy has been witnessing service-driven growth, particularly since the 1990s. The share of services in India's GDP has risen over much of the post-independence period, and there was a marked acceleration in this trend since the early 1990s. Mohan (2008) highlights that it is the continuing and consistent acceleration in growth in services over the decades which accounts for the continuous acceleration in overall GDP growth of the country since the 1980s. Nagaraj (2008) observes that the services sector boom from 1991-92 has been dominated by communications and business services; while the communications boom seems largely domestic demand-led growth, business services seem entirely export-driven. Balakrishnan and Parameswaran (2007) also infer that the acceleration in the growth of the Indian economy over the last quarter century has consistently been led by services. Ghose (2019) has pointed out that through the subsequent reforms and growth accelerations since the 1980s, the lead of services in the growth process only got strengthened. Basu (2019) has said that a boost from the information technology sector triggered the overall services sector growth in the 2000s. He has highlighted that a policy shift in the computing sector in the late 1970s, shrinking government bureaucracy after 1991, and tax exemption for IT products played a significant role in the success of India's IT sector. Similarly, the relative importance of the services sector in employment generation has also increased substantially. India has followed the non-traditional pattern of structural change, where unskilled agriculture labour was drawn to the urban informal services sector and contributed to economic growth through labour transfer between sectors (Nayyar, 2019).

In this paper, we are concerned with the sources of growth in India's services sector. Particularly, we examine the TFP growth performance of India's services and the industry contributions to the services sector TFP growth. To provide a comparative perspective, a similar analysis is undertaken for the manufacturing sector. The period covered for the analysis is 1993-94 (hereafter 1993) to 2018-19 (2018). The analysis is based on the India KLEMS dataset, version 2020.

In the analysis presented in the paper, we make a distinction between market services and non-market services. We study the rate of TFP growth attained in these two sub-sectors and the contributions made by individual industries to the TFP growth in these two sub-sectors.

One aspect that has received special attention in the study is the spillover effect of TFP growth. We examine the possibility of an inter-sector spillover effect from manufacturing to market and non-market services. We also examine the spillover effect on India's services sector from TFP growth attained by India's important trade partners.

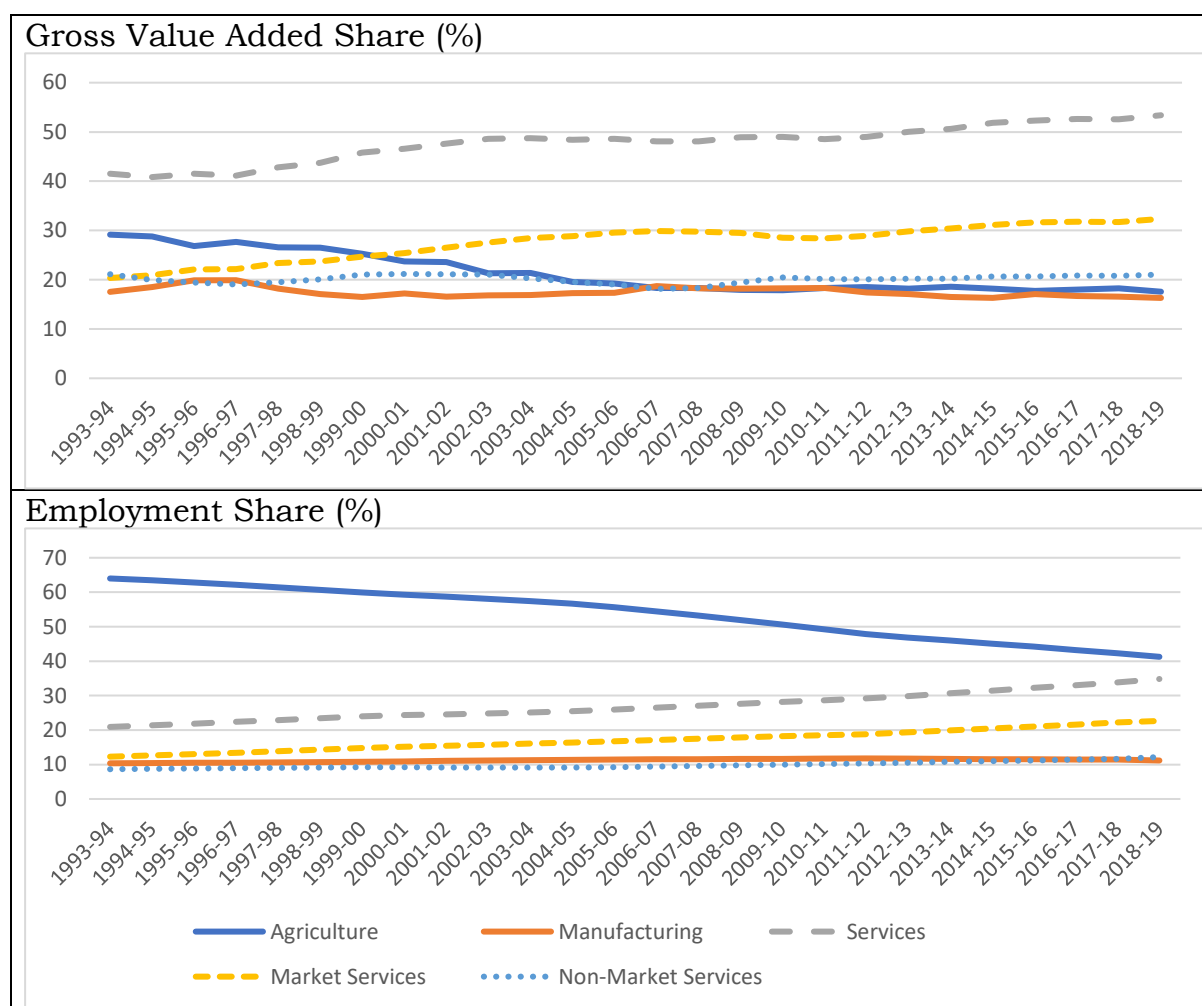
The rest of the paper is organized as follows. Section 2 begins with an analysis of growth trends in India's services sector. Section 3 presents the estimates of Domar aggregated TFP growth in the market and non-market services sectors of the Indian economy. Section 4 deals with the industry contributions to services sector TFP growth. This section also presents a comparison of TFP growth rates in the manufacturing, market services, and non-market services sectors. Section 5 is devoted to an econometric analysis of the determinants of TFP growth in the market and non-market services sectors. ARDL (Auto-Regressive Distributed Lag) models are estimated for carrying out the analysis. Also, a VAR model is estimated to study the inter-relationship between TFP growth attained in the manufacturing, market services, and non-market services sectors. Finally, Section 6 sums up the main findings of the study and concludes.

2. Service sector in India and its contribution to economic growth

In Figure 1, we depict the changing structure of the Indian economy since 1993, in terms of the share of the service sector in gross value added (GVA) and employment. Further details are provided in Table 1, which presents the shares of disaggregate industries in value-added and employment.

We start the discussion with the value-added shares of different broad sectors (Figure 1) to understand how the relative importance of different sectors has behaved over the 25 years in our assessment of overall economic growth. We observed that the share of agriculture & allied activities has declined steadily over the past two and half decades. In terms of value-added, the share of agriculture and allied activities declined from 29 percent in 1993 to 16 percent in 2018, and the opposite occurred for the services sector whose share increased from 41 percent in 1993 to 53 percent in 2018. The share of non-market services, which consists of public administration, education, and health services, remained stagnant at around 20 per cent over the entire period whereas the share of market services, which constitute trade, transportation, business, and financial services, has increased from 15 per cent in 1993 to 32 per cent in 1998. Thus, the sub-sector has more than doubled its share in value added during this period.

Figure 1: Sectoral shares in aggregate gross value added (GVA) and employment



Source: Authors' computations from India KLEMS database, 2020.

Unlike agriculture, the services sector's contribution to employment remains low, non-commensurate with the movement in Service's share in GVA. Yet, we find that there has been a consistent upward movement in services sector employment, from a 21 percent share in total employment in 1993. As in the case of value-added, we find that the employment share of market services (22 per cent) exceeds that of non-market services (12 per cent). There are possibly many reasons for the relatively low employment absorption in the services sector. Nayyar (2012) finds that educational requirements vary across different sub-sectors in the service sector and this fact manifests itself through low quality of employment.

