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RESEARCH ARTICLE

Examining the impact of economic cycles on India's information technology sector

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Abstract

The link between the Indian IT industry and business cycles is examined in this article. The IT-BPO sector has spearheaded India's transition from an agricultural to a service economy. The industry has dominated this field by producing around 10% of India's service industry earnings and developing a special "service-directed" export-oriented business model. In India there has been massive growth in the software industry due to its potential of exports and for hardware, a very promising demand at the domestic front has been indicated, starting in 1991. The main factors influencing the rise in technology adoption in India include the country's economic growth, the quick development of its technological infrastructure, the fierce competition among Indian businesses, the government's increased attention, and the introduction of new business models that enable the provision of IT to untapped markets. The study investigates the potential relationship and sensitivity of the IT sector to the cyclical patterns of the Indian economy. If so, what is the degree of correlation between IT companies and Indian business cycles? Whether the movements of IT Industry are procyclical and coincident to the movements of GDP. Data analysis was comprised of stationarity tests, detrending, and log transformation. Comparative charts clearly highlighted a positive relationship, but because of IT exports, the relationship is more complex. Also, it has been found the IT is not a lagging indicator.

Keywords: Indian business cycle, Information technology, Data analysis.

Introduction

Every industry responds to changes in the business cycle differently. While several industries are completely unaffected by economic fluctuations, others are quite susceptible to them (El-fitouri, M. O. 2015). For cyclical sectors, there may be differences in the degree of timing and variation. Depending on how sensitive and coherent the economic activity is, these industries may have small to substantial increases during an expansionary phase. The purpose of the study is to determine how susceptible the Indian IT sector is to shifts in the country's economic cycles.

The basis of a deep alignment is laid by the interaction of economic activity and the information technology industry; nevertheless, in order to make a factual conclusion, this alignment must be demonstrated using statistical principles. Between 1991–1992, the IT industry's share of GDP was 4.4%; by 2019–20, that number had risen to 7.4%. From 2009 to 2017 (Figure 1), the sector's direct employment for both the export and local markets grew from 1.96 million to 3.86 million, indicating its increasing significance. Indian GDP, exports from India, IT industry turnover, IT employment, and IT exports are the key study criteria (Figure 2) (Akman, I., and Rehan, M. 2010).

During the 2017 fiscal year, the information technology and business process management sector in India employed about 15 million people both directly and indirectly. The world's leading location for IT businesses to offshore is India. With its steady growth in recent years, the IT-BPM industry now makes up over 30% of the worldwide market for BPM outsourcing. Over 448,400 people worked worldwide for the global information technology services business Tata Consultancy Services as of March 31, 2020. Greater than the connection between GDP and IT overall, the spearman correlation between employment in the IT industry and GDP is 1. This might be because the IT industry generates a lot of indirect jobs, which

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further solidifies the bond (Costello, A. B., and Osborne, J. 2005).

Objective

The study's goal is to determine how much the Indian business cycle influences the country's IT sector. The purpose of the study was to determine how sensitive the Indian GDP is to the IT industry. The IT Industry may be divided into two categories: IT exports and IT domestic (Dua P, Banerji A 2012). The growing dominance of IT exports is demonstrated by their contribution to the whole IT sector; as a result, there is an interdependent component of global fluctuations that is likely to affect the study. The study will determine if there is a high or moderate link between the GDP of India and the IT industry, based on the assumption that a relationship exists. This research may offer a chance to determine the impact of overall economic activity on the IT Industry.

Research Methodology

The study's analysis has been arranged as follows: The cyclical trends relating to the GDP and Indian IT industry are examined in section 1. Several graphical patterns, such as the contribution of domestic IT, IT exports, and overall IT to GDP, have been taken into consideration during the observation process (Ghemawat, P.& Steven A. A. 2007). To determine the relationship between the GDP and the IT industry, section 2 estimates the correlation coefficient. The cyclical trends were identified by inferring from comparative charts using a specific model approach that first checked stationarity. After detrending the data, the data was subjected to log transformation to determine the sensitivity of the IT industry to the Indian GDP. A detailed analysis of the significant role of IT exports to the total IT output indicates that global business cycles are interfering. Spearman the relationship between India's GDP and the IT sector has been established via the application of correlation coefficients; Section 3 provides a detailed analysis of how the IT sector and exports have responded to periods of economic slowdown in India (Hamilton J 2016), (Hamilton JD 1989).

Section 1: Cyclical Patterns Pertaining to GDP and Indian IT Industry

Strong stationarity

Strong stationarity requires the shift-invariance (in time) of the finite-dimensional distributions of a stochastic process. This means that the distribution of a finite sub-sequence of random variables of the stochastic process remains the same as we shift it along the time index axis (Hodrick, R. and E. Prescott 1980) (Figure 3). For example, all i.i.d. stochastic processes are stationary. Formally, the discrete stochastic process $\boldsymbol{X}=\{x_i ; i\in\mathbb{Z}\}$ is stationary if

$$F_X(x_{t_{1+\tau}}, ..., x_{t_{n+\tau}}) = F_X(x_{t_1}, ..., x_{t_n})$$

The stationarity condition for $T\subset Z$ with $n\in\mathbb{N}$ and any $\tau\in Z$. [Cox & Miller, 1965]. For continuous stochastic processes the condition is similar, with $T\subset\mathbb{R}$, $n\in\mathbb{N}$ and any $\tau\in\mathbb{R}$ instead. This is the most often used definition of stationarity, which is just called stationarity for short. Other names for it include strong-sense stationarity and strict-sense stationarity.

