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Aims and Scope

The Journal of Institute of Public Enterprise is a peer-reviewed journal devoted to publication of professional and academic research on the policy and functional facets of public sector enterprises, public policy and public systems. The aim of the journal is to provide a platform for researchers, academicians, practitioners and policy-makers from diverse sectors to stimulate scholarly debate in the contemporary issues and emerging trends in Public Policy, Public and Private Enterprise Management, Joint Ventures, Public Administration, Privatization and Disinvestment both in India and abroad.

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Causal Relationship between Public Debt and Economic Growth in India : An Application of Toda-Yamamoto Approach

C.Prasanth*

The relationship between public debt and economic growth has been a widely discussed issue in academic circles as well as policymakers across global economies. This study explores the causal relationship between public debt and economic growth in the case of the emerging economy India, employing annual time series data of the Central Government public debt and GDP over the time period 1981-82 to 2020-21. The Augmented Dickey Fuller test for stationarity of variables revealed that the variables were stationary at order I(0) and I(1) fulfilling the conditions for an Auto Regressive Distributed Lag (ARDL) analysis. The result of ARDL analysis confirms the existence of a long-run cointegrating relationship between public debt and economic growth. Further, Toda-Yamamoto approach applied to understand the causal relationship between the variables and the direction of causality indicate the existence of bi-directional causal relationship between India's Central Government public debt and economic growth.

Keywords : Public debt, Economic growth, Cointegration, ARDL, Causality, Toda-Yamamoto Test.

Introduction

Whether public debt leads to economic growth or growth aspirations propel public debt has been an unending debate among academic circles as well as policymakers. While it is argued that public debt is essential to finance the fiscal activities of an economy, it needs to be acknowledged that public debt could also have detrimental effects on the economy. Historically, public debt was considered a major source of war financing. Over the years, the significance of public debt towards war financing was reduced as economies turned to borrowed finances to meet their developmental needs. In the modern world, public debt has occupied a prominent place in the monetary and fiscal policies of the advanced as well as emerging economies alike.

While there is no consensus on whether public debt is good or bad for the economy, the theoretical perspectives of the issue revolve majorly around three

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schools of thought. The Neo-classical theorists consider debt to have a detrimental impact on economic growth (Bernheim, 1989; Rangarajan & Srivastava, 2005). On the contrary, the Keynesian school considers debt to have a positive effect on economic growth (Bal & Rath, 2014). Differing from the above two theories, the Ricardian Equivalence perspective, popularised by Barro (1974), considers debt to have a neutral impact on economic growth (Buchanan, 1976). The relationship between public debt and economic growth varies across time as well as across nations (Gounder & Sami, 2019). Therefore, no consensus exists on the relationship between public debt and economic growth in academic literature.

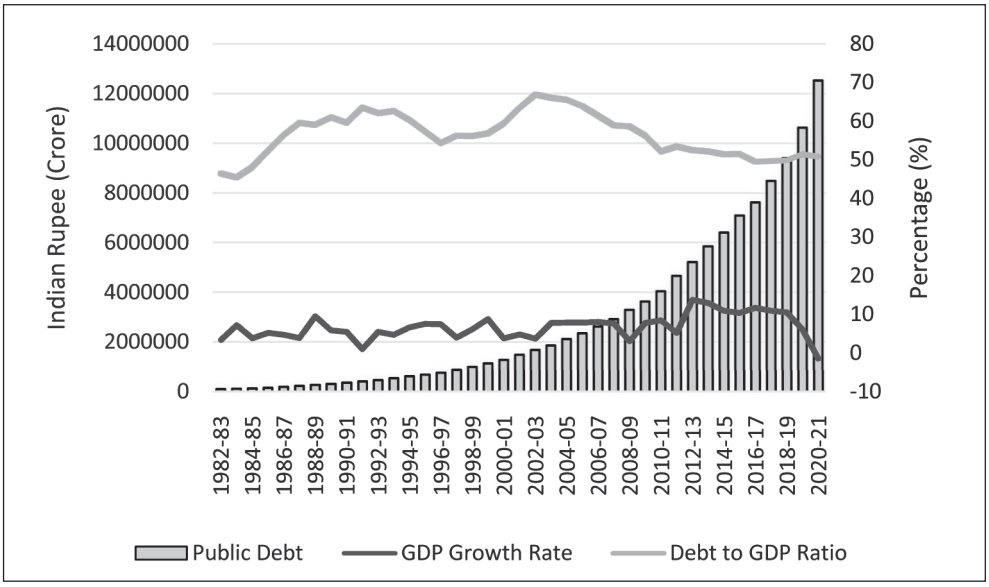
Stylised Facts on India's Fiscal Finances

In India, public debt is classified under two broad heads, viz. Internal Debt and External Debt. Internal debt refers to Rupee-denominated debt, consisting of marketable securities (dated securities and treasury bills) and non-marketable securities (14 Day Intermediate Treasury Bills, compensation and other bonds, securities issued to international financial institutions, securities against small savings, special securities issued against postal insurance and annuity funds – Post Office Life Insurance Funds and Rural-POLIF).