Table 1: Shares in GVA and Employment, Services Sub-sectors and industries

Industry	Gross Value Added Share (%)				Employment Share (%)			
	1993-94	2003-04	2008-09	2018-19	1993-94	2003-04	2008-09	2018-19
Services	41.5	48.8	48.9	53.4	20.9	25.1	27.6	34.8
Market Services	20.4	28.5	29.5	32.4	12.3	16.0	17.8	22.6
Trade	7.6	9.1	9.3	11.4	7.6	9.4	9.9	11.3
Hotels and Restaurants	0.7	1.0	1.1	1.1	0.9	1.3	1.5	1.9
Transport and Storage	4.7	5.5	5.0	4.7	2.6	3.5	3.9	5.0
Post and Telecommunication	1.6	2.1	2.1	1.5	0.2	0.4	0.4	0.4
Financial Services	4.1	5.6	6.1	5.6	0.6	0.6	0.8	1.2
Business Service	1.8	5.2	5.9	8.1	0.3	0.8	1.3	2.8
Non-Market Services	21.1	20.3	19.4	21.0	8.6	9.1	9.8	12.2
Public Administration and Defense	5.7	6.1	5.9	6.1	2.7	2.1	1.9	1.7
Education	2.3	3.0	3.0	4.3	1.7	2.4	2.8	3.9
Health and Social Work	1.1	1.5	1.4	1.7	0.6	0.8	0.9	1.4
Other services	12.1	9.6	9.2	8.9	3.7	3.8	4.2	5.2

Source: Authors' computations from India KLEMS database, 2020.

Table 1 provides a detailed analysis of the service sector's contribution to Gross Value Added (GVA) and employment. From Figure 1, we can see that the services sector has been the single largest contributor to the increases in value added in the post-reform period. The steep increase in the share of services between 1992 and 2003 is due to the expansion of the market services, of which trade, business services, financial services, and transport & storage had high value-added shares in all four years. The share of business services had risen sharply from about one per cent in 1980 to 8.1 per cent in 2018, followed by trade (increased from 6.9 per cent to 11.4 per cent) and financial services (increased from 2.7 per cent to 5.6 per cent).

The share of non-market services in aggregate value added has remained constant. Within non-market services, education, health, and public administration registered an increase in value-added shares between 1993 and 2018, while other services recorded a decline. In the case of employment, the observed increase in the employment share of market services arises from trade, business services, and transportation & storage. The employment share of non-market services increased only slightly. Within

non-market services, education and other services had an increase in employment shares, whereas public administration recorded a decline

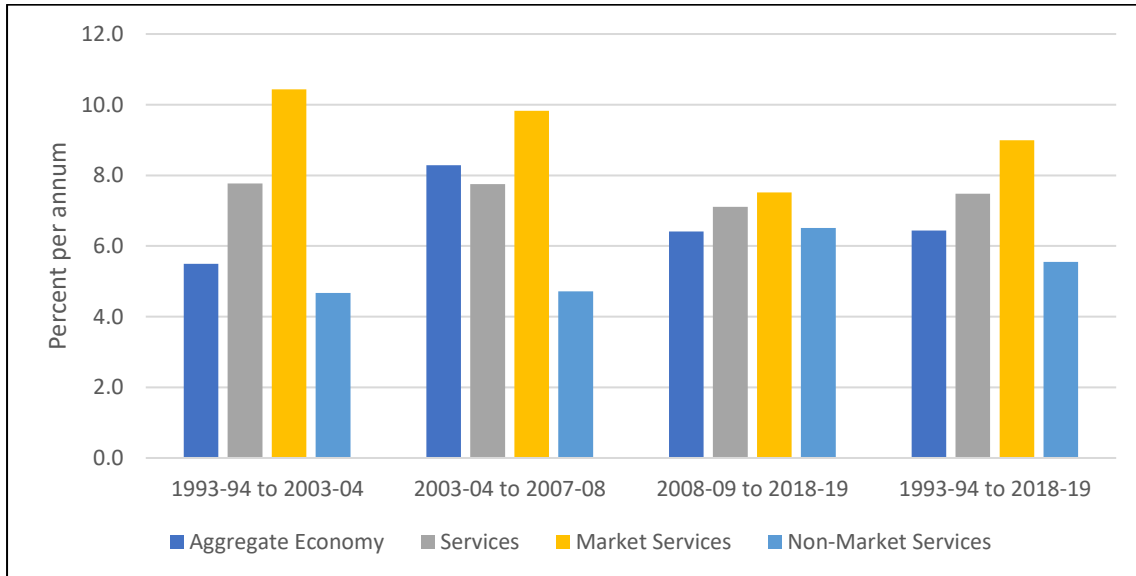
It would be interesting to consider next the growth rates in double deflated value added in the aggregate economy and the services sectors of the economy. The growth rates in double deflated GVA for the aggregate economy and the services sector with further disaggregation between market services and non-market services growth rates have been obtained as Tornqvist aggregates of industry value-added growth rates. In a Tornqvist aggregation approach, the growth rate of each industry value added is weighted by the nominal value-added share of that industry while calculating the aggregate value-added growth rate. Another commonly used approach is to simply sum the real value added across industries to obtain aggregate value added and compute the growth rate—an approach often called the aggregate production function approach (see Jorgenson et al., 2007). The Tornqvist approach, which is consistent with the aggregate production possibility frontier approach described in Jorgenson et al. (2007), relaxes several assumptions in the aggregate production function approach, such as a common production function across all industries.

Figure 2 presents the average growth rates in double deflated GVA for the aggregate economy and services sectors for the three sub-periods and the entire period. The average annual growth rate in value-added of the Indian economy was 6.4 per cent during 1993-2018. The average annual growth rates in Gross Value Added (GVA) for market services and non-market services were 7.5 and 5.5 per cent respectively. Market services had high value-added growth for the overall period as well as in all sub-periods. It is interesting to note that during the 2003-07 period, when the aggregate economy witnessed a growth acceleration (8.3 per cent per annum), the services sector did not register any improvement in growth rate. The overall growth rate of the Indian economy declined to 6.4 per cent in the post-financial crisis period and market services depicted a similar trend, but the growth performance of non-market services was opposite to the aggregate economy trend.

We observe from Figure 3 that service-sector growth is widely spread across different industries. In accounting for growth in value added in different industries, we find that post and telecommunication registered the maximum growth (around 14 per cent per annum) for the period 1993-2018 followed by business services (12 per cent per annum). If we consider the period 1993-2002, we find that post and telecommunications and business services exhibited high growth rates of around 27 per cent and 15 per cent respectively. The telecommunication liberalization began in 1994 with the private sector being allowed to offer telecom services. The rapid innovation in

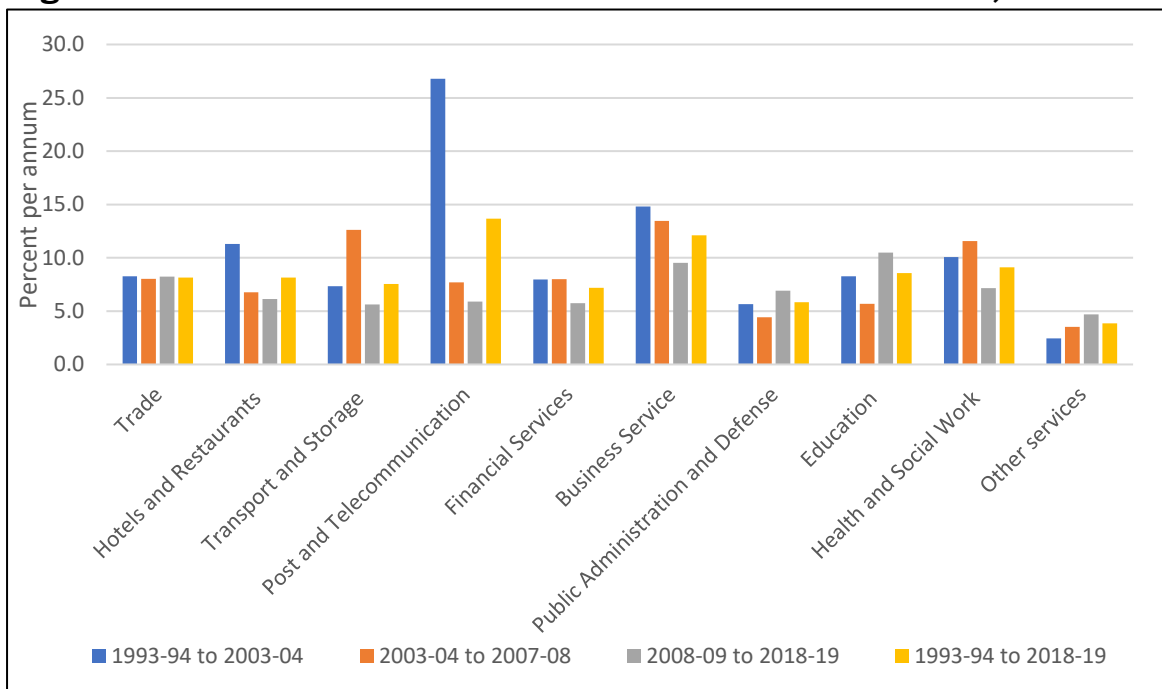
IT makes it a dynamic contributor to the growth of the Indian economy itself (Singh, 2014).

