

Peer-reviewed research

Assessing the Resilience of India's Service Sector to Shocks and Fluctuations

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Keywords: Service sector, Economic resilience, Sub-sectoral effects, Time-series analysis, JEL: O0 L80 E320 C22

<https://doi.org/10.46557/001c.117126>

Asian Economics Letters

Vol. 5, Issue 3, 2024

This study analyzed the resilience and adaptability of India's service sector, offering valuable insights into its overall performance and the intricate dynamics of its sub-sectors affecting gross value added compared to other sectors. We employed the HP filter method and vector autoregressive model to unveil the remarkable resilience of the service sector in the face of economic shocks, such as significant cyclical fluctuations and short-term disruptions experienced during the challenging year of 2020 marked by the COVID-19 pandemic. Moreover, the study identified sectors trade, hotels and restaurants, and business services, which caused heightened impulses to the economy, while others, such as agriculture, industry, transport, storage and communication, financial services, public administration, and other services, were capable of absorbing shocks and stabilizing the economy. These findings have significant implications for policymakers, emphasizing the need for investment in the service sector, particularly in infrastructure development, to foster economic resilience and stability.

I. Introduction

Numerous studies have analysed the repercussions of the COVID-19 pandemic on economic growth, encompassing both a broad perspective and a particular focus on the industrial sector (Padhan & Prabheesh, 2021). However, it is equally imperative to comprehend the implications on the services sector, which plays a pivotal role in controlling India's economy. Over the years, the services sector has demonstrated remarkable resilience and sustainability, evidenced by its rising contribution to gross value added (GVA), which increased from 33% in 1981 to 54% in 2021. In comparison, the industrial sector lags with a contribution of 25.9%, while the agricultural sector ranks third with a 20.2% contribution in 2021 (Ministry of Finance, Government of India, 2021). Rather than merely highlighting the vulnerabilities of major sectors to shocks, it is crucial to gain a nuanced understanding of the specific role played by the sectors in fostering economic resilience. This necessitates exploring how the sectors with the highest contribution respond to specific shocks and exhibit faster recovery, as economic sectors differ in their reactions to economic shocks (Mai et al., 2019). Therefore, this study examined the impact of shocks on the sectors and their effect on the economy.

Despite the turbulence of economic crises, the service sector has historically exhibited commendable resilience,

outpacing other sectors in terms of productivity and resistance to the global financial crisis, particularly when contrasted with the industrial sector (Rath, 2018). However, by a stark deviation from this trend, the sector underwent a dramatic contraction in 2020, largely attributable to the lockdown during the pandemic. This shift had profound repercussions on India's service industry, leading to a significant disruption in supply chains and a notable downturn in consumer spending (Dev & Sengupta, 2020).

To enhance resilience and effectively respond to such shocks, countries must initiate and coordinate timely sector-specific policies (Vidya et al., 2023) and thoroughly analyze the service sector's ability to adapt to the "new normal" swiftly and contribute to a V-shaped economic recovery. This study explored the following research questions: (i) have there been any cyclical fluctuations within the services sector? (ii) which sectors correlate with the GVA's cyclical movements? (iii) how does the aggregate GVA respond to shocks in agriculture, industry, and service sub-sectors? The existing literature has employed various approaches to analyze macroeconomic adjustments to shocks, including the business cycle approach and the VAR methodology for macroeconomic equilibrium adjustments within a dynamic general equilibrium framework. However, different sectors exhibit distinct behaviors and responses to economic and political shocks (Chowdhury & Irfan, 2022). Recognizing these important considerations, this study

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adopted the (Hodrick & Prescott, 1997) (hereafter HP) filter method and the VAR model to address these research objectives. Firstly, the study utilized the HP filter to decompose the share of services in gross value added (SGVA) into its long-run trends, cyclical fluctuations, and short-term shocks. Secondly, the study examined how fast the service sector can recover from shocks and which service sub-sectors can affect the aggregate GVA. This was done by simulating how GVA reacts to a sectorial unit shock. This study revealed several key findings: The service sector in India demonstrates resilience to economic shocks amidst significant cyclical fluctuations and short-term shocks. The pandemic year of 2020 resulted in a decline followed by a subsequent recovery in 2021. Business services negatively correlate with the GVA, while agriculture, industry, and other service sub-sectors correlate positively with cyclical movements. The aggregate GVA is highly sensitive to unit shocks from the service sub-sectors, such as trade, hotels and restaurants, and business services. However, the impulse response has faster recovery rates. Conversely, agriculture, industry, transport, storage and communication, financial services, public administration, and other services do not disturb the national income but stabilize the economy. This study contributes to the existing literature by highlighting the diverse responses of GVA to sector-specific shocks. It is the first, to our knowledge, to comprehensively examine the effects of COVID-19 on the aggregate GVA, with reference to services sub-sectors, before and during the pandemic.