From the surge in public debt during the two oil shocks of 1970 and 1980 to the balance of payments crisis in 1991, there have been compositional changes in India's public debt profile. The period from 1970 to 1991 also saw the introduction of External Commercial Borrowings (ECBs) as well as NRI deposits which widened the avenues of India's external debt composition. However, the crisis of 1991 rendered India's fiscal balances vulnerable with public debt to Gross Domestic Product (GDP) reaching a new high of 62.05 per cent (see Figure-1), while it had reached 72 per cent for the combined finances of the Central and State Governments. The formulation of the New Economic Policy constituting structural reforms and the Liberalisation – Privatisation – Globalisation (LPG) strategy proved effective enough to drive the debt to GDP ratio to pre-crisis levels.

The late nineties and early 2000s once again saw the Indian economy plagued by fiscal exuberance, resulting in a surge in the debt to GDP ratio. Central Government debt had reached an exorbitant 66.85 per cent of GDP in the 2002-03 fiscal year. This time the government resorted to fiscal legislation enabling fiscal discipline rather than executive action, so that the deficit and debt levels would be administered in conformity with the levels considered

Figure-1 : India's GDP Growth Rate, Central Government Debt and Debt to GDP Ratio



Source : RBI Handbook of Statistics 2020-21.

prudent for the economy as laid down by the legislation. Financing through borrowing is generally a softer option compared to having increased taxation, which calls for setting exogenous limits on both national and sub-national debt and deficit levels (Rangarajan & Srivastava, 2005). Such a limit was exercised through the introduction of the Fiscal Responsibility and Budget Management Act (FRBMA) in 2004 with consideration for legislation not only at the national but also at the sub-national level to rein in fiscal profligacy.

Enactment of FRBMA by the Centre and the Fiscal Responsibility Legislation (FRL) in the States helped bring down the combined public debt to GDP ratio from an exorbitant level of 83 per cent in 2003-04 to 71 per cent by 2007-08. Figure-1 captures the peaks in Central Government debt to GDP ratio in 2003-04 and the fall in these ratios after the enactment of FRBM legislations. As per the 2018 amendment of FRBMA, the debt to GDP ratios have been targeted at 40 per cent and 60 per cent for the Central Government and the General Government (Central and the State Governments combined) respectively. In recent years, Central Government debt could be seen gradually declining towards the FRBMA target.

However, the year 2020-21 witnessed a drastic fall in the economy's GDP due to social and economic impacts of the COVID-19 pandemic. The GDP growth rate spiralled down to a negative 1.36 per cent. Now, the onus lay on the Central Government to contain the pandemic, without compromising on the objective of securing lives and livelihoods along with measures to revive the economy. These measures included a well-calibrated expenditure strategy involving huge fiscal stimulus as well as relaxations in monetary regulations, which meant the relaxation of fiscal deficit and debt targets. Once the economy signals returning to normalcy, the debt and deficit targets are likely to to be reigned to levels deemed sustainable for the economy.

Synoptic Review of Literature

An overview of literature which analyses the relationship between public debt and growth suggests that debt has a negative (Elmeskov & Sutherland, 2012; Panizza & Presbitero, 2014; Brida et al., 2017; Sami & Gounder, 2019), positive (Elmendorf & Mankiw, 1999; Egert, 2015) or neutral effect (Barro, 1974, 1979; Buchanan, 1976) on economic growth. Examining both advanced and emerging economies, Reinhart and Rogoff (2010a) found that at higher levels of debt to GDP ratio (ninety per cent and above), economic growth is weakened, thereby indicating the adverse impact of public debt. In contrast to this, Minea and Parent (2012), found that, even though a debt to GDP growth rate above 90 per cent has a deleterious impact on economic growth, above 115 per cent, the negative impact decreases with increasing debt. Pescatori et al. (2014) found higher levels of debt to have a negative impact on economic growth in the case of selected advanced economies. In the Indian context, few studies have shown that public debt affects economic growth adversely (Bal & Rath, 2014; Mohanty & Panda, 2020), while Singh (1999) found domestic debt to have a neutral impact on economic growth, asserting the existence of Ricardian Equivalence in India. Bringing the argument that correlation does not mean causation, Panizza and Presbitero (2014) analysed whether public debt has a causal effect on economic growth. Even though the study found a negative relationship between public debt and economic growth, there was no evidence to suggest the existence of any causal relationship between public debt and economic growth. Employing Canonical Cointegration Regression, followed by the Error Correction Model for 20 OECD countries over the period 1970-2009, Donayre and Taivan (2015) found that with the increase in public debt, the modern welfare states exhibited low real economic

growth, whereas more traditional states exhibited either causality from low growth to growth in public debt or bidirectional causality. Using augmented Solow growth modelling framework and an ARDL approach to cointegration, Gounder and Sami (2019) found an adverse relationship between Fiji's public debt and economic growth in both the long and the short run. Further, the results of the Granger Non-Causality test following Toda-Yamamoto (1995) revealed unidirectional causality running from public debt to economic growth.