Fig 2: Double Deflated Value-Added Growth



Source: Authors' computations from India KLEMS database, 2020.

Fig 3: Double Deflated Value-Added Growth Rate, Industries



Source: Authors' computations from India KLEMS database, 2020.

In Table 2, we have shown the contribution of services sectors and the constituent services industries to the aggregate economy GVA growth, and in Figure 4, we make a graphic presentation of these contributions. As we have seen earlier, the services sector has been the best performing sector in the Indian economy, as reflected both in terms of its value-added share and its growth rate. We have seen that the services sector contributed around half of India's economic growth. Thus, out of the growth rate of the Indian economy of 6.44 per cent during 1993-2018, 3.55 per cent (more than half) came from the services sector. Within services, the contribution of market services was the largest component.

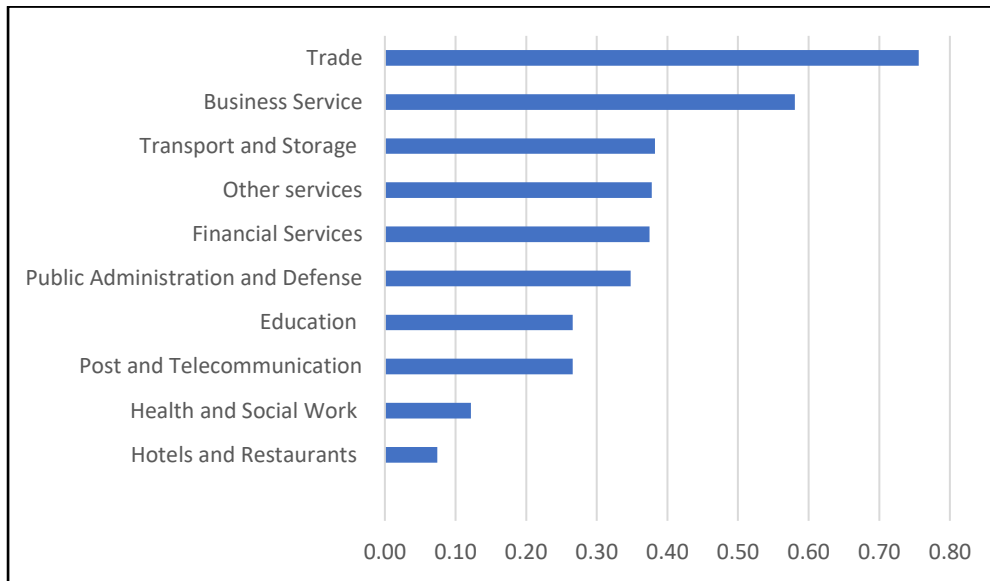
**Table 2: Industry Contribution to aggregate economy value added growth
(Percentage points per annum)**

	1993-94 to 2003- 04	2003-04 to 2007- 08	2008- 09 to 2018- 19	1993-94 to 2018- 19
Aggregate Economy Value Added Growth	5.50	8.29	6.41	6.44
Services Sector	3.42	3.76	3.60	3.55
Market Services	2.48	2.85	2.28	2.43
Trade	0.68	0.75	0.84	0.76
Hotels and Restaurants	0.09	0.07	0.06	0.07
Transport and Storage	0.36	0.69	0.28	0.38
Post and Telecommunication	0.53	0.15	0.11	0.27
Financial Services	0.38	0.44	0.33	0.37
Business Service	0.44	0.74	0.66	0.58
Non Market Services	0.94	0.91	1.32	1.11
Public Administration and Defense	0.34	0.25	0.41	0.35
Education	0.22	0.17	0.36	0.27
Health and Social Work	0.12	0.17	0.10	0.12
Other services	0.25	0.32	0.44	0.38

Source: Authors' computations from India KLEMS database, 2020.

In the post-GFC (global financial crisis) period, market services observed a decline in the contribution to the growth of the aggregate economy, while the contribution of the non-market services sector increased. At the disaggregate industry level, we observe from Table 2 and Figure 4 that trade is the biggest contributor among services industries followed by business services. Among non-market services, other services and public administration have made a relatively higher contribution to aggregate value-added growth.

Fig. 4: Industry Cont. to Aggregate Economy Value added growth (1993-94 to 2018-19) (percentage points per annum)



Source: Authors' computations from India KLEMS database, 2020.

3. TFP Growth in Service Sector Industries and Domar Aggregation

Having discussed the growth performance of the services sector and its contribution to the aggregate economy GVA growth, we now turn to TFP (total factor productivity) growth. Many earlier studies on TFP growth in various sectors or industries of the economy have computed the TFP growth rate using the value-added-based production function, ignoring the explicit role of intermediate inputs in the production process. Recent research work on growth and productivity has commonly been based on the gross output version of the production function. One advantage of using the value of gross output rather than gross value added as the measure of output is that it incorporates the fact that intermediate inputs (material, energy, services) are as important as factor inputs (labour, capital) in a production process (Gollop and Jorgenson, 1980). At the same time, it should be noted that the use of gross value added allows comparison between firms that are using heterogeneous raw materials (Griliches and Ringstad, 1971). Productivity estimates are also sensitive to the measurement of output and inputs, besides being sensitive to the specific methodology of estimation used. The TFP growth estimate derived from gross output is more accurate than the TFP growth obtained by using value-added as a measure of output. This is so because estimation of TFP based on gross output imposes one less restriction on the production function.

Table 3 presents the decomposition of output growth for the different industries with the services sector for the period 1993-2018. The contribution

of an input to output growth is defined as the product of the value share of the input and the growth rate of the input. Thus, each input contributes to output growth in proportion to its value share, while TFP contributes to output growth point for point. We observe in Table 3 wide variations in output growth across different services industries with over 10 percent growth in business services and telecom sectors in the period 1994-2018, while other services and public administration grew at around 4-6 per cent per annum.

Table 3: Sources of output growth 1993-94 to 2018-19

(percent per annum)

Industry	Gross Output Growth	Contribution of					
		Capital	Labour	Energy	Materials	Services	TFP
Trade	8.3	5.4	1.2	0.2	0.3	1.4	-0.2
Hotels and Restaurants	7.1	1.2	0.7	0.1	3.6	1.2	0.4
Transport and Storage	7.3	1.4	0.9	1.2	0.9	1.9	1.0
Post and Telecommunications	11.5	2.9	0.5	0.4	4.7	1.1	1.9
Financial Services	8.0	3.4	1.0	0.2	0.5	1.9	0.8
Business Service	12.7	6.1	2.6	0.4	1.3	3.2	-1.0
Public Administration and Defense	5.9	0.8	-0.2	0.0	0.2	1.3	3.8
Education	9.2	3.3	2.7	0.0	0.3	1.5	1.3
Health and Social Work	7.7	2.9	1.9	0.0	2.1	0.1	0.6
Other services	4.3	2.4	1.3	0.0	0.5	0.7	-0.7

Source: Authors' computations from India KLEMS database, 2020.

While comparing the contributions of factor inputs - material, energy, services, labour, and capital, we found that capital input is the dominant source of output growth for a majority of the industries - trade, financial services, health, business services, and other services. Materials input contributed significantly to gross output growth in certain industries like post & telecommunications, hotels & restaurants, and health & social work. Services input is observed to be the dominant source of output growth for transport and storage. The contribution of energy and services input to output growth has been relatively less than that of materials input. TFP is the dominant source of output growth in public admin and defence, and it is an important source of growth in transport and storage and post & telecommunications.

Table 4 provides the TFP growth rates for individual industries of the services sectors for the three sub-periods and the entire period, 1993-2018. We observe from Table 4 that the TFP growth rate of service-sector is widely varying across different industries, from over 6.8 per cent per annum in post & telecommunication (the highest in 1993-94 to 2003-04) to around -1.9 per cent per annum growth for ‘trade’ (the lowest) for the period of 2008-2018.