The remaining paper is organised as follows. Section II discusses data and methodology followed by the discussion of main findings in Section III. The final section provides concluding remarks.

II. Data and Methodology

Our research utilized quarterly data from the first quarter of 1981 to the fourth quarter of 2021. This extensive dataset enabled us to evaluate the service sector's resilience, flexibility, among other sub-sector dynamics. The data was sourced from the Reserve Bank of India (RBI) database. We utilized the HP filter, VAR modelling, and Impulse Response Function (IRF) simulations to measure shocks and resilience. Notably, the service GVA growth rate exhibits a distinct trend of increasing stability from 1981 to 2021, and during the period, services surpassed agriculture and industry in growth. Furthermore, a detailed examination of quarterly fluctuations in the Indian economic sectors is essential to uncover the aggregate GVA sector's response mechanisms to identify sector-specific shocks. As a first step, the HP filter method (1997) decomposed the aggregate output into growth and cyclical computations. When the filters were applied to the quarterly data, the two bandpass filters, Baxter-King and Christiano-Fitzgerald filters, and the HP filter resembled each other and persistently produced similar results (Baxter & King, 1999). Therefore, the present study incorporated the HP filter to detrend the services output growth from 1981q1-2021q4. The HP filter is a statistical tool for data smoothing. It estimates and isolates the long-run trend components within a

data series, allowing for a more precise analysis of the underlying patterns. The HP filter optimizes the smoothed series y^T and reduces the fluctuations y around its own value. This process is subject to a constraint that limits the second difference. The HP filter selects y^T such that the variability is minimised, leading to a more streamlined series for robust analysis.

$$\sum_{i=1}^n (y_t - y_t^T)^2 + \lambda \sum_{i=2}^{n-1} (\Delta y_{t+1}^T - y_t^T)^2 \quad (1)$$

Here, y^T is growth, λ is the smoothing weight, and n is the sample size. The value for λ is 1,600, as quarterly data was used (Backus et al., 1992). As a next step, we tested the stationarity of the series with the Augmented Dickey-Fuller (ADF, 1981) and Phillips-Perron (PP, 1988) tests. Following this, we conducted a VAR estimation.

GVA growth rate $\{gva_t\}$, the value of variable gva at the time t can be regressed on its own historical values and is given by the auto-regression model (AR). The ρ -order AR model is provided as;

$$AR(\rho) : gva_t = \phi_1 gva_{t-1} + \phi_2 gva_{t-2} + \dots + \phi_\rho gva_{t-\rho} + \varepsilon_t \quad (2)$$

Where, $gva_{t-\rho}$ denotes ρ - periods lagged gva_t , a stable VAR model of ρ - order is given as

$$\gamma_t = \eta + \sum_{j=1}^2 \beta_j y_{t-j} + \sum_{j=1}^4 \delta_j GVAR_{t-j} + \mu_t \quad (3)$$

Where

$\gamma_t = [AGR_t, IND_t, THR_t, TSC_t, FS_t, BS_t, PA_t, OS_t]$; AGR stands for Agriculture; IND stands for Industry; the sub-sectors of services are given as THR (trade, hotels, and restaurants), TSC (transport, storage, and communication), FS (financial services), BS (business services), PA (public administration), and OS (other services); η is a vector associated with the constant term, β_j is a matrix of VAR parameters for lag j ; δ_j represents the slope coefficients for the effects of GVA for up to two lags; and μ_t is a white noise disturbance term. All the endogenous variables in the VAR model are predicted based on their own lagged values and the lags of the other variables. After developing the VAR model, IRF simulations were applied to identify the sectors that affect the national income.

III. Results

The data revealed a consistent upward trend in the service sector since 1981. Over this period, the sector completed three distinct business cycles in India, characterized by alternating phases of growth and contraction (Figure 1). These cycles occurred during the periods of 1998q4-2002q1, 2007q2-2011q1, and 2015q1-2020q1. Moreover, the data indicates that the services exhibited relatively low volatility in terms of shocks between 1981 and 2020. However, two significant shock years stood out in 2010-2011 and 2019-2020, which can be attributed to the global economic crisis and the COVID-19 pandemic. Despite unprecedented shocks (2019-20), the sector recovered faster in 2021, exhibiting its potentiality to withstand shocks.