In the Indian context, the causal relationship between public debt and economic growth have been analysed in very few studies. Among them, Singh (1999) found that no causal relationship exists between domestic public debt and economic growth, thereby evincing Ricardian Equivalence in India. Undertaking a state-level analysis, Mohanty et al. (2016) found bi-directional causality between public debt and economic growth in India. This is in consonance with the views of Reinhart and Rogoff (2010b) which state that for higher levels of debt there is bidirectional causality with economic growth. Further, the study also found a positive effect of public debt on economic growth. A causal analysis of the combined public debt of State and Central Government by Manik and Khan (2017) revealed that while there is no causal relationship among the variables in the short-run, the existence of unidirectional causality between economic growth and external debt was evident in the long-run.

The Central Government has a larger role to play in the fiscal finances of India. On the enactment of FRBMA in 2004, ensuring intergenerational equity in fiscal management and long-term macroeconomic stability vested with the Central Government (Ministry of Finance, 2018). Furthermore, a larger share of the combined public debt of India constitutes the Central Government debt, indicating the importance of central government debt in India's fiscal finances. The review of literature reveals that, in the Indian context, there is a lacuna in addressing the total Central Government debt and its association with economic growth. While previous studies have analysed the relationship between domestic public debt and economic growth (Singh 1999, Mohanty et al. 2016), and the combined debt of the Centre and States together and economic growth (Manik & Khan 2017), the present study attempts to address the gap in the relationship between public debt and economic growth of India by considering the Central Government finances.

Data Sources and Variable Description

The present study resorts to time series data on GDP & Central Government's public debt over the sample period 1981-82 to 2020-21,taken from the National Accounts Statistics, Ministry of Statistics and Programme Implementation (MoSPI), Government of India and RBI Handbook of Statistics. Central Government total liabilities are considered to be the total public debt in this study. The variables are converted to their natural logarithmic form in order to interpret the estimated coefficients as elasticities.

Methodology

The empirical analysis begins with testing of stationarity of the variables using the Augmented Dickey Fuller test. Based on the order of integration, an appropriate method such as Auto Regressive Distributed Lag (ARDL) model or Vector Auto Regressive (VAR) model could be used.

After checking the order of integration, cointegration test is conducted to examine whether a long-run equilibrium relationship exists between public debt and economic growth. In the present study, the ARDL model proposed by Pesaran et al. (2001) is adopted since only one equation is used. Further, the ARDL model is applicable for series which are integrated at I(0) or I(1) order (Pesaran et al., 2001). However, this method cannot be used if the variables are integrated of the order I(2).

An Error Correction Model (ECM) is obtained from the ARDL, which integrates the short-run dynamics with the long-run equilibrium. A simple ARDL model could be given as :

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_0 X_t + \beta_1 X_{t-1} + \varepsilon_t \text{ .....(1)}$$

The ARDL model estimated in the present study follows unrestricted ECM given by the equation :

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta Y_{t-1} + \sum_{i=1}^{q} \alpha_2 \Delta DEBT_t + \\ + \Phi_1 Y_{t-1} + \Phi_2 DEBT_{t-1} + \varepsilon_t \text{ .....(2)}$$

Where, the first part of the equation α_1 and α_2 denote shot-run dynamics of the model, the second part Φ_1 and Φ_2 represent the long-run relationship, Δ denotes the difference operator, and ε_t is the error term. The null hypothesis of the equation $\Phi_1 + \Phi_2 = 0$ signify that long-run relationship doesn't exist between the variables.

The first step in the ARDL approach is choosing the maximum lag lengths p and q using VAR lag length selection criteria based on the minimum values obtained in the Akaike Information Criteria (AIC), Final prediction error (FPE), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). In ARDL analysis, residual errors should not be correlated.

The ARDL test involves two critical value bounds, which depend on the order of integration of the variables. The bounds test is conducted on the null hypothesis of no cointegration. The hypothesis of the bounds test is as follows :

$$H_1 : \Phi_1 = \Phi_2 = 0$$

$$H_1 : \Phi_1 \neq \Phi_2 \neq 0$$

If the null hypothesis is rejected, the bounds tests indicate cointegration between the variables. In other words, if the test statistic exceeds the upper critical value bound, then we reject the null hypothesis and conclude the existence of a long run relationship between the variables. If the test statistic lies below the critical value bounds, then we accept the null hypothesis of no cointegration. If the test statistic lies between the upper and lower critical bounds, then we cannot draw any conclusive inference.

Empirical studies relating to correlation and causation emphasize that correlation between variables does not necessarily imply the existence of a causal relationship (Panizza & Presbitero, 2014). Therefore, causality tests are employed to determine whether there exists any causal relationship among the variables of interest.

Granger's (1988) approach to whether *X* causes *Y* is basically on the premise that how much of the variable *Y* can be explained by the past values of *Y*, and additionally checking whether addition of lagged values of variable *X* can lead to changes in variable *Y*. Variable *Y* is said to be Granger-caused by *X* if the variable *X* helps in the prediction of variable *Y*, or equivalently if the coefficients on the lagged *X*'s are statistically significant.