Tab 4: TFP Growth rates, Services Industries, by sub-period

(percent per annum)

	1993-94 to 2003-04	2003-04 to 2007-08	2008-09 to 2018-19	1993-94 to 2018-19
Trade	1.9	0.0	-1.9	-0.2
Hotels and Restaurants	1.4	-0.5	-0.1	0.4
Transport and Storage	1.4	2.7	-0.1	1.0
Post and Telecommunication	6.8	1.0	-1.7	1.9
Financial Services	0.4	1.2	1.0	0.8
Business Service	-1.0	-0.6	-1.1	-1.0
Public Administration and Defense	3.7	2.8	4.4	3.8
Education	0.9	-2.4	3.4	1.3
Health and Social Work	0.9	0.9	0.2	0.6
Other services	-1.3	-1.4	0.1	-0.7

Source: Authors’ computations from India KLEMS database, 2020.

Table 5 presents the aggregate level of TFP growth rates in the market services sub-sector and non-market services sub-sector based on Domar aggregation (see Domar, 1961: for sector level application of Domar aggregation, see Das and Kalita, 2011; and Krishna et al., 2018; among others). The table also provides the contributions of different industries to aggregate TFP growth for the different sub-sectors of services for the period 1993-2018.

Before discussing the industry-level contributions to aggregate TFP growth, it is important to note that according to theory, the Domar weights typically add up to more than one. This usually implies that in the presence of intermediate transactions between the industries (or the use of intermediate inputs), aggregate productivity growth will be greater than the weighted average growth rates of the industries. This means productivity gains from the production of intermediate inputs have an additional effect of

reducing input prices in downstream industries. We observed that transport and storage was the highest contributor among market services industries followed by financial services for the period 1993-2018. Among non-market services, public administration has made a relatively higher contribution to aggregate TFP growth.

Table 5: TFP growth rates in Market services and Non-Market services, based on Domar aggregation (percentage points per annum)

	Industry Contribution to aggregate TFP growth			
	1993-94 to 2002-03	2003-04 to 2007-08	2008-09 to 2018-19	1993-94 to 2018-19
Market Services	1.71	1.05	-0.90	0.43
Trade	0.82	-0.02	-0.78	-0.05
Hotels and Restaurants	0.09	-0.05	-0.03	0.01
Transport and Storage	0.50	0.96	0.00	0.37
Post and Telecommunication	0.32	0.07	-0.17	0.05
Financial Services	0.08	0.18	0.17	0.14
Business Service	-0.10	-0.08	-0.09	-0.09
Non-Market Services	0.38	-0.10	1.06	0.60
Public Administration and Defense	0.53	0.34	0.66	0.56
Education	0.08	-0.22	0.35	0.15
Health and Social Work	0.07	0.05	0.01	0.04
Other services	-0.31	-0.27	0.04	-0.14

Source: Authors' computations from India KLEMS database, 2020.

4. Pattern of India's Service Sector TFP Growth – Widespread or Uneven?

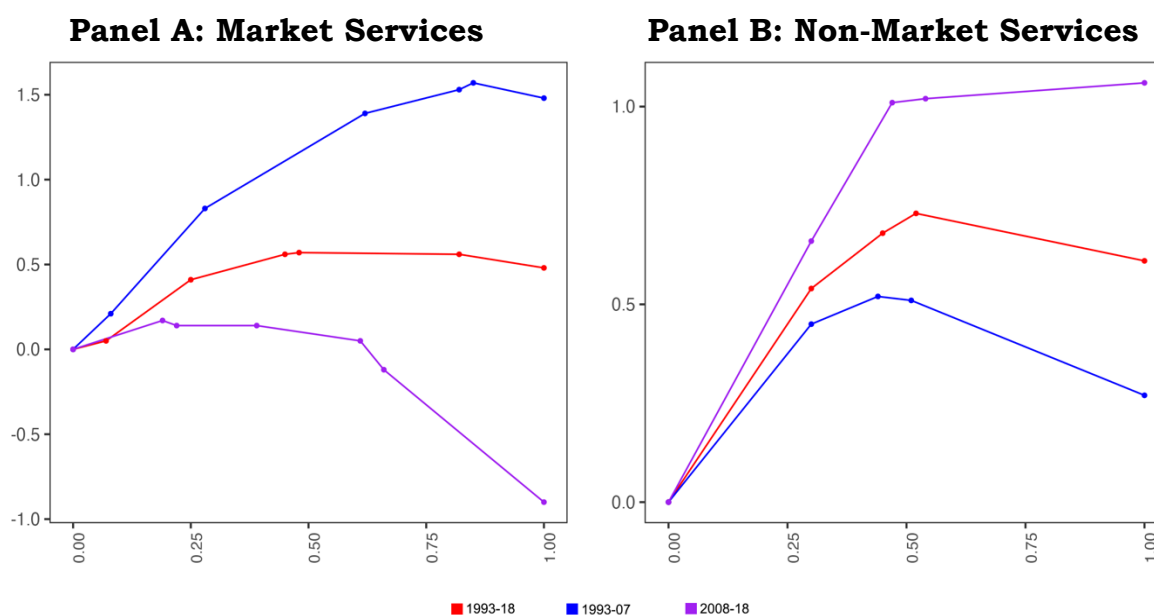
Having investigated the sectoral-level contributions from the market and non-market segments of the services sector to aggregate TFP growth in Section 3 above, it is worthwhile to investigate the industry-level heterogeneity in order to unmask the variation in industry-level TFPG contributions from the respective sub-sectors. We utilize Harberger diagrams (Harberger, 1998; Timmer *et al.*, 2011) by plotting the cumulative Domar-weighted contribution of individual service sector industries for each sub-sector of services, against the cumulative value-added share of these industries in their respective sub-sector. The resulting pattern in the diagrams can either have a 'yeasty' or a 'mushroom' pattern. The former refers to the situation when growth is more broad-based while the latter refers to the situation when growth is more

localized in a few industries. To summarise the pattern in a quantitative sense, we calculate the relative area under the Harberger¹. This relative area lies between zero to one, the closer we get to one the greater is the localization and thus a more mushroom-type pattern.

Figure 5 presents the Harberger diagrams for both Market and Non-Market Services for three periods – 1993-18 (overall period), 1993-07 (post liberalisation and pre-GFC), and 2008-18 (post-GFC). Looking at the market services sub-sector first in Panel A, we observe that TFP growth (Domar-weighted) was widespread during 1993-07 – creating more of a ‘yeasty’ pattern with 0.30 relative area under the Harberger. The 2008-18 sub-period does not give us a well-described pattern. This is mostly due to the large negative contribution of several industries towards aggregate market services TFP growth that push down the cumulative industry contributions to a negative, including – Transport & Storage (-0.03), Post and Telecommunication (-0.09), Business Services (-0.17), Financial Services (-0.003) and importantly are a large negative contribution from Trade (-0.78). These industries account for 81 per cent of the value-added share in Market Services for 2008-18 – creating a negative drag on the Domar-weighted market services TFPG for this period at an annual average of -0.9 ppts (percentage point per annum). Thus, all of the TFP growth in market services during 1993-18 (0.48 ppts.) was only due to growth observed in the pre-GFC period (1.48 ppts.). Overall for 1993-18, TFP contributions from Market Services industries remained widespread – the relative area under the Harberger is around 0.46, as shown in Table 6 below.

¹ The relative area is the curvature of the diagram measured by the area between the Harberger and a diagonal line divided by the total area under the diagram.

Fig. 5: Harberger Diagrams for Services sub-sectors; 1993-18, 1993-07 & 2008-18



Source: Based on Authors' calculations

Focusing next on Non-Market Services, it is apparent from Panel B of Figure 5 and Table 6 that TFP contributions to aggregate non-market services TFP growth were mostly widespread for the overall period and the post-GFC sub-period (2008-18). However, the industry contributions tend towards a more 'mushroom' pattern for 1993-07 with positive contributions from only two industries – Public Administration and Health.