Weak stationarity

Weak stationarity only requires the shift-invariance (in time) of the first moment and the cross moment (the auto-covariance). This means the process has the same mean at all time points, and that the covariance between the values at any two time points, *t* and *t–k*, depend only on *k*, the difference between the two times, and not on the location of the points along the time axis (Jhamb, R. K. 2011). Formally, the process $\{x_i ; i\in Z\}$ is weakly stationary if:

- The first moment of x_i is constant; i.e. $\forall t, E[x_i]=\mu$
- The second moment of x_i is finite for all t; i.e. $\forall t, E[x_i^2]<\infty$ (which also implies of course $E[(x_i-\mu)^2]<\infty$; i.e. that variance is finite for all t)
- The cross moment — i.e. the auto-covariance — depends only on the difference u-v; i.e. $\forall u,v,a$, $\text{cov}(x_u, x_v)=\text{cov}(x_{u+a}, x_{v+a})$

The third condition implies that every lag $\tau\in$N has a constant covariance value associated with it:

$$cov(X_{t_1}, X_{t_2}) = K_{XX}(t_1, t_2) = K_{XX}(t_2 - t_1, 0) = K_{XX}(\tau)$$

Note that this directly implies that the variance of the process is also constant, since we get that for all $t\in\mathbb{N}$

$$Var(X_t) = cov(X_t, X_t) = K_{XX}(t, t) = K_{XX}(0) = d$$

This presents a particular image of processes that are weakly stationary as having constant mean and variance. In order to observe the co-movement of GDP and the IT industry, detrending and log transformation were performed for statistical inference, since the time series stationarity test reveals that the series represents non-stationarity (Mathur, Somesh Kumar 2007).

Elimination of trend and seasonality

Here it is assumed that the TS model is additive and there exists both trend and seasonal components, that is

Xt = mt + st + Yt ,

The seasonality component st is such that st = st–d, where d denotes the length of the period and X d k=1 sk = 0. With a seasonal effect of a constant period length d it is convenient to index the data by the number of the season and the number within the season, for example monthly data (d = 12) for b years would be denoted by xjk, j = 1, . . . , b, k = 1, . . . , 12. As before we want to extract the residuals Ybt in order to examine their statistical properties. Small trend method was used for estimation of the trend and the seasonal components (Mohanty J, *et al.*, 2003).

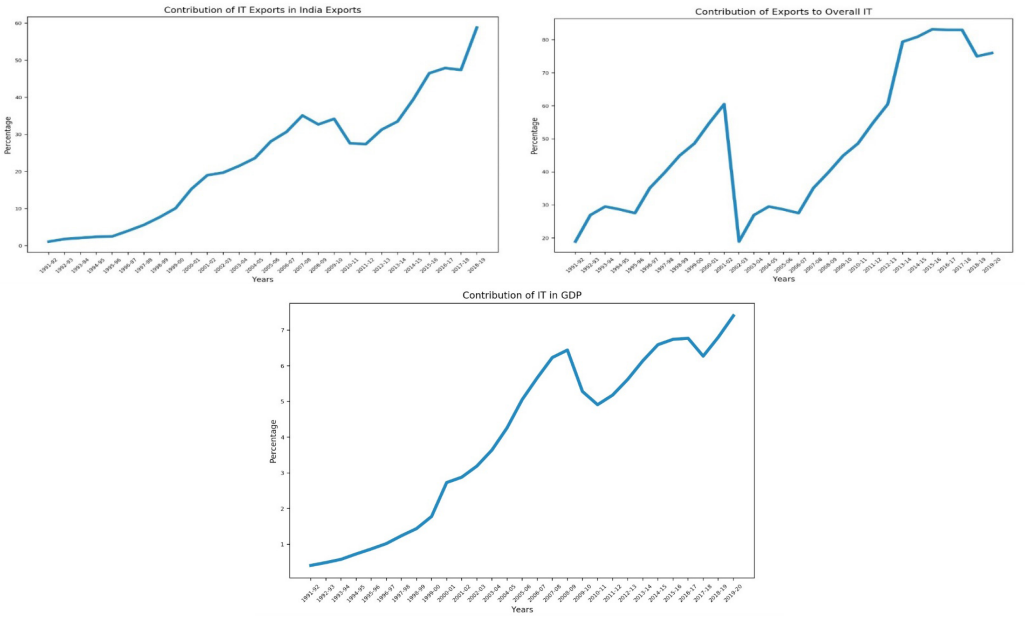

Figure 1: Contribution of IT exports to Indian exports and overall IT & IT to GDP (Annexure Table 2)

Contribution ratio analysis

This method is useful when the time series has a small trend and we may assume that the trend within each period is constant. Then, due to the assumptions of model the period average is an unbiased estimator of the trend, that is mb j = 1 d X d k=1 Xjk. The seasonal component estimator, which satisfies the model assumptions is sbk = 1 b X b j=1 (Xjk – mˆ j). Following liberalization, the IT sector began to pick up steam and grow to the point where it is now contributing to the improvement of other vital industries' productivity due to the stimulation in all sectors (Palachy, S. 2019).