The services sector comprises interconnected sub-sectors that exhibit varying relationships with the aggregate GVA. Table 1 displays correlation coefficients, highlighting

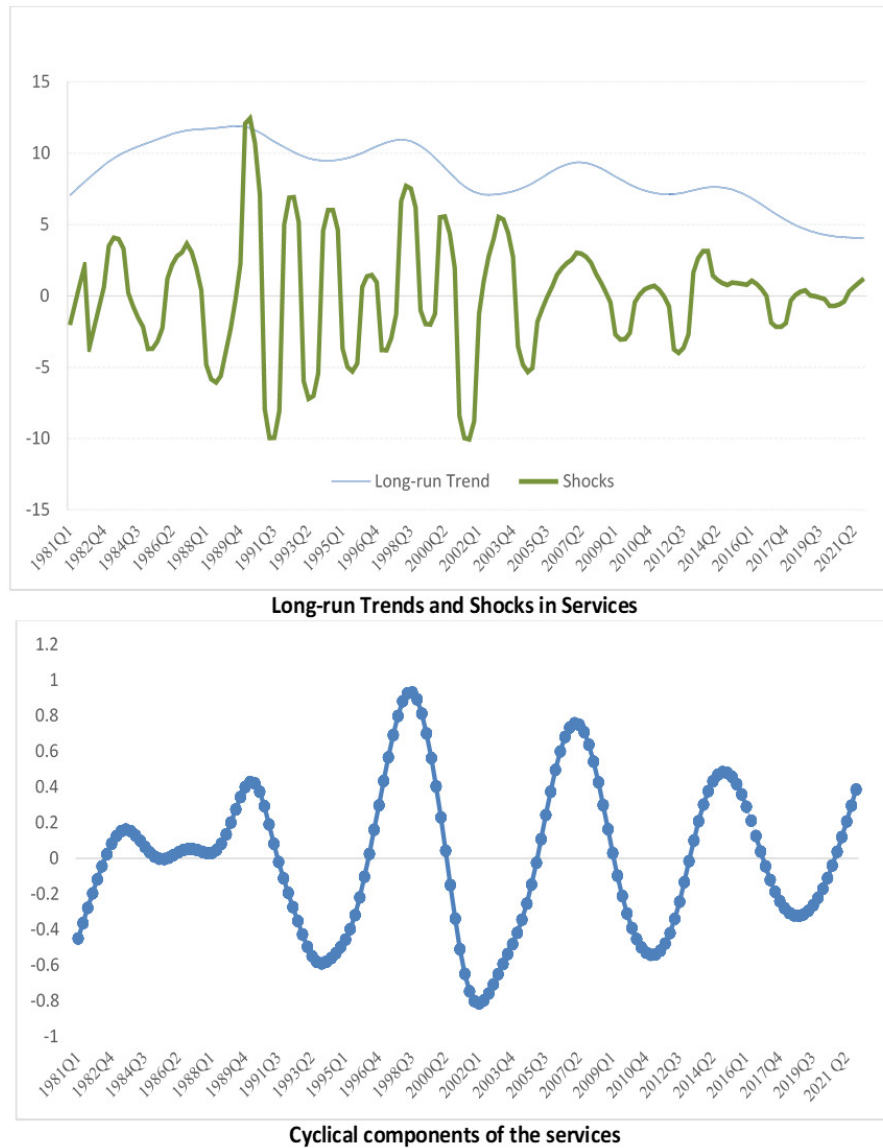


Figure 1. The HP filter of quarterly services growth rate (1981q1-2021q4)

Note: HP filter is applied to separate the service sector time series into its trend, shocks, and cyclical components. The growth of the service sector from 1981Q1 to 2021Q4 is long-run trend and it is represented by a thin line above the shocks (short-run shocks). The cyclical components (fluctuations) of services are given in the second half of the figure.

the associations between fluctuations in GVA growth and sectoral growth rates. Agriculture and Industry demonstrate a positive correlation coefficient of 0.685 and 0.667, indicating a linkage with the GVA cyclical movements. Conversely, business services display a negative correlation of 0.076. Only business services exhibit a negative correlation with GVA movements compared to service sub-sectors, whereas other sub-sectors exhibit positive correlations.

Subsequently, we examined the potential impact of shocks within the sectors on national output. To accomplish this, we conducted VAR and IRF simulations, which showed that the variables were stationary at level (Table 2). Analyzing a 10-period observation window, we observed varying responses of the cyclical component of GVA to the shocks exhibited by each sector over time. Notably, the COVID-19 pandemic in 2020-21 had a widespread impact, with service sub-sector shocks affecting national output in many ways.