Table 6: Harberger Diagram (Market Services and Non-Market Services) Summary Statistics

	1993-18	1993-07	2008-18
Market Services			
Domar-Weighted Market Services TFPG	0.48	1.48	-0.90
Relative area under Harberger	0.46	0.30	-
Non-Market Services			
Domar-Weighted Non-Market Services TFPG	0.61	0.27	1.06
Relative area under Harberger	0.44	0.62	0.33

Source: Based on Authors' calculations

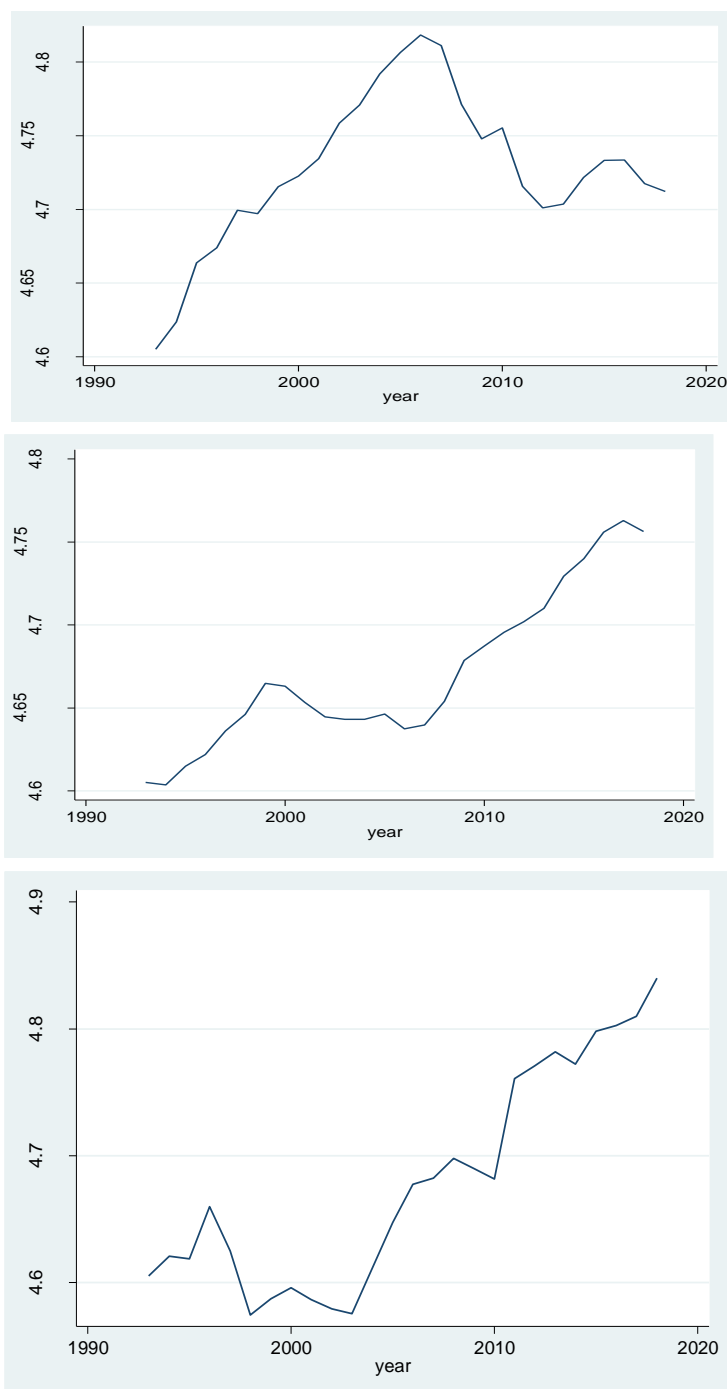
5. Comparison of Trends in TFP Growth: Manufacturing, Market Services, and Non-Market Services

Figure 6 compares TFP growth in the market and non-market services sectors with TFP growth in manufacturing. To facilitate comparison, the growth rates computed by the Domar aggregation method have been applied to a base year figure, 1993=100, and then the TFP index has been computed. The logarithm of the TFP index is shown in the figure.

The figure brings out that the TFP index of market services was on the rise in the period till about the mid-2000s, since then there has been a downward trend. It will be noticed from Table 5 that TFP growth in market services was positive during 1993-2002 and 2003-2007. After 2007, the growth rate in TFP turned negative because of a significant fall in the TFP growth rates in Trade, and Transport & Storage.

In manufacturing and non-market services, TFP growth has been positive since the mid-2000s. In the post-GFC period, it is the manufacturing and non-market services sectors that contributed majorly to the aggregate economy TFP growth.

Fig. 6: Comparison of TFP indices



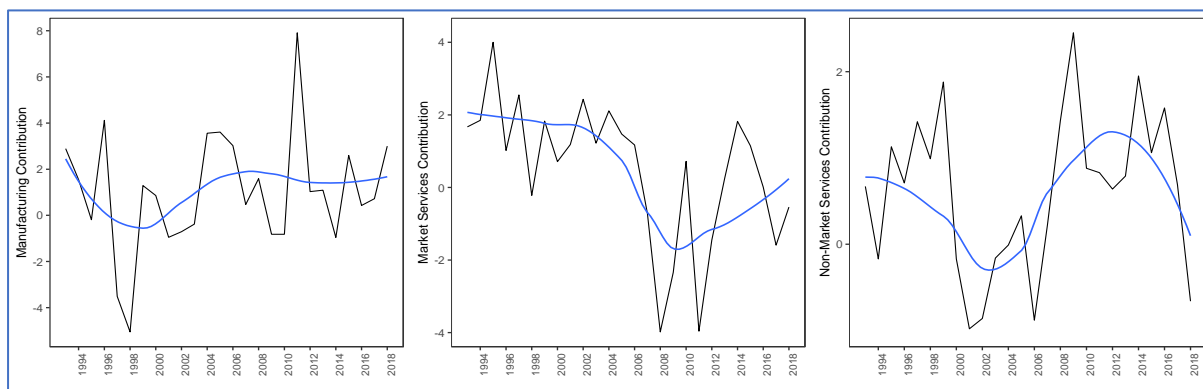
Source: Autors' computations

Figure 7: Domar-weighted Industry Contributions to Aggregate sub-sector TFPG, 1993-18

Panel A: Manufacturing

B: Market Services

C: Non-Market Services



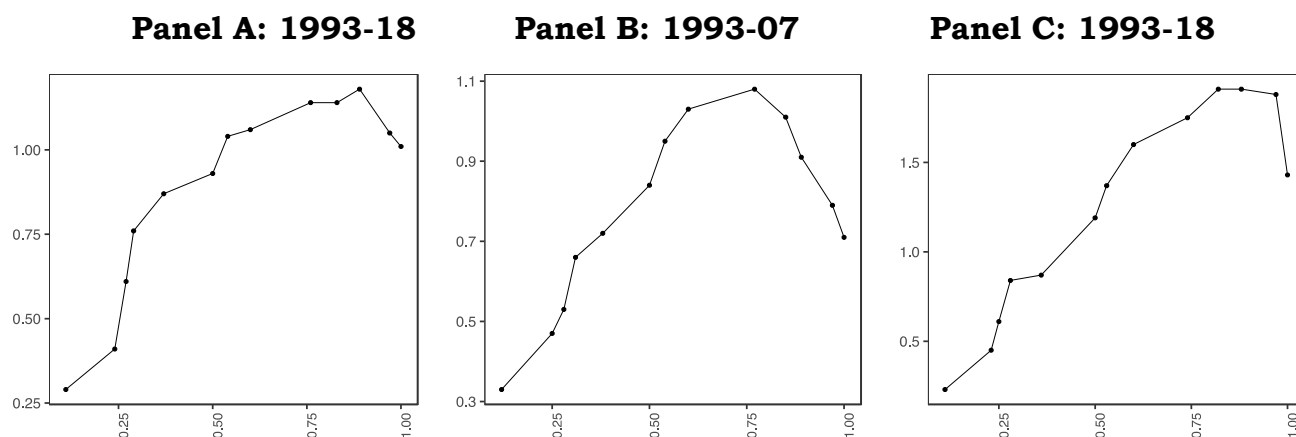
Note: The blue curve is generated using locally estimated scatterplot smoothing.

Source: Based on Authors' computations

Figure 7 presents a comparison of TFP growth rates in the manufacturing sector, market services sector, and non-market services sector. The growth rates have been smoothened. The smoothen curves on TFP growth for the manufacturing sector and the non-market services sector are suggestive of a cyclical pattern. As regards the market services sector which has been an important contributor to the aggregate level of TFP growth, it is seen from the figure that there was a downward trend in the growth rate of TFP in the market services sector till almost the end of the 2000s, and there has been a trend reversal thereafter. However, despite the upward trend, the growth rate in TFP in the market services sector remained negative and thus the contribution of the market services sector to the aggregate economy TFP growth has been negligible in the post-GFC period.

Figure 8 presents the Herberger diagram of Domar weighted industry contributions to aggregate manufacturing TFP growth. Such diagrams for the market services and non-market services have been presented and discussed in Section 4. From Figure 8 and the associated table (Table 7), it is seen that the relative area under the Herberger curve has come down in the post-GFC period. Thus, in the post-GFC period, not only did Indian manufacturing attain a relatively faster growth rate in TFP, but also the industry contributions were more evenly spread.