Value Contribution = Aggregate IT Turnover/GDP

India has accumulated significant brand value over the years, as was shown in the IT industry. India is becoming one of the most popular locations for business process outsourcing (BPO) in the IT enabled services (ITES) sector. The fact that the IT sector's share of the GDP has grown five times in the last 20 years from 0.40% in 1991 to 7.4% in 2019 tells us how important the sector is to the Indian economy (Annexure Table 1). The amount of India's IT exports indicates that leading Indian IT companies are more vulnerable to global cyclical fluctuations and have a global footprint. It becomes crucial to comprehend how Indian IT exports contribute to the definition of the link between Indian IT and GDP since they snare a portion of the country's total IT demand. By considering the value of non-oil export data, the contribution of IT exports to Indian exports has been determined (Annexure Table 2). The share of IT exports to total IT turnover has climbed from 18.95% in the years 1991–1992 to 83% in the years 2017–2018 (Annexure Table 3) following a significant decline in IT contribution to entire IT in the years 2001–2002 (Pandey R, *et al*., 2017).

Table 1: Stationarity test results - *p-value*

IT exports	0.8935648379391815
IT domestic	1.0
IT overall	0.9974698725579773
India exports	0.875626970623796
GDP	1.0

Stationarity Analysis

High *p-values* are observed for IT exports, IT domestic, IT overall, India export and GDP. It goes on to state that these time series show a definite trend. These trends could be attributed to multiple factors and some of these can be answered in terms of correlations with other series. For example, the trend in IT exports can be correlated to the GDP (Patnaik, I., & Sharma, R. 2002).

An observation of the above charts exhibit trend in the data. To prove the same stationarity test was conducted as shown in Table 1.

The lag value is kept at 9, which was the default parameter in the implementation library. A clearer picture of these trends can be derived from the Hodrick Presscott filter that was applies to this same time series. The filter splits the trend and the cycle into two parts - showing a clear uptrend in IT exports/GDP/IT overall. Stationarity was also tested on Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test. Similar results were observed in both cases - thereby confirming the non-stationarity of the data (Pierre-Richard AgCnor, *et al*., 2000).

Stationarity test reveals the time series of the variables IT overall, IT exports, domestic IT and GDP all have non stationarity features therefore in order to capture the

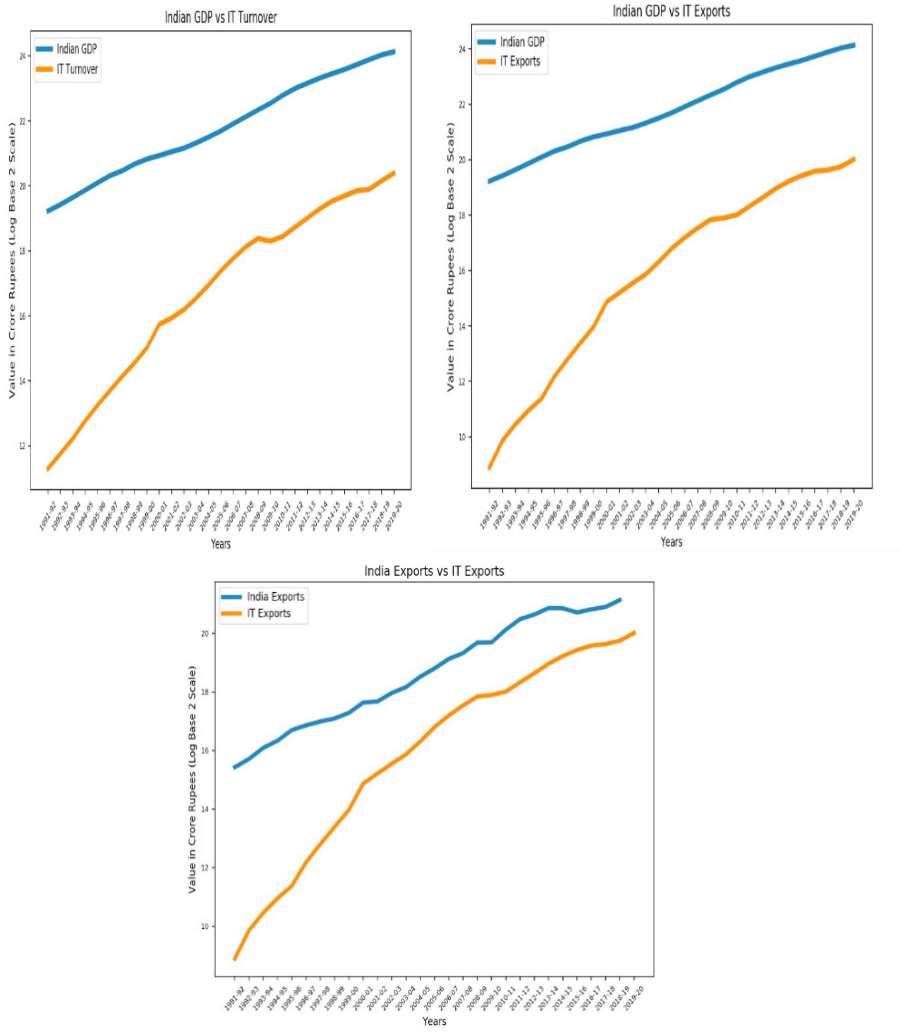

Figure 2: Indian GDP and IT turnover & Indian GDP and IT exports & Indian exports to IT exports (Annexure Table 5)