Granger's test is based on the axiom 'past causes the future'. Suppose we are testing the direction of causality between the variables – debt, *D* and economic growth, *Y*, following Jadhav et al. (1992), the estimation of the following equations can be considered :

$$Y_t = f(Y_{t-1}, Y_{t-2}, \ldots Y_{t-m}) \quad \ldots..(3)$$

$$Y_t = f(Y_{t-1}, Y_{t-2}, \ldots Y_{t-m}, D, D_{t-1}, Y_{t-2}, \ldots D_{t-n}) \quad \ldots..(4)$$

$$D_t = f(D_{t-1}, D_{t-2}, \ldots D_{t-m}) \quad \ldots..(5)$$

$$D_t = f(D, D_{t-1}, Y_{t-2}, \ldots D_{t-m}, Y_{t-1}, Y_{t-2}, \ldots Y_{t-n}) \quad \ldots..(6)$$

Where, *m* and *n* are the chosen lag lengths. Equations (3) and (5) are restricted, while equations (4) and (6) are the corresponding unrestricted versions. Whether *D* causes *Y* is determined by equations (3) and (4), while whether *Y* causes *D* is determined by equations (5) and (6). *D* causes *Y* if the current and lagged values of *D* significantly explain

the variations in *Y*, or if the coefficients on all independent *D* variables are significant (Equation-4).

Four possible results that could be obtained from the equations are as follows :

1) Uni-directional causality from *D* to *Y*.

2) Uni-directional causality from *Y* to *D*.

3) Bi-directional causality, where *D* causes *Y* and *Y* causes *D*.

4) No causality, where *D* and *Y* are independent, and therefore, *D* doesn't cause *Y* and *Y* does not cause *D*.

The present study analyses the direction of causality by employing a more robust test for causality proposed by Toda and Yamamoto (1995). The Toda-Yamamoto (TY) non-Granger causality test involves estimating an augmented VAR that ensures the asymptotic distribution of Wald statistics (Gounder & Sami, 2019). Analysing causal relationships using TY procedure doesnot require the variables to be stationary or cointegrated, thereby eliminating sensitivity to the order of integration of variables. TY procedure is based on the estimation of the augmented VAR model of order k by the maximum integrated order of the system's variables (d_{max}). Therefore, the estimation of VAR of the order ($k+d_{max}$) is undertaken. Now, the modified Wald test follows the Chi-square distribution with degrees of freedom decided by ($k + d_{max}$) lag length.

Empirical Results and Discussion

Economic growth is measured based on the changes in GDP. For this purpose, the study uses the nominal GDP, which is converted into its natural logarithmic form so that the coefficients could be interpreted as elasticities. India's Central Government debt is considered as public debt, which is also converted into its natural logarithmic form. The descriptive statistics of the variables are presented in Table-1.

The Jarque-Bera test statistic is used to check whether the series is normally distributed. Under the null hypothesis of a normal distribution, Jarque-Bera test statistic follows a Chi-Square (χ^2)

Table-1 : Descriptive Statistics

Variables	Mean	Median	Max.	Min.	SD	Kurtosis	Jarque-Bera	Prob.
LNGDP	15.34	15.30	16.49	14.26	0.69	1.76	2.65	0.27
LNPDEBT	14.05	14.14	16.34	11.43	1.43	1.87	2.32	0.31

distribution with 2 degrees of freedom. From Table-1, as indicated by the probability value of the Jarque-Bera test statistic, it is evident that the null hypothesis of normal distribution is accepted for both the variables at a 5% level of significance.

The next step in the analysis of time series data is checking for stationarity of the variables. The present study uses Augmented Dickey Fuller (ADF) test to check for stationarity of the variables.

The results of the Augmented Dickey Fuller Test for stationarity (Table-2) reveal that nominal GDP is stationary at the first difference, I(1), while public debt is stationary at levels, I(0). As the variables are stationary at either I(0) or I(1), and no variables are stationary at I(2), going by Pesaran et al. (2001), the ARDL Bounds test would be appropriate for the test of cointegration among the variables. Prior to conducting the ARDL Bounds test, the appropriate lag length for the ARDL model is selected using the VAR lag selection criteria.

The optimum lag length is selected based on the minimum values of Final prediction error (FPE), Akaike Information Criteria (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). The results indicate a maximum lag of 1 (Table-3).

Now, it is important to check whether the residuals are serially correlated. For this purpose, we use the Breusch-Godfrey Serial Correlation LM Test.

The results of the Breusch-Godfrey Serial Correlation LM Test (Table-4) show that we fail to reject the null hypothesis that the residuals are serially uncorrelated. Therefore, the residuals are not serially correlated.

In order to test whether the data is homoscedastic, we apply the Breusch-Pagan-Godfrey Heteroskedasticity test.

Based on the results in Table-5, the null hypothesis of no heteroscedasticity at 5% level of significance is accepted as indicated by the p-value.

Table-2 : Stationarity Test Using Augmented Dickey Fuller Test

Variables	Notation	Levels		First Difference		Inference
		t-statistics	p-value	t-statistics	p-value	
Nominal GDP	LNGDP	-0.83	0.80	-2.93	0.05	I(1)**
Public Debt	LNPDEBT	-4.70	0.00	-	-	I(0)*

Note :

* *stationarity at 5% level of significance,*

** *stationarity at 10% level of significance.*

Table-3 : VAR Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-5.553959	NA	0.005279	0.431655	0.520532	0.462335
1	177.7834	335.2454*	1.87e-07*	-9.816193*	-9.549562*	-9.724152*
2	179.7357	3.346853	2.11e-07	-9.699183	-9.254798	-9.545781
3	180.2852	0.879136	2.59e-07	-9.502009	-8.879870	-9.287247
4	181.7278	2.143397	3.03e-07	-9.355876	-8.555983	-9.079753
5	182.8682	1.563948	3.65e-07	-9.192469	-8.214822	-8.854985

** indicates lag order selected by the criterion.*
LR : Sequential modified LR test statistic (each test at 5% level)
FPE : Final prediction error
AIC : Akaike information criterion
SC : Schwarz information criterion
HQ : Hannan-Quinn information criterion.