Figure 8: Harberger Diagrams for Domar-weighted industry contributions to Aggregate Manufacturing TFP Growth



Source: Based on Authors' computations

Table 7: Harberger Diagram (Manufacturing) Summary Statistics

	1993-18	1993-07	2008-18
Domar-Weighted Manufacturing TFPG	1.01	0.71	1.43
Relative area under Harberger	0.37	0.51	0.37

Source: Based on Authors' computations

6. Explaining TFP Growth in Market Services and Non-Market Services, Econometric Analysis

The role of manufacturing as an engine of growth is widely recognised in the literature (Kuznets, 1957 and 1973; Chenery, 1960), especially in developing countries. Haraguchi *et al.* (2017) discuss several studies that recognize the manufacturing sector's role as a driver of economic growth. In particular, Hirschman (1958) argues that linkage effects from the manufacturing sector are particularly stronger than that from the agriculture and services sectors. Su and Yao (2016) use long-run Granger causality tests and panel regressions for their analysis and conclude that the manufacturing sector drives service sector growth in middle-income countries. Notably, Dahejia and Panagariya (2015) look at the Indian context by using firm-level data to investigate this spillover effect – they find evidence that there exists a positive and significant direct effect of manufacturing growth on the growth of GVA in large urban services firms.

Goldar and Mitra (2010) investigated the inter-relationship between growth rates in different sectors of the Indian economy. By applying a vector auto-regression (VAR) model and then applying variance decomposition, they

find that at the tenth time horizon (medium to long run) 41 per cent of the forecast error variance in the secondary sector growth is explained by the trade-transport sector growth whereas the secondary sector growth explains 92 per cent of the forecast error variance of the trade-transport sector growth. Hence, the causality runs from the secondary sector growth to the trade-transport sector growth. Similarly, while 40 per cent of the forecast variance of manufacturing sector growth is explained by the financial services sector growth, about 64 per cent of the forecast variance of the financial services sector growth is explained by the manufacturing sector growth. Again, the direction of causation seems to be from manufacturing sector growth to financial services sector growth.

6.1 ARDL Model

Building on the hypothesis that manufacturing sector growth has been a causative factor behind the services sector growth, it is arguable that an increase in the rate of growth in manufacturing productivity should translate into higher productivity growth in the services sector as well. The import liberalisation of the manufacturing sector (tariff reforms) around the 1990s and early 2000s contributed positively to the productivity growth in the Indian manufacturing sector (Goldar and Kumari, 2003; Topalova and Khadelwal, 2011; Das, 2006, 2016) and can thus serve as an important factor for growth in service sector productivity during this period. With the gradual fall of import penetration, the spillover effect may still remain through robust growth in manufacturing productivity. Another channel through which import penetration in the domestic market of manufactured products may augment services sector productivity is that these industries will get access to better quality imported intermediate inputs. Such imports of parts and components may help domestic producers to make better quality products, which in turn may help the using services sector industries to attain higher productivity.

In this context, we estimate an ARDL model to investigate some important determinants of TFP growth in India's market services and non-market services sector. The Domar aggregated TFP growth rates discussed above are the dependent variables. To implement the model, the growth rates have been used to construct a TFP index, and the logarithm of that index has been taken as the dependent variable. The series have been depicted above in Figure 6.

The TFP index for the manufacturing sector is taken as a key explanatory variable. For the market services TFP index, the import

penetration ratio² (for non-petroleum products) is taken as an explanatory variable along with a variable representing the TFP index of India's trading partners (hereafter called the world TFP index). The TFP indices for 34 countries, India's trade partners, have been taken from Penn World Table version 10.0 (see Feenstra, et al., 2015). A weighted average has been taken using trade weights. The purpose of including this variable in the model is to find out if there is an international spillover effect of TFP on the TFP growth attained by India's market services sector.

In the model explaining the TFP index for the non-market services which include public administration and defense, and education and health, a variable representing infrastructure development has been used.³

The estimates of the ARDL models are presented in Tables 8 and 9. The explanatory power of the models is satisfactory. The results of the Pesaran, Shin, and Smith (2001) Bounds Test indicate that there is the existence of cointegration.

The main findings emerging from the estimates of the ARDL model in Tables 8 and 9 are: (a) TFP growth in manufacturing has a significant positive effect on TFP growth in the non-market services sector, but not on the TFP growth in the market services sector. Several specifications were tried for the market services sector, and in none of the specifications, the coefficient of the manufacturing sector TFP was found to be positive and statistically significant. (b) Investment in infrastructure promoted TFP growth in the non-market services sector. (c) Market services TFP growth is positively impacted by a spillover effect of TFP growth in India's trade partners.

² This is computed as $M / (Q + M - X)$. M= non-oil imports (RBI, handbook of statistics on Indian economy), X= non-oil exports (RBI, handbook of statistics on Indian economy) and Q= value of gross output of agriculture, mining and manufacturing, excluding petroleum industry, taken from India KLEMS database.

³ Net cumulative public investment in infrastructure has been computed by taking data on capital formation by the public sector in *National Accounts Statistics*. Cumulative net investment (at 2011-12 prices) from 1960 onwards has been computed for each year from 1980 onwards. This has been divided by the series on aggregate capital stock available in India KLEMS dataabse. The investments in the following industries are considered: (i) electricity, water supply and other utility services, (ii) construction, (iii) transport, and (iv) communication.

Table 8: ARDL Model 1 (Dependent Variable: Market Services TFP) and PSS Bounds Test

Explanatory Variables	Long-run coefficients
TFP growth in manufacturing	0.0246 (0.0890)
TFP index_world	4.3495*** (0.4654)
Import penetration ratio	-2.5672*** (0.4166)
<hr/>	
ARDL Structure	(1, 3, 0, 2)
No. of observations	23
R ²	0.8325
Adjusted R ²	0.6929
<hr/>	
Pesaran, Shin, and Smith (2001) Bounds Test	
F-value	11.423
t-ratio	-4.458

Note: The critical values for the PSS bounds test at a 5% level of significance are 5.8 and -4.0. The hypothesis of a 'no level relationship' is rejected. Optimal lag lengths for the ARDL structure are determined by BIC. Standard errors are shown in parenthesis. Rainfall is taken as an exogenous variable.

: $p < 0.1$, **: $p < 0.05$, * : $p < 0.01$*

Source: Authors' computations

In Figure 10 the logarithm of marketing services TFP index and the TFP index of India's trading partners are presented. It may be seen that there are some similarities in the direction of movements. From the end of the 2000s, both series had a downward trend. There is a possibility that the TFP index for India's trade partners may be reflecting the global economic growth. To investigate this aspect, the growth rate in GDP of OECD countries was added as an extra variable in the model estimate shown in Table 9. In this case, too, the coefficient of the world TFP index remained positive and statistically significant. The coefficient of GDP growth in OECD countries was also found to be positive.

Table 9: ARDL Model 2 (Dependent Variable: Non-Market Services TFP) and PSS Bounds Test

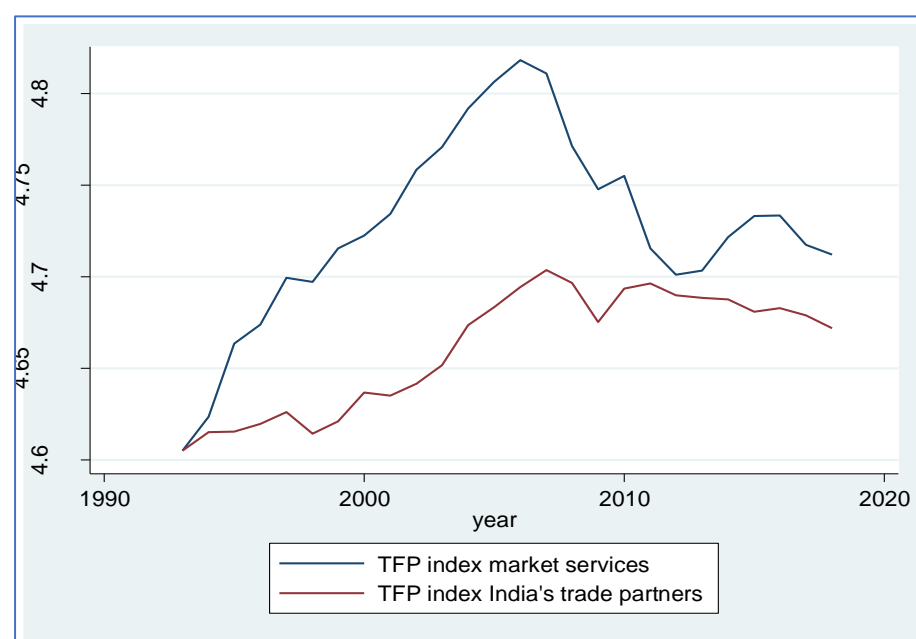
Explanatory Variables	Long-run coefficients
TFP_Manufacturing	0.4356*** (0.0589)
TFP_market_services	-0.1333 (0.1075)
Infra Capital-Total Capital ratio	0.0096** (0.0041)
ARDL Structure	(1, 3, 0, 2)
No. of observations	23
R ²	0.863
Adjusted R ²	0.767
Pesaran, Shin, and Smith (2001) Bounds Test	
F-value	18.624
t-ratio	-6.292

Note: The critical values for the PSS bounds test at a 1% level of significance are 8.9 and -5.0. The hypothesis of a 'no level relationship' is rejected. Optimal lag lengths for the ARDL structure are determined by BIC. Standard errors are shown in parenthesis.