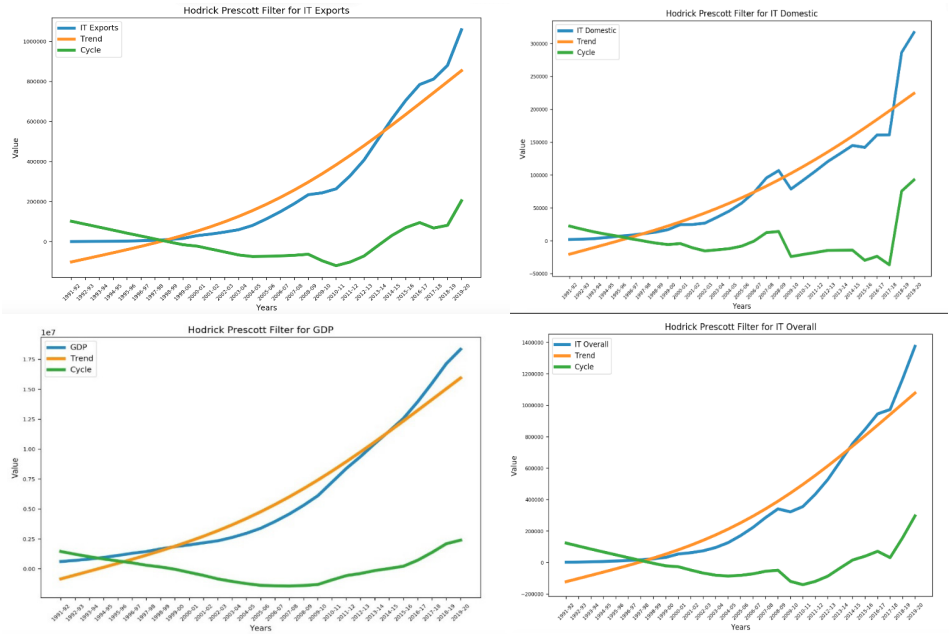

Figure 3: Hodrick Pesscott filter graphs

fluctuations de trending has been carried for drawing the inference regarding the sensitivity and to understand the movements of GDP and IT. Basically two comparative charts as shown in Figure 4 have been drawn to identify the cyclical movement of the IT Industry and GDP. In the first graph IT Industry has been assumed to be coincident to the cyclical movement of the GDP. In the second graph IT industry has been assumed to be lagging to the cyclical movement of the GDP. The comparative charts have been drawn considering the actual turnover by carrying the de trending and log transformation (Stock, *et al.*, 1992).

Figure 4 shows the annualized changes in GDP along with the movement of overall IT industry, IT exports and IT Domestic from 1991 to 2019. Compared to the enormous fluctuations in IT exports, IT overall, and IT domestic, the GDP has relatively moderate annualized variations.

However, the large decline for the IT domestic in the year 2008–2009 is significant. The domestic IT has relatively larger change in comparison to IT exports. During 2001–2002 and 2008–09 there is a negative swing. During the recession year of 2001 and 2008 the downwards swing points towards high sensitivity of IT to recession. A point to be noted is that both the recession periods were driven more by the global recessionary trends and their repercussions were observed in Indian economy, but the impact was comparatively low on IT exports during the 2008 recession in comparison to domestic IT.

Section 2 Correlation Between the GDP and IT Industry

However, the observation of cyclical movement of IT Industry parameters with GDP shows that there is a comparatively less pro cyclical movement over most of the period of 1991 to 2019. Therefore, in order understand how IT relates to GDP spearman correlation as shown in Table 2 the coefficient was calculated basis which statistical inference was drawn.

Figure 5 highlights that the IT industry movements are comparatively less pro cyclical to GDP for most time period between 1991 to 2019 therefore from the Figures 4 and 5 the deduction is that the cyclical fluctuations of IT industry are not completely defined by Indian GDP movements but there are other situational factors which intervene to an

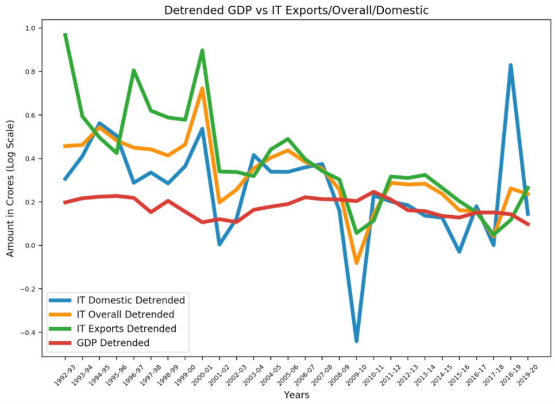

Figure 4: Detrended GDP Vs IT exports/overall/domestic (Annexure Table 6)

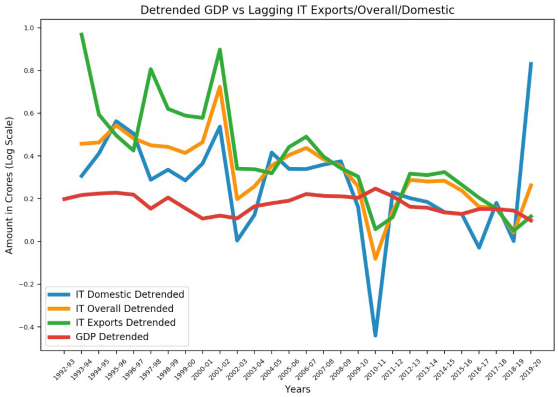

Figure 5: Detrended GDP *vs* lagging IT exports/overall/domestic

Table 2: Correlation coefficient

Detrended (Coincident)	*Spearman*
Indian GDP *vs* IT overall	0.792556103
Indian GDP *vs* IT exports	0.836458199
Indian GDP *vs* IT domestic	0.535303777
Indian exports *vs* IT exports	0.486032672

extent. These interventions are global business cycles, or any structural change in Indian economy. In order to further strengthen this deductive statement comparative growth charts were drawn considering the percentage change in growth of IT domestic, IT exports and IT overall in relation to growth of Indian GDP