Table-4 : Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.034261	Prob. F(1,34)	0.8543
Obs*R-squared	0.039260	Prob. Chi-Square(1)	0.8429

Table-5 : Breusch-Pagan-Godfrey Heteroskedasticity Test

F-statistic	2.408746	Prob. F(3,35)	0.0835
Obs*R-squared	6.674127	Prob. Chi-Square(3)	0.0830
Scaled explained SS	13.26610	Prob. Chi-Square(3)	0.0041

Further, we conduct the ARDL bounds test for cointegration following Pesaran et al. (2001)

The ARDL long-run bounds test indicates a long-run cointegrating relationship between public debt and economic growth. The results (see Table-6) show that the F-statistic value is higher than the upper bound value of 4.16 at 5% level of significance. Therefore, we reject the null hypothesis of no long-run cointegration between the variables. The ARDL Error Correction Regression gives the error correction coefficient which shows how much of the disequilibrium

Table-6 : Critical Values for Bounds Test

Test Statistic	Value	Significance Level.	I(0)	I(1)
F-statistic	18.91170	10%	3.02	3.51
k	1	5%	3.62	4.16
		1%	4.94	5.58

in the previous period is corrected in the current period. A positive coefficient of error correction term indicates divergence, while a negative coefficient indicates convergence (Nkoro & Uko, 2016).

Table-7 shows that the error correction coefficient is negative, indicating convergence and significance as required. The coefficient of error correction indicates that about 3 per cent of any disequilibrium is corrected within the time period of one year. Here, public debt is observed to have a negative relationship with economic growth.

Model Stability Diagnostics

The next step involves finding out whether the model is stable. For this purpose, the inverse roots of the AR characteristic polynomial and the plot of Cumulative Sum of Recursive Residuals (CUSUM) are observed.

The inverse roots of the AR characteristic polynomial given in Figure-2 show that all roots fall within the unit circle, thereby indicating that the model characterises dynamic stability.

The CUSUM test, which is based on the cumulative sum of recursive residuals, plots the cumulative sum along with the level of significance limits. If the cumulative sum falls outside the level of significance limits, it indicates instability of parameters. In Figure-3, the plot of CUSUM statistic of the estimated model lies within the critical bounds at 5% level of significance. This shows that the estimated parameters of the model are stable over the sample period.

Table-7 : ARDL Error Correction Regression

Dependent Variable : D(LNGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNPDEBT)	-0.829215	0.161287	-5.141239	0.0000
CointEq(-1)	-0.032555	0.004204	-7.744490	0.0000