*: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$

Source: Authors' computations

Fig. 9: Market Services TFP Index and TFP index of India's Trade Partners

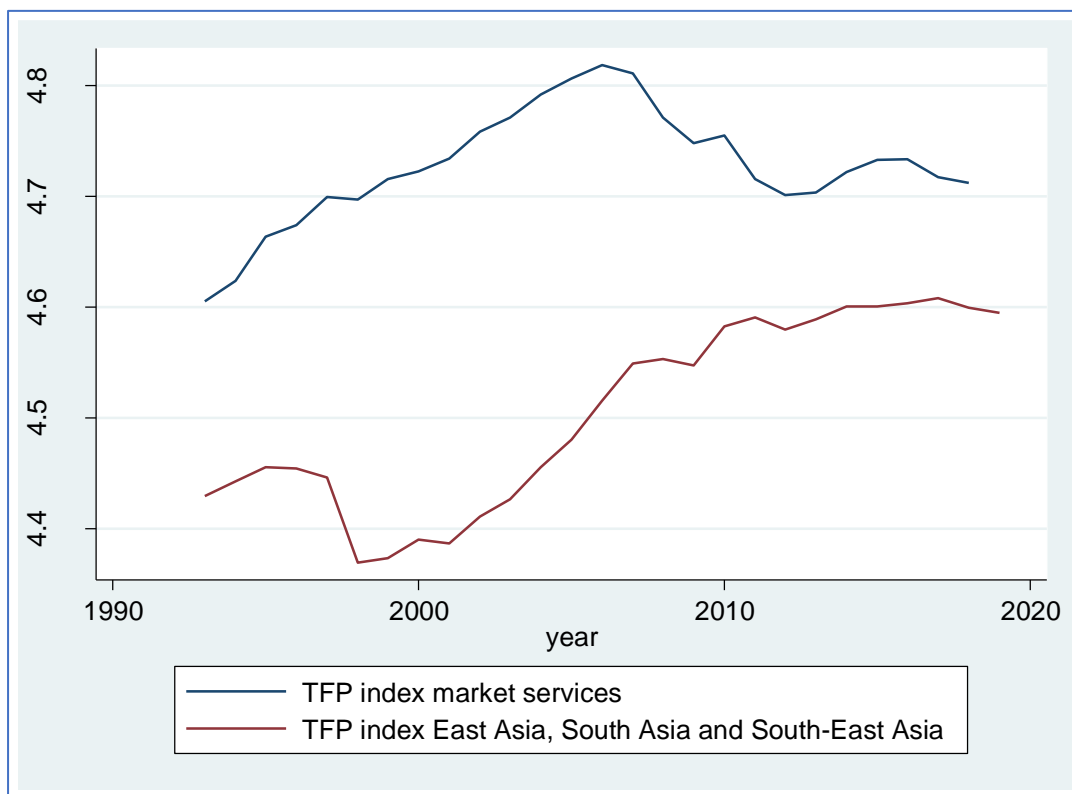


Note: The logarithm of the index values is shown.

Source: Authors' computations

An interesting finding emerging from the results reported in Table 8 is that there is a negative effect of import penetration on TFP growth in market services. It should be pointed out that the import penetration variable relates only to merchandise trade and basically captures the level of import penetration in the domestic market of manufactured products. Why should a lowering of import penetration in the domestic market of manufactured products lead to increased productivity of market services is not clear? This is possibly arising from the demand for services by domestic manufacturing. When locally produced products are replaced by imports, the demand for services by the local manufacturers goes down and this shows up in a reduction in the TFP of market services.

Fig. 10: Market Services TFP Index and Weighted Average TFP index of Developing Countries of East, South, and South-East Asia



Note: The logarithm of the index values is shown. The weights are according to India's trade with the countries in 2017.

Source: Authors' computations

The analysis presented above has indicated there was a productivity spillover from India's trade partners to India's market services sector. This issue is investigated further by considering a weighted average TFP index of emerging market economies of East, South and South-East Asia (hereafter

called TFP index of developing Asia). This has been constructed using TFP indices from Penn World Table version 10.0 (see Feenstra, et al., 2015) (weights used are according to India's trade). In Figure 10, a comparison is made between the TFP index for India's market services sector and the TFP index of developing Asia. The movement do not show as much similarity as in Figure 9 given above.

To examine the relationship between the TFP index of India's market services sector and the TFP index of developing Asia, an ARDL model has been estimated. The results are reported in Table 10. Two points emerge from the results reported in the table. First, infrastructure development has a positive effect on TFP in market services, like its effect on the non-market services. Second, a significant positive coefficient for the TFP index of developing Asia is not found in the model estimate obtained. It may thus be inferred that the finding of a significant positive coefficient of the world TFP variable in Table 8 reflects the productivity spillover effects emerging from developed countries to India.

Table 10: ARDL Model 1 (Dependent Variable: Market Services TFP) and PSS Bounds Test

Explanatory Variables	Long-run coefficients
TFP growth in manufacturing	0.281 (0.392)
TFP index developing Asia	-0.591 (0.467)
Infra Capital-Total Capital ratio	0.050* (0.024)
Import penetration ratio	-1.820 (1.568)
ARDL Structure	(2,1, 1, 2,12)
No. of observations	24
R ²	0.870
Adjusted R ²	0.752
Pesaran, Shin, and Smith (2001) Bounds Test	
F-value	6.59
t-ratio	-3.34

Note: The critical values for the PSS bounds test at a 10% level of significance are 4.4 and -3.6. The F-value crosses the critical limit, and the t-value only falls marginally short of the critical value. Optimal lag lengths for the ARDL structure are determined by BIC. Standard errors are shown in parenthesis.

*: $p < 0.1$, **: $p < 0.05$, *** : $p < 0.01$

Source: Authors' computations

6.2 VAR Model

Building on the results from the ARDL model, we estimate a VAR model to better capture the evolution of the relationship between manufacturing and the two sub-sectors of services in a stochastic environment. We use the respective Domar-weighted TFP growth series for each sector (1993-18) as the variables in VAR model, including five lagged terms as suggested by the BIC (Bayesian Information Criteria). Each series was tested for the existence of a unit-root before executing the VAR model. The ADF, ERS and KPSS test give the same results – all three series are integrated of order zero and are hence stationary (this is expected since we are already working with growth rates). The constant term is dropped from the model due to statistical insignificance in all three estimated equations.

Granger causality tests were conducted in the estimated VAR model to investigate the lagged effects of manufacturing productivity on the productivity of the services' sub-sectors. The results are summaries in Table 11 below. Under the null hypothesis is Domar-weighted Manufacturing TFP growth does not Granger cause the sub-vector of Domar-weighted market services and D-weighted non-market services, the resulting F-value 3.72 with a p-value of 0.007. Thus, we strongly reject the null even at one percent level of significance. The same null hypothesis of instantaneous Granger causality results in a insignificant F-value at even 10 per cent level of significance and hence cannot be rejected. Thus, manufacturing productivity does seem to have a lagged impact on services productivity.