Table 3: Partial coefficient

Variable 1 and 2	*Spearman's corrlation coefficient*	*Null probability*	*Variable 3*	*D Value*
GDP and Indian exports	0.43	2.29 E-02	IT overall	0.85
			IT exports	1.46
			IT domestic	0.83
GDP and overall IT	0.79	4.98 E -07	India exports	4.73
			IT exports	-0.36
			IT domestic	4.31
GDP and IT exports	0.84	3.07 E-08	India exports	5.57
			IT overall	2.32
			IT domestic	4.88

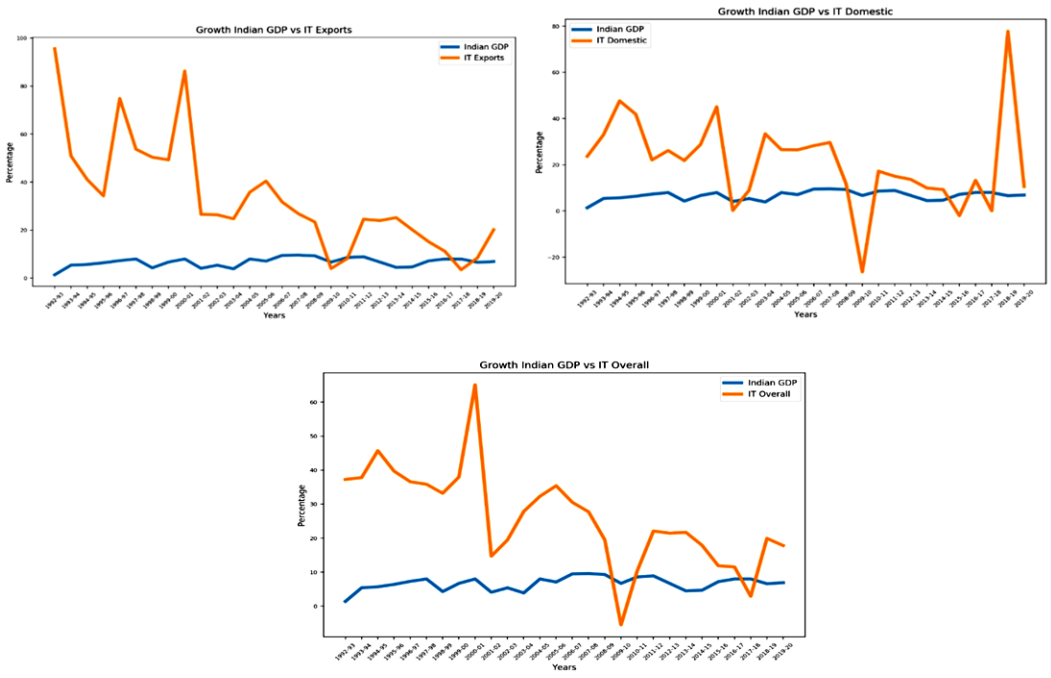

Figure 6: Comparison between growth of IT industry and GDP

Inference

The observed cyclical relationship between GDP and IT overall shows that IT is not a coincidental component and that, for the most part, the procyclical movement is nonexistent. Figure 6's first graph compares the cyclical movement of India's IT exports and GDP. The demand for IT exports in the global market was negatively impacted and slowed down during the recessionary periods of 2001 and 2008. The second graph shows the procyclical trend of domestic IT demand relative to GDP in India and shows how sensitive domestic demand is in India, pointing to a significant reduction in Indian customers' IT budgets. The third graph clearly depicts the slowdown even in the year 2017-18. Though the sensitivity exists but it is observed that there is no clear indication of pro cyclical movements in all the three graphs.

The Spearman product moment coefficient of correlation (r) was the primary statistical metric used to determine the link between the industry's overall IT and IT exports to GDP. An empirical indicator of the degree of correlation between changes in GDP and the overall IT industry and IT exports is provided by this statistic. The degree of association increases as r gets closer to 1 or –1, with coefficients nearer –1 indicating countercyclical sectors and coefficients nearer 1 indicating cyclical industries. The Spearman correlation coefficient reveals a somewhat stronger association between Indian IT exports and GDP in India. Nonetheless, there isn't much of a link between domestic IT and the GDP of India. In order to understand the dependence and relationship partial Spearman correlation ranking was calculated by taking three sets of variables, GDP being common various combinations were tested and the result is as follows. In this test (see Annexure for more details) the D parameter given an indication whether the given correlation between the two variable is due to the third variable. If the modulus of the value of the D-parameter is less than 1 then the given correlation between two variables is very likely to be the result of the behavior of the third parameter.

Table 4: Correlation coefficient

Detrended (Lagging)	*Spearman*
Indian GDP vs IT overall	0.3327
Indian GDP vs IT exports	0.2222
Indian GDP vs IT domestic	0.3787

The analysis suggests that the GDP is most strongly correlated to IT exports followed closely by the IT overall. As per Table 3. The counter-intuitive result is that the GDP and Indian exports (overall) are only moderately correlated, most likely due to the lag between the export cycle and the national output. But most significant result can be gleaned from the D value, which suggests that the correlation between the GDP and IT overall is due to the presence of IT exports as the third variable, but the correlation between GDP and IT exports is not due to the IT overall. This suggests that the IT domestic output plays a more complex role in the overall IT business cycle.