Figure-2 : Inverse Roots of AR

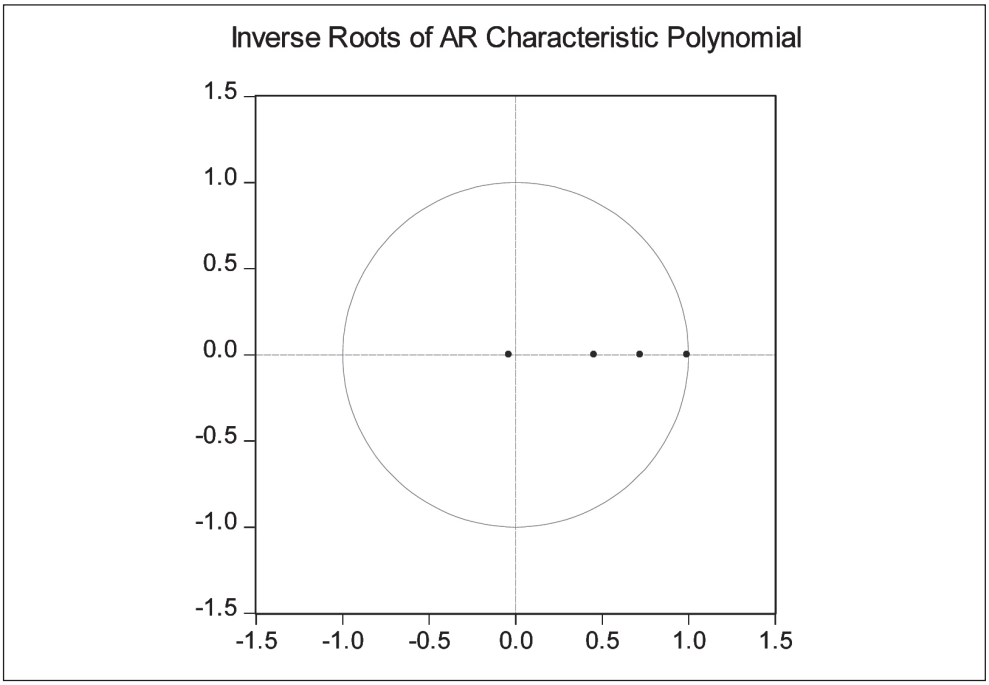
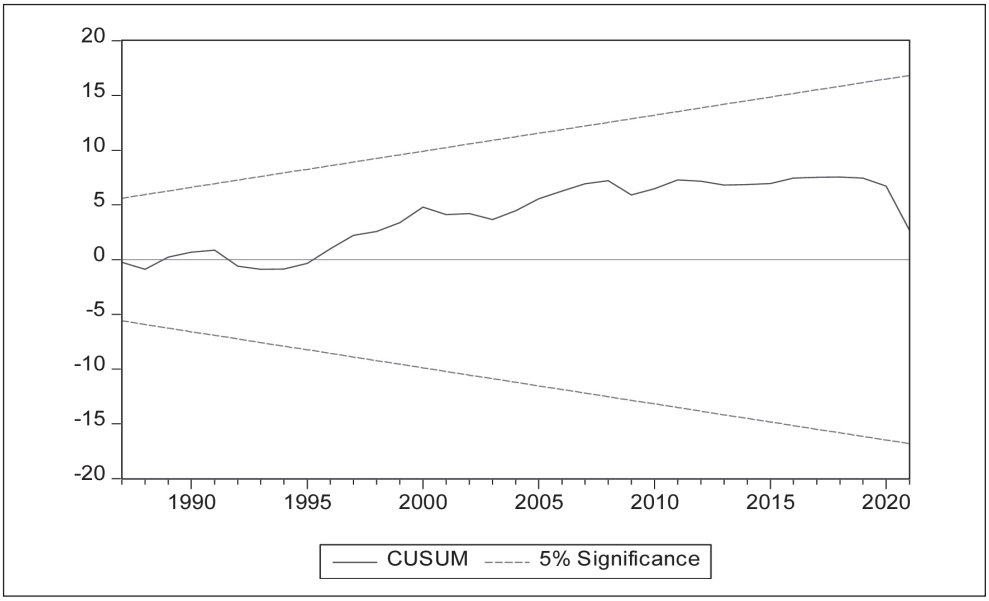


Figure-3 : Plot of Cumulative Sum of Recursive Residuals



Toda-Yamamoto Granger Non-Causality Test

After having found that a long-run cointegrating relationship exists between public debt and economic growth, we proceed to check for the existence of any causal relationship between the variables. For this purpose, we employ the Toda-Yamamoto test for Granger Non-causality.

In the T-Y Granger Causality test, rejection of the null hypothesis implies a rejection of Granger non-causality. From Table-8, it is observed that the null hypothesis of LNGDP does not Granger cause LNPDEBT is rejected, showing that economic growth leads to public debt. In the second part, the null hypothesis of LNPDEBT does not Granger cause LNGDP is rejected at a 5% level of significance, revealing that public debt leads to economic growth. Therefore, the T-Y Granger Causality test reveals a bidirectional causality between public debt and economic growth. The results are in consonance with the results of Mohanty et al. (2016), in which a bidirectional causal relationship between public debt and economic growth was found in India's state-level analysis. To summarise, we can say that a bi-directional causality exists between economic growth and public debt, indicating that public debt leads to economic growth and vice versa.

Conclusion

A brief survey of the literature shows varying results on the relationship between public debt and economic growth across nations as well as over different time periods. The study embarks on the lacuna in the literature on the causal relationship between economic growth and public debt of India's Central Government finances. The study finds a negative relationship between India's public debt and economic growth, which is similar to the results of Mohanty and Panda (2020). The results of the ARDL long-run bounds test reveal a long-term cointegrating relationship between India's Central Government debt and economic growth. Further, the T-Y test for Granger Non-causality indicates the existence of a bidirectional relationship

Table-8 : Results of Toda-Yamamoto Granger Non Causality Test

Null Hypothesis	Chi-Square (χ^2)	p-value	Inference
LNGDP does not Granger cause LNPDEBT	4.241795	0.0394*	Reject
LNPDEBT does not Granger cause LNGDP	6.387057	0.0115*	Reject

** at 5% level of significance.*

between public debt and economic growth. Therefore, public debt leads to economic growth, indicating that debt has been used for productive purposes. While the converse of economic growth leading to more recourse to public debt also holds true in the case of the Indian economy. Even though the relationship between public debt and economic growth has been found to be negative, public debt is essential for a developing economy like India to provide a release from various constraints on economic growth such as foreign exchange constraints, investment constraints for developmental activities etc. During adverse economic situations such as the ongoing COVID-19 pandemic, fiscal stimulus to revive the economy becomes an essential policy of the government. Under such circumstances, when the GDP level plummets due to a fall in economic activities, the Keynesian paradigm of fiscal stimulus to stimulate the aggregate demand in the economy becomes indispensable. However, the bidirectional relationship between public debt and economic growth in the Indian context suggests that during adverse economic situations, it was public debt that helped sustain economic growth, while during normalcy, growth aspirations led to incurrence of public debt.