Table 11: Granger and Instantaneous Granger Causality Tests

Direction of Causality	
<i>Granger Causality: manf</i> → [<i>mkt_tfp</i> , <i>nmkt_tfp</i>]	
F-value	3.72***
(df1,df2)	(10,18)
<i>Instantaneous Granger Causality: manf</i> → [<i>mkt_tfp</i> , <i>nmkt_tfp</i>]	
Chi-squared value	3.94
df	2

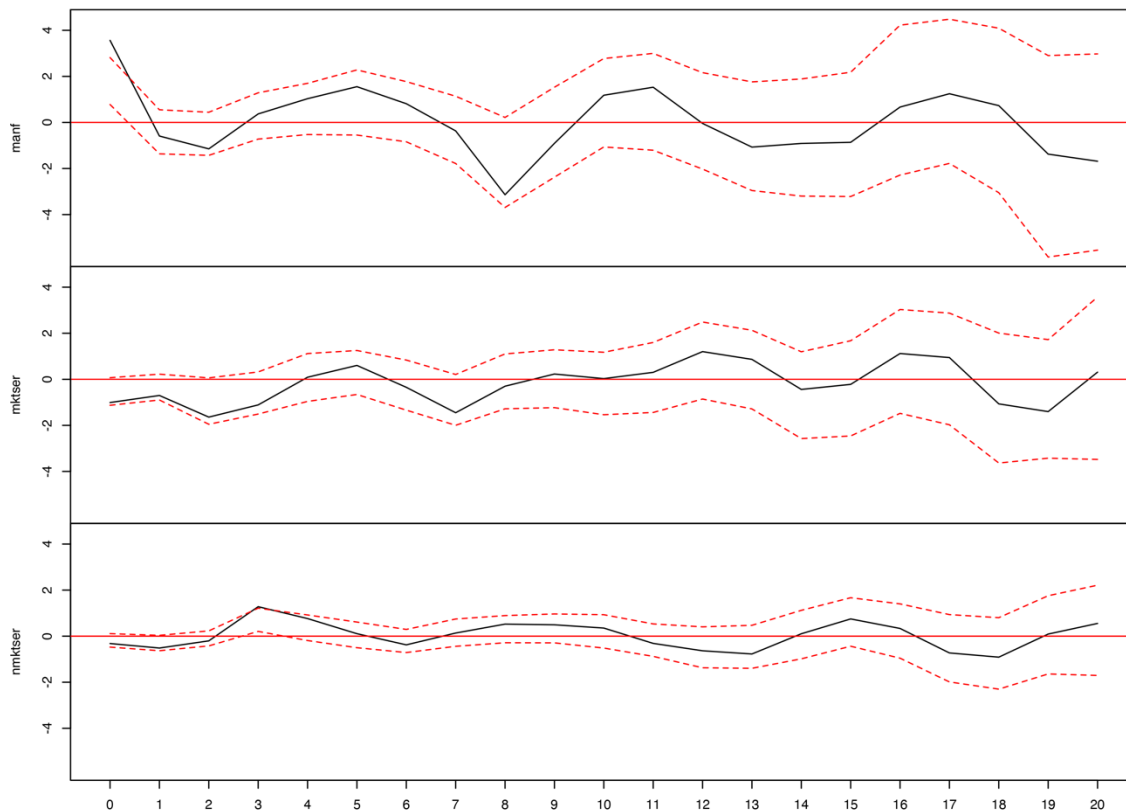
Note: *: $p < 0.1$, **: $p < 0.05$, *** : $p < 0.01$

Source: Based on Authors' calculations

Following up the VAR model and the corresponding Granger causality tests, we look at impulse response functions (orthogonalized) to see the long-run effects of a simulated unit shock on Domar-weighted manufacturing TFP growth on the corresponding Domar-weighted series for the services sub-sectors. The impulse response is shown in Figure 11 below. There is no instantaneous impact, echoing the results from the instantaneous Granger

causality tests. The lagged effects appear to be broadly positive for the services sub-sector, however the effect appears to remain insignificant throughout

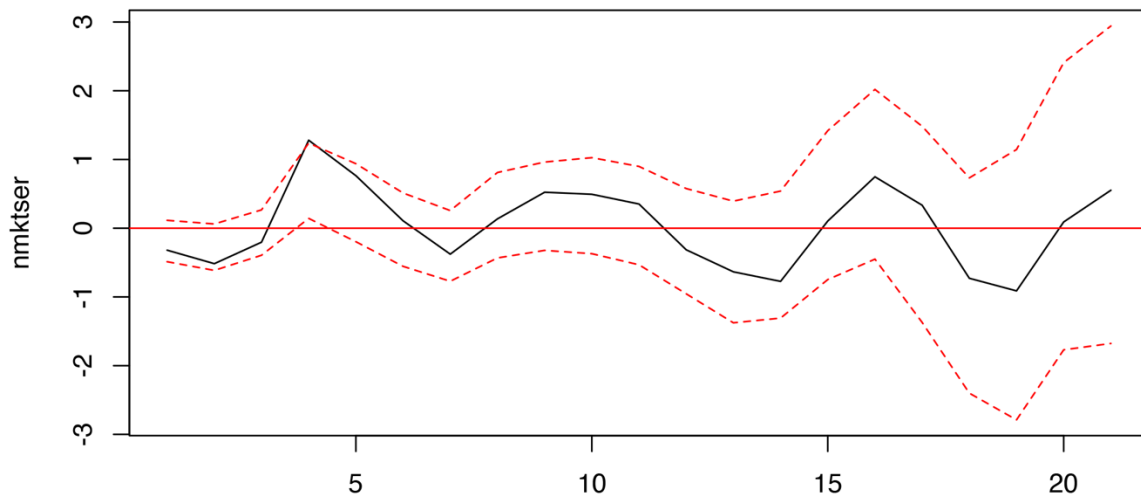
Figure 11: Impulse Response from a unit shock to D-weighted Manufacturing TFPG



Source: Based on authors' computations

except when we look three periods ahead at the non-market services. To see this effect more clearly, we zoom into the third panel of Figure 11 above, this is shown in Figure 12 below. We observe that there exists a significant positive impulse response from Domar-weighted non-market services TFPG growth around three periods after the unit shock to Domar-weighted manufacturing TFPG growth – this effect however lasts for only one period and has no persistence. We suspect that the power of our VAR model remains low due to the limited number of observations for which the Domar-weighting procedure could be applied. The corresponding results from the Granger tests and the IRF analysis could be much more pronounced with a larger sample size. However, we do pick up some significant effects even in our limited sample which creates impetus for further investigation when a Domar-weighted series with more observations is computable.

Figure 12: Impulse Response from Domar-weighted non-market services TFPG



Source: Based on Authors' computations.

7. Conclusion

One of the most interesting features of the Indian economy since the 1980s is the emergence of services as the dominant sector and the main driver of GDP growth. Among fast-growing developing countries, India is distinctive for the role of the service sector. Where earlier developers grew on the basis of exports of labour-intensive manufactures, India has concentrated on services. Indian services sector observed an increase in its share from nearly 41 percent in 1980 to more than 53 per cent in 2018. The share of agriculture declined by 13 percentage points between 1993 and 2018 and manufacturing had remained around 17-18 percent during the period. We observe that services grew at 7.5 percent per annum during 1993-2018 and the growth has improved over different sub-periods until the financial crisis in 2007-08. The value-added growth for services was 7.8 percent for the period 1993 to 2007 and then it slightly declined to 7.1 percent in the next sub-period. Within services, market services industries like business services, post & telecommunication, and financial services registered the fastest growth than non-market services industries i.e. health & social work; education & public administration. The market services sector grows at a faster rate (9.0 % per annum), while non-market services grew at a much slower rate (5.5 % per annum). In terms of contribution to the aggregate value-added growth, out of the average growth of 6.44 percent per annum during the period, 1993 to 2018, 2.43 percentage points came from market services, 1.11 percentage

points from non-market services. Within the market services, trade and business services contributed the most.

Our estimates of TFP growth show wide heterogeneity across industries and over time. The growth rate of TFP varied across industries ranging from (-)2.4 percent to 6.8 percent rate of growth per annum. We observe high rates of TFP growth for public administration for the entire period as well as for sub-periods. We find a striking observation of negative TFP growth for business services. Applying Domar weights we observed that transport and storage was the highest contributor among market services industries followed by financial services. Among non-market services, public administration has a relatively higher contribution to aggregate TFP growth. From Harberger diagrams based on Domar-weighted industry-level contributions to the service sector TFP growth, it is apparent that industry-level TFP growth in the services sector was highly localized in the post-GFC period while localization was much less pronounced in the pre-GFC period (panel B) and the overall time period (panel A).

In this paper, we have examined several factors that drive the TFP growth in the services sector. These include the role of manufacturing TFP – any spillover effect from manufacturing to market services and non-market services. Our results suggest that TFP growth in manufacturing has a significant positive effect on TFP growth in the non-market services sector but not on the TFP growth in the market services sector. We also estimate a VAR model to capture the evolution of the relationship between manufacturing and the two sub-sectors of services in a stochastic environment. From the impulse response functions, we found that a simulated unit shock to domar-weighted manufacturing TFPG appears to significantly impact domar-weighted non-market services TFPG 3 periods ahead. We also introduced sector specific factors such as the import penetration ratio and TFP index of India's trading partners for market services and infrastructure capital-total capital ratio for non-market services. Investment in infrastructure promoted TFP growth in both the market and non-market services sectors. Market services TFP growth is positively impacted by a spillover effect of TFP growth in India's trade partners. However, the spillover seems to be emerging from developed countries, not so much from developing countries.

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