As per Table 4 the correlation coefficient when calculated by considering IT industry as lagging is very low. The coefficient is .3327 between IT overall and GDP which clearly negates the idea of IT industry as lagging. So, this is ruled out.

Section 3: Recession in Indian Economy and Response of Indian IT Industry

Recession year

2008 -09

Inference

As per Figure 4 the downswing is comparatively very high in domestic IT than overall IT and least in IT exports

Justification

Global problems have little effect on India IT exports require careful consideration. Given that India is a top exporter of IT services, it is important to comprehend the situation of Indian IT services exports. With a strong increase of 9.3% in 2008–09 and an explanation for 88% of the real GDP growth, the services sector has been one of the primary drivers of India's growth during the era of global economic crises. Software services, which comprise business processing and outsourcing (BPO) as well as information technology enabled services (ITES-BPO), make up the majority of exports within the services industry. This accounted for about half of India's total services exports in 2008–09 and increased by 30% annually on average between 2005–06 and 2007–08. Out of a total of USD 90 billion in services exported, this sector's exports in 2008–09 climbed by 28% over the previous year to USD 40.8 billion. Countries may require more of these services, particularly offshoring services, as a result of lowering manufacturing costs. Additionally, there has been a diversification of export destinations, which has supported the demand for India's software services abroad. Additionally, it was noted that between 2001 and 2008, Indian IT productivity increased, supporting the industry's demand throughout the global recession (Annexure Table 4). Domestic IT demand in India was particularly hard hit during the 2008 crisis because customers' IT budgets were drastically cut, which led to extremely cost-based decision-making and a sharp decline in IT spending on discretionary services. Due to this, Indian IT-BPO companies implemented stringent internal controls, such as cost management, increased productivity, and utilization, as well as external controls, such as maintaining price levels, expanding the scope of deals, managing client risk, and so on.

Recession year

2001 -2002

Inference

As per the Figure 4 the downswing is comparatively higher in domestic IT than overall IT and IT exports

Justification

The dependence on US markets was high and post September 11, 2001, there was a slowdown in the US market. As per the report of Skoch consultancy nearly, 80% of companies were in the process of renegotiating their contract with Indian companies. The survey was conducted for 50 companies based in US, Hong Kong and Singapore. Another development was that the US firms ideated the concept that rather than outsourcing a better option would be to venture into India through collaborations. The biggest factor that led to the slowdown was the change in demand and expectation of foreign firm's expected value contribution, cost optimization from Indian IT companies.

Conclusion

The study highlights the growing significance and contribution of IT Industry towards Indian economy. The impact is observed because of adoption of IT at domestic front and international front thus leading to a steady rise in contribution to GDP. In the period between 1991-2019 the contribution increased from 0.4 to 7.40%. Also, it is observed the IT exports contribution to overall IT increased from significantly from 18 to 76% between the years 1991-2019, thus indicating towards the interception of global fluctuations on Indian IT Industry trends. However, it has been observed that there is a dynamic interplay between IT overall, IT domestic and IT exports.

According to the research done to determine how closely the Indian GDP and the IT sector are tied, there is a positive correlation between the two. The extent may be seen in the estimated.83 connection between GDP and IT. The movement of IT overall, IT domestic, and IT exports versus GDP was shown to be less strongly procyclical in character, despite the strong link. Given that the IT sector is not very procyclical, it's possible that other factors—such as the growing importance of exports—are defining the oscillations instead of the IT business. Additionally, it appears that the industry is vulnerable to shocks and aftershocks from different economic events. Global shocks may also influence and characterize variations in Indian IT exports, which may then indirectly affect the cyclical movement of Indian IT as a whole.

To further probe to understand the complexity of IT Industry, Spearman partial correlation analysis was carried which suggests that the dynamics of the movements between IT overall, IT exports and IT domestic is far more prominent and complicated than expected. The analysis suggests that the GDP is most strongly correlated to IT exports followed closely by the IT overall. The counter-intuitive result is that the GDP and Indian exports (overall) are only moderately correlated, most likely due to the lag between the export cycle and the national output. But most significant result can be gleaned from the D value, which suggests that the correlation between the GDP and IT overall is due to the presence of IT exports as the third variable, but the correlation between GDP and IT exports is not due to the IT overall. This suggests that the IT domestic output

plays a more complex role in the overall IT business cycle.

To identify that whether IT Industry is lagging or coincident comparative graph and correlation analysis was carried which reflects that IT is not a lagging industry. A closer examination reflects higher sensitivity of IT domestic during the downswing of the year 2008-09, in comparison to IT exports. The reason is that there were strict IT budget controls pushed by the domestic businesses however as Indian IT exports was efficient and cost effective in providing IT services. The global demand for Indian IT products was hit but still the impact was not very high. A probable reason for this is that the nature of the services is such that to lower production costs, countries demanded more of Indian IT 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. But during the recession of 2001 – 2002 the impact on IT exports and IT domestic was almost similar owing to the fact the Indian IT exports offering was in the nascent stage and there were comparatively lower economies of scale than what existed in the year 2008. The conclusion is that though Indian IT Industry is sensitive to GDP but because of Indian IT export being one of the major contributors the response of IT exports has been different during different recession phases.