References

Bal, D.P., & Rath, B.N. (2014). Public debt and economic growth in India : A reassessment. *Economic Analysis and Policy*, *44*(3), 292-300. https://doi.org/10.1016/j.eap.2014.05.007

Barro, R.J. (1974). Are government bonds net wealth?. *Journal of Political Economy*, *82*(6), 1095-1117. https://doi.org/10.1086/260266

Barro, R.J. (1979). On the determination of the public debt. *Journal of Political Economy*, *87*(5, Part 1), 940-971. https://doi.org/10.1086/260807

Bernheim, B. D. (1989). A neoclassical perspective on budget deficits. *Journal of Economic Perspectives*, 3(2), 55-72. https://doi.org/10.1257/jep.3.2.55

Brida, J.G., Gómez, D.M., & Seijas, M.N. (2017). Debt and growth : A non-parametric approach. *Physica A : Statistical Mechanics and Its Applications*, *486*, 883-894. https://doi.org/10.1016/j.physa.2017.05.060

Buchanan, J.M. (1976). Barro on the Ricardian equivalence theorem. *Journal of Political Economy*, 84(2), 337-342. https://www.jstor.org/stable/1831905

Donayre, L., & Taivan, A. (2015). Causality between public debt and real growth in the OECD : A country-by-country analysis. http://dx.doi.org/10.2139/ssrn.2668447

Égert, B. (2015). Public debt, economic growth and nonlinear effects : Myth or reality?. *Journal of Macroeconomics*, 43, 226-238. https://doi.org/10.1016/j.jmacro.2014.11.006

Elmendorf, D.W., & Mankiw, N.G. (1999). Government debt. In J.B. Taylor, & M. Woodford (Eds.), *Handbook of Macroeconomics* (pp.1615-1669). Elsevier. https://doi.org/10.1016/S1574-0048(99)10038-7

Elmeskov, J., & Sutherland, D. (2012). Post-crisis debt overhang: growth implications across countries. http://dx.doi.org/10.2139/ssrn.1997093

Gounder, N, & Sami, J. (2019). *Public debt and economic growth : Empirical evidence from Fiji*. School of Economics Working Paper No. 7, The University of the South Pacific, Suva.

Granger, C. (1988). Some recent development in a concept of causality. *Journal of Econometrics*, 39(1-2), 199-211. https://doi.org/10.1016/0304-4076(88)90045-0

Jadhav, N., Joshi, H., & Roy, P. (1992). Money, output and prices : Causality issues and evidence. *Indian Economic Journal*, 40(1), 18.

Manik, N., & Khan, N. A. (2018). Public debt and economic growth in India : Evidence from granger causality test. In *Challenges and Issues in Indian Fiscal Federalism* (pp. 123-142). Springer.https://doi.org/10.1007/978-981-10-6217-9_10

Minea, A., & Parent, A. (2012). *Is high public debt always harmful to economic growth? Reinhart and Rogoff and some complex nonlinearities*. CERDI Working Paper E2012.18. https://halshs.archives-ouvertes.fr/halshs-00700471/document

Government of India (2018). *Report of the Comptroller and Auditor General of India on compliance of the Fiscal Responsibility and Budget Management Act, 2003 for the year 2016-17*. Ministry of Finance, Government of India, New Delhi.

Ministry of Statistics and Programme Implementation. National Accounts Statistics. Government of India. https://mospi.gov.in/web/mospi/download-tables-data/-/reports/view/templateOne/16701?q=TBDCAT

Mohanty, A., Patra, S.K., Kumar, S., & Mohanty, A. (2016). An empirical analysis of effect of public debt on economic growth in India in the post-reform era. *Asian Economic and Financial Review*, *6*(11), 692-705. https://doi.org/10.18488/journal.aefr/2016.6.11/102.11.692.705

Mohanty, R. K., & Panda, S. (2020). How does public debt affect the Indian macroeconomy? A structural VAR approach. *Margin: The Journal of Applied Economic Research*, *14*(3), 253–284. https://doi.org/10.1177/0973801020920092

Nkoro, E., & Uko, A.K. (2016). Autoregressive Distributed Lag (ARDL) cointegration technique : application and interpretation. *Journal of Statistical and Econometric methods*, *5*(4), 63-91. https://www.scienpress.com/Upload/JSEM/Vol%205_4_3.pdf

Panizza, U., & Presbitero, A.F. (2014). Public debt and economic growth: Is there a causal effect?. *Journal of Macroeconomics*, 41, 21-41. https://doi.org/10.1016/j.jmacro.2014.03.009

Pesaran, M.H., Shin, Y., & Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326. https://doi.org/10.1002/jae.616

Pescatori, M.A., Sandri, M. D., & Simon, J. (2014). *Debt and growth: is there a magic threshold?*. International Monetary Fund.

Rangarajan, C., & Srivastava, D. (2005). *Fiscal deficits and government debt in India : Implication for growth and stabilization.* National Institute of Public Finance and Policy (NIPFP) Working Paper, Vol. 35.