Our findings indicate that GVA exhibited high sensitivity to unit shocks from the service sub-sector, trade, hotels, and restaurants (1.173), and business services (0.530), with minimal time lags. Conversely, the response of GVA to unit shocks from agriculture (0.006), industry (0.008), transport, storage, and communication (0.065), financial services (-0.046), public administration (-0.13), and other services (0.02) was relatively negligible.

The response of GVA to a unit shock originating from the trade, hotels, and restaurants sector exhibited a gradual decline from 1.173 in the initial period to -0.074 by the tenth period. Similarly, business services demonstrated a decreasing response from 0.530 to zero by the tenth period. In comparison, the GVA's reaction to agriculture, industry, and service sub-sectors, including transport, communication and storage, finance, public administration, and other services consistently declined, ultimately reaching 0.001 in the final period.

Table 1. Pearson correlation between the pairwise cyclic components of the economic sectors

	GVA	AGR	IND	THR	TSC	FS	BS	PA	OS
GVA	1								
AGR	0.685**	1							
IND	0.667**	0.176	1						
THR	0.259	-0.084	0.439**	1					
TSC	0.193	-0.025	0.243	0.652**	1				
FS	0.13	0.344*	0.131	0.091	0.157	1			
BS	-0.076	-0.131	-0.141	0.208	0.387*	0.159	1		
PA	0.13	0.15	0.068	-0.051	0.167	0.196	0.041	1	
OS	0.267	-0.166	0.413**	0.636**	0.591**	-0.067	0.216	0.332*	1

Notes: This table presents correlation coefficients between gross value addition (GVA) and various sectors including agriculture (AGR), industry (IND), trade, hotels, and restaurants (THR), transport, storage, and communication (TSC), financial services (FS), business services (BS), public administration (PA), and other services (OS). * and ** represent statistical significance at the 1% and 5% levels, respectively.

Table 2. Unit root test results

	Intercept and Trend	Intercept and Trend
Unit root test	ADF	PPT
GVA	-4.726*** (0.000)	-14.863*** (0.000)
AGR	-9.925*** (0.000)	-30.808*** (0.000)
IND	-4.634** (0.000)	-5.890** (0.000)
THR	-6.110** (0.010)	-5.661** (0.000)
TSC	-5.949*** (0.002)	-12.528*** (0.000)
FS	-5.732*** (0.000)	-16.184*** (0.000)
BS	-5.219*** (0.000)	-5.092*** (0.000)
PA	-4.774** (0.000)	-4.627** (0.000)
OS	-5.092** (0.000)	-4.351** (0.000)

Notes: This table displays results from Augmented Dickey-Fuller (ADF, 1981) and Phillips-Perron (PP, 1988) tests for gross value addition (GVA) and various sectors including agriculture (AGR), industry (IND), trade, hotels, and restaurants (THR), transport, storage, and communication (TSC), financial services (FS), business services (BS), public administration (PA), and other services (OS). Models are estimated with both intercept and time trend. ***, **, * represent statistical significance at 1%, 5%, and 10% levels, respectively.

Within the services sector, unit shocks from sub-sectors of trade, hotels, restaurants, and business services manifested a greater potential to disturb the economy. Interestingly, despite this susceptibility, these sub-sectors demonstrated resilience and a faster recovery trajectory than their counterparts in the sector, causing less harm in the long run. This duality presents a compelling dynamic nature of the sector.

In contrast, transport, storage, communication, financial services, public administration, and other services were capable of absorbing shocks and served as a stabilizing factor in the national economy (Figure 2). It is important to acknowledge that these findings were derived from historical data and responses to past shocks, and future events may yield different outcomes.

IV. Conclusion

In conclusion, the service sector has been pivotal in driving India's economic growth over the past four decades. In spite of cyclical fluctuations, it has consistently exhibited resilience, swift recovery from economic shocks, and less economic disturbance in the long-run. The aggregate

GVA is particularly vulnerable to economic shocks originating from trade, hotels and restaurants, and business services. However, these sub-sectors have also demonstrated rapid recovery, contributing to the overall stability of the economy.

Conversely, agriculture, industry, transport, storage and communication, financial services, public administration, and other services have emerged as crucial sectors for stabilizing the economy during economic shocks, given their capacity to absorb and rebound from such disruptions within a relatively short time. Strategic investments in these sectors, along with infrastructure development and urbanization can boost the economy and increase the resilience capacity of the service sector in the long term.