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Annexure

Table 1: Contribution of IT / GDP

Year	*Contribution IT/ GDP*	*Year*	*Contribution IT/ GDP*	*Year*	*Contribution IT/ GDP*
1991–92	0.41	2002–03	3.19	2013–14	6.14
1992–93	0.49	2003–04	3.64	2014–15	6.59
1993–94	0.58	2004–05	4.26	2015 –16	6.74
1994–95	0.73	2005–06	5.05	2016 –17	6.77
1995–96	0.87	2006–07	5.66	2017–18	6.27
1996–97	1.02	2007–08	6.23	2018–19	6.8
1997–98	1.24	2008–09	6.44	2019 –20	7.40
1998–99	1.44	2009–10	5.28		
1999–00	1.78	2010–11	4.91		
2000–01	2.73	2011–12	5.18		
2001–02	2.88	2012–13	5.62		

Table 2: Contribution of IT exports / Non-Oil Indian Exports

Year	*Contribution IT Exports / India Exports*	*Year*	*Contribution IT Exports / India Exports*	*Year*	*Contribution IT Exports / India Exports*
1991–92	1.1	2002–03	19.7	2013–14	33.5
1992–93	1.8	2003–04	21.5	2014–15	39.5
1993–94	2.1	2004–05	23.6	2015–16	46.5
1994–95	2.4	2005–06	28.1	2016–17	47.9
1995–96	2.5	2006–07	30.7	2017–18	47.4
1996–97	4.0	2007–08	35.1	2018–19	58.8
1997–98	5.6	2008–09	32.7	2019–20	
1998–99	7.7	2009–10	34.2		
1999–00	10.1	2010–11	27.6		
2000–01	15.3	2011–12	27.4		
2001–02	19.0	2012–13	31.3		

Table 3: Contribution of IT Exports / Overall IT

Me	*Contribution Exports / Overall IT*	*Year*	*Contribution*	*Year*	*Contribution*
1991–92	18.9	2002–03	64.0	2013–14	79.4
1992–93	26.9	2003–04	62.4	2014–15	80.9
1993–94	29.5	2004–05	64.0	2015 –16	83.2
1994–95	28.6	2005–06	66.4	2016 –17	83.0
1995–96	27.5	2006–07	67.0	2017–18	83.0
1996–97	35.1	2007–08	66.5	2018–19	75.0
1997–98	39.8	2008–09	68.7	2019 –20	76
1998–99	44.9	2009–10	75.6	2019 –20	76
1999–00	48.6	2010–11	74.1		
2000–01	54.8	2011–12	75.6		
2001–02	60.5	2012–13	77.1		

Table 4: Direct and Indirect employment generation by IT Industry in Million

FY 2008	*Direct employment*	*Indirect employment*
FY 2009	1.96	8
FY 2010	2.3	8.2
FY 2011	2.5	8.3
FY 2012	2.8	8.9
FY 2013	3	9.5
FY 2014	3.29	10
FY 2015	3.52	10
FY 2016	3.7	10
FY 2017	3.86	12

Source : NASSCOM

Table 5: Data of Indian IT Industry and GDP

Time	*IT Domestic (Rs Billion)*	*IT Overall (Rs Billion)*	*IT EXPORTS (Rs Billion)*	*Rs to Dollar Conversion*	*IT Domestic (Rs Crore)*	*IT Overall (Rs Crore)*	*IT EXPORTS (Rs Crore)*	*GDP at factor cost in Rs Crore At Current Prices*	*GDP at factor cost in Rs Crore At Constant Prices 2004-05 as a base year (CSO)*	*Indian OIL Exports (RBI)*	*Indian Non Oil Exports (RBI)*	*Total Exports rs Crore (RBI)*
1991–92	20.41	25.17	4.76	24.5	2041	2517	476	613528	1367171	1022	43020	44042
1992–93	25.24	34.55	9.31	30.6	2524	3455	931	703723	1440504	1379	52309	53688
1993–94	33.56	47.61	14.05	31.4	3356	4761	1405	817961	1522344	1248	68504	69751
1994–95	49.56	69.38	19.82	31.4	4956	6938	1982	955386	1619694	1309	81365	82674
1995–96	70.32	96.93	26.61	33.4	7032	9693	2661	1118586	1737741	1518	104836	106353
1996–97	85.87	132.39	46.52	35.5	8587	13239	4652	1301788	1876319	1710	117107	118817
1997–98	108.35	179.85	71.5	37.2	10835	17985	7150	1447613	1957032	1311	128790	130101
1998–99	132.04	239.56	107.52	42.1	13204	23956	10752	1668739	2087828	376	139377	139753
1999–00	170.02	330.52	160.5	43.3	17002	33052	16050	1858205	2254942	169	159393	159561
2000–01	246.69	545.65	298.96	45.7	24669	54565	29896	2000743	2348481	8542	195029	203571
2001–02	247.38	625.84	378.46	47.7	24738	62584	37846	2175260	2474962	10107	198911	209018
2002–03	269.52	747.87	478.35	48.4	26952	74787	47835	2343864	2570935	12469	242668	255137
2003–04	359.55	956.16	596.61	46.0	35955	95616	59661	2625819	2775749	16397	276969	293367
2004–05	454.88	1265.1	810.23	44.9	45488	126511	81023	2971465	2971465	31404	343935	375340
2005–06	575.18	1713.1	1137.92	44.3	57518	171310	113792	3390503	3253073	51533	404885	456418
2006–07	737.84	2236.1	1498.23	45.2	73784	223607	149823	3953276	3564364	84520	487259	571779
2007–08	956.63	2856.3	1899.7	40.3	95663	285633	189970	4582086	3896636	114192	541672	655864
2008–09	1068.8	3412.9	2344.17	46.0	106876	341293	234417	5303566	4158676	123398	717357	840755
2009–10	787.3	3225.8	2438.5	47.4	78730	322580	243850	6108903	4516071	132899	712635	845534
2010–11	923	3561	2638	45.6	92300	356100	263800	7248860	4918533	188779	954143	1142922
2011–12	1062	4348	3286	47.9	106200	434800	328600	8391691	5247530	267915	1198045	1465959
2012–13	1207	5281	4074	54.4	120700	528100	407400	9388876	5482111	330819	1303500	1634318
2013–14	1327	6428	5101	60.5	132700	642800	510100	10472807	5741791	383248	1521763	1905011
2014–15	1450	7578	6128	61.1	145000	757800	612800	11504279	9712133	346082	1550363	1896445
2015 –16	1420.67	8478.17	7057.50	65.5	142066.6	847817.1	705750.4	12574499	10491870	199638	1516747	1716384
2016 –17	1609.73	9457.15	7847.42	67.1	160972.8	945715.2	784742.4	13965200	11328285	211509	1637925	1849434
2017–18	1611.37	9732.69	8121.32	64.5	161137.3	973269	812131.7	15513122	12074413	241435	1715080	1956515
2018–19	(b $)41	(b$)167	(b$)126	69.9	286500	1167200	880700	17139962	12803128	325929	1981797	2307726
2019 –20	(b$)44	(b$)191	(b$)147	72	316800	1375200	1058400	18343237	13301120			

Source: CSO, RBI & Ministry of Information Technology and Communications.

Table 6: Detrended Data

	GDP	*IT Exports*	*IT Domestic*	*IT Overall*	*India Exports*	*GDP*	*IT Exports*	*IT Domestic*	*IT Overall*	*India Exports*
1991–92										
1992–93	90195	455	483	938	9646	0.197878479	0.967819594	0.306435728	0.456980494	0.285719677
1993–94	114238	474	832	1306	16063	0.217024392	0.593717058	0.411030805	0.462578918	0.377614238
1994–95	137425	577	1600	2177	12923	0.224051678	0.496386832	0.562433472	0.543255212	0.24521979
1995–96	163200	679	2076	2755	23679	0.227520538	0.425011548	0.504758883	0.482423411	0.363355134
1996–97	183202	1991	1555	3546	12464	0.218818341	0.805882586	0.288219121	0.449778997	0.159880538
1997–98	145825	2498	2248	4746	11284	0.153181448	0.620092145	0.335473057	0.442000006	0.130890784
1998–99	221126	3602	2369	5971	9652	0.205082358	0.588589896	0.28527589	0.413592878	0.103247202
1999–00	189466	5298	3798	9096	19808	0.155151344	0.577968254	0.364729422	0.464350535	0.191228817
2000–01	142538	13846	7667	21513	44010	0.106626191	0.897379171	0.53699477	0.723238277	0.351423985
2001–02	174517	7950	69	8019	5447	0.120651989	0.340188359	0.004029632	0.19781802	0.038095133
2002–03	168604	9989	2214	12203	46119	0.107701011	0.337925771	0.123663467	0.256993642	0.287644946
2003–04	281955	11826	9003	20829	38230	0.163878612	0.318721561	0.415800076	0.354464541	0.201434462
2004–05	345646	21362	9533	30895	81973	0.178406915	0.441543345	0.339293594	0.403938873	0.355491451
2005–06	419038	32769	12030	44799	81078	0.190324933	0.489995725	0.338527508	0.437346538	0.282157643
2006–07	562773	36031	16266	52297	115361	0.22154936	0.396859981	0.359294491	0.384355983	0.325101945
2007–08	628810	40147	21879	62026	84085	0.212955855	0.342512491	0.374653032	0.353197315	0.197939054
2008–09	721480	44447	11213	55660	184891	0.210958186	0.303305592	0.159904979	0.256848157	0.358288765
2009–10	805337	9433	-28146	-18713	4779	0.203950611	0.056916774	-0.440952535	-0.081353831	0.008177315
2010–11	1139957	19950	13570	33520	297388	0.246840793	0.113450592	0.22941717	0.142625442	0.434792275
2011–12	1142831	64800	13900	78700	323037	0.21120743	0.316887916	0.202381213	0.288069505	0.359117806
2012–13	997185	78800	14500	93300	168359	0.161990899	0.3101135	0.18464191	0.280459201	0.156843971
2013–14	1083931	102700	12000	114700	270693	0.157623817	0.32433412	0.136742695	0.283558788	0.221110603
2014–15	1031472	102700	12300	115000	-8566	0.135522393	0.264636197	0.12788453	0.237447211	-0.006501796
2015–16	1070220	92950.4	-2933.355	90017.075	-180061	0.128330351	0.203741805	-0.029485028	0.161935883	-0.143925174
2016–17	1390701	78991.9	18906.155	97898.125	133050	0.151335315	0.153061049	0.180249061	0.157652762	0.107711459
2017–18	1547922	27389.3	164.45	27553.79	107081	0.151652821	0.049494621	0.001473107	0.041432804	0.081202354
2018–19	1626840	68568.2	125362.75	193931.01	351211	0.143874854	0.116936893	0.830245099	0.262141294	0.23818577
2019–20	1203275	177700	30300	208000		0.09788434	0.265162396	0.145037196	0.236589662	