Submitted: February 15, 2023 AEST, Accepted: September 29, 2023 AEST

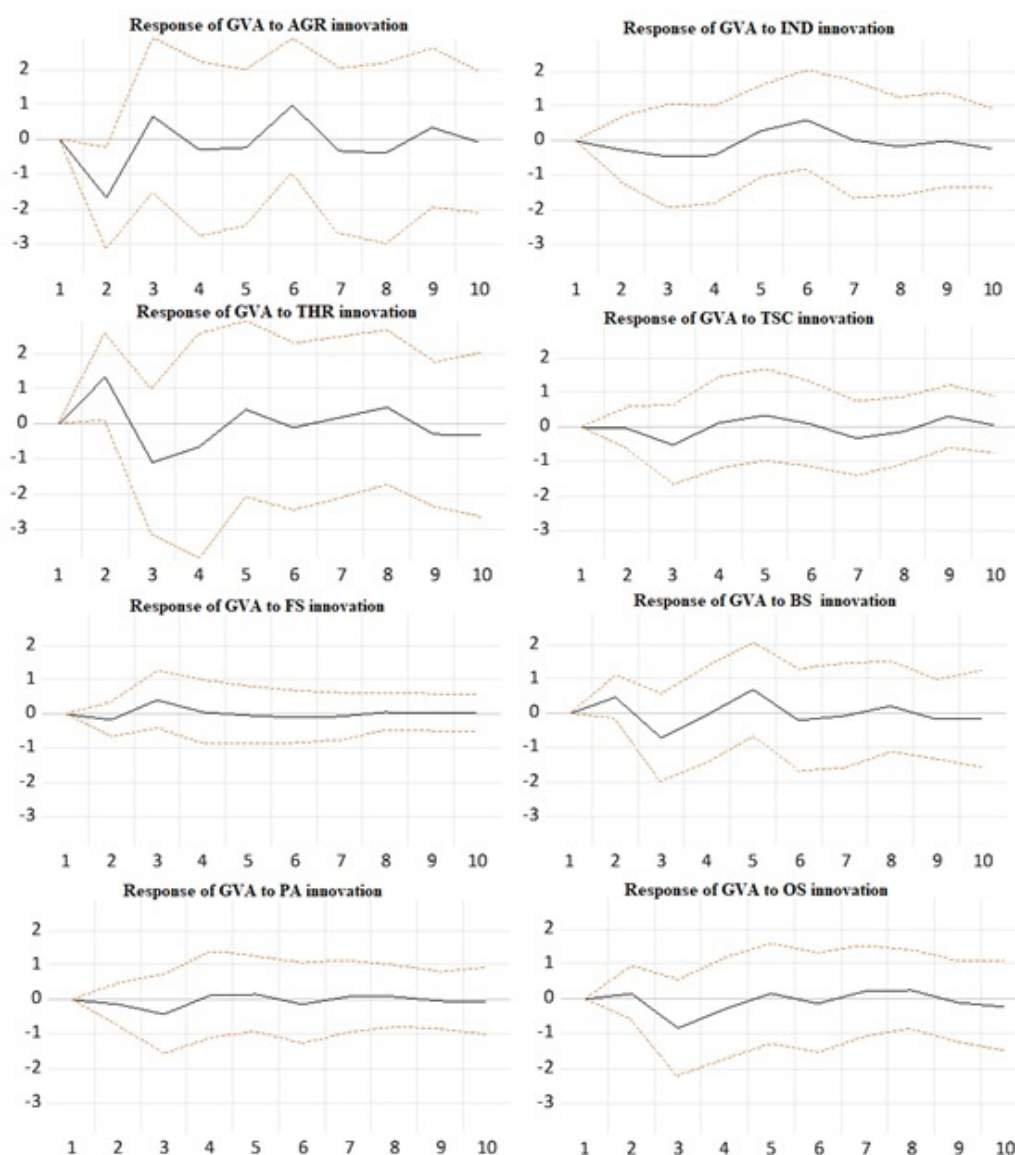


Figure 2. The results of IRF simulation (1981q1-2021q4)

Note: This figure depicts how total gross value added (GVA) responds to innovation shock in agriculture (AGR), industry (IND), trade, hotels, and restaurants (THR), transport, storage, and communication (TSC), financial services (FS), business services (BS), public administration (PA), and other services (OS), revealing sectoral impacts on overall economic output using Impulse Response Function (IRF).



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