Reserve Bank of India. Handbook of Statistics on Indian Economy, 2020-21. https://www.rbi.org.in/scripts/Annual Publications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20Economy

Rogoff, K., & Reinhart, C. (2010a). Growth in a time of debt. *American Economic Review, 100*(2):573-578. https://doi.org/10.1257/aer.100.2.573

Reinhart, C., & Rogoff, K. (2010b). *Debt and growth revisited*. MPRA Paper 24376, University Library of Munich, Germany. https://mpra.ub.uni-muenchen.de/24376/

Singh, C. (1999). Domestic debt and economic growth in India. *Economic and Political Weekly*, 34(23), 1445–1453. http://www.jstor.org/stable/4408051

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, *66*(1-2), 225-250. https://doi.org/10.1016/0304-4076(94)01616-8.

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Causality and Impulse Response of Major Stock Markets Return to Covid-19 : An Econometric Analysis

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The study investigates into the short run causality and impulse response of major stock markets return to the growth in number of cases and growth in number of deaths in Covid-19 in five major economies of the world (USA, China, Japan, Germany and India) based on the data collected from WHO Covid-19 dashboard and Yahoo finance for the study period February 01, 2020, to April 30, 2020. Block Exogeneity Wald Test with an underlying VAR model and Granger causality test have been conducted to find out the causality among the underlying variables subject to fulfillment of stationarity condition. It is observed that among all the five countries, the stock return of the SSE Composite Index (China) is not Granger caused by the growth in either cases or deaths from Covid-19. However, the return of Sensex (India) to Granger was caused by both these variables. The impulse response of S&P 500 (USA) is found to be far-fetched due to a sudden shock in the US Covid scenario, while it is comparatively short-lived in the Chinese economy. A few policies have been taken up by the Indian Government to ensure economic turnarounds amid this scenario. However, those measures are required to be implemented properly to gain more fruitful results.

Keywords : COVID-19; China; Germany; India; Impulse Response; Japan; VAR-Granger Causality; US. JEL Classification: B23, C87, E44.

1. Introduction

Openness and dependencies of the Indian stock market on the world economies have increased in the recent past precisely since the economic reforms and liberalization process in the financial markets. Given the fact that the Indian market is gradually getting integrated with other global markets, it is becoming more vulnerable to the threats originating in those markets because of economic

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integration and causality among world markets. As a result, developing countries that welcomed excessive capital flows were more vulnerable to those financial disturbances than industrial nations. It is widely believed that these developing economies were much more adversely impacted as well (Saha, 2021).

Stock market returns respond to several major events, such as disasters (Kowalewski & Spiewanowski, 2020), sports (Buhagiar et al. 2018), news, environmental (Alsaifi et al., 2020) and political events (Bash & Alsaifi, 2019). Recently, stock returns have also started to respond to epidemic or pandemic diseases, such as SARS (Chen et al., 2007) and Ebola virus (Ichev & Marinc, 2018).

The study is an attempt to analyse the impact of the Covid-19 pandemic on stock returns. Since the stock market provides liquidity to existing investors and acts as a barometer of economic performance, a declining trend in the stock market poses a threat to market sentiment.

An increase in the spread in terms of (a) daily growth in the number of cases; and (b) daily growth in the number of deaths made the authorities to roll out containment measures that include closing off large cities, national boundaries and restraining people from going out of their houses (Yang et al., 2020). It stalled all domestic and international economic activity. The results started to be reflected in the respective stock markets. Covid-19 and its far-reaching impact on stock returns thus made the study a significant one, more so due to a dearth of research in this field. The specific questions required to be addressed in the current study are : (a) whether the movement in stock return is caused by the growth in number of cases and growth in number of deaths in Covid-19 in the short run?; and (b) how the stock returns respond to the growth in number of cases and death in Covid-19?

2. Past Studies and Research Gap

It has been 18 months since the first Covid-19 case has been diagnosed in China. However, even during this small tenure, researchers all around the world have come forward to contribute their thoughtful opinionsonthe impact of Covid-19 on the economy, especially on stock market movements. A few of them are discussed here. Liu and Hu (2020) in their paper used a macro neo-classical economic growth model to predict that the savings rate of China will rise as a preventive measure to the Covid-19 pandemic. However, because of global financial turmoil, this sudden surge in savings may create an economic imbalance. Hence, the authors propose that the Chinese Government should focus on international collaboration

and stimulate domestic demand to increase consumption. Baker, Bloom, Davis and Terry (2020) in their paper quantify economic uncertainty in the United States (US) in terms of contraction in the gross domestic product (GDP) in the past several weeks due to the pandemic. It is observed that almost half of the around 20 per cent contraction in the US GDP is due to the negative effect of Covid-19. The study also identifies the indicators of uncertainty measures as – stock market volatility, uncertainty arising out of news-feeds, and subjective uncertainty in business expectation surveys. The disaster effects of these uncertainty shocks are measured with the help of a model developed by Baker, Bloom and Terry (2020). McKibbin and Fernando (2020) explore the seven scenarios of Covid-19 spread in the coming year and its impact on macro economic outcome and financial market in global dynamic stochastic general equilibrium (DSGE) or computable general equilibrium (CGE) situations using a model developed by Lee and McKibbin (2004) and extended by McKibbin and Sidorenko (2006). The paper also explores the impact of the outbreak on the global economy in the short-run and the need for investment in the public health system, especially in the developing countries with higher population density. Deitrich, Kuester, Muller and Schoenle (2020) make a survey of households on a daily basis to understand their perception of the impact of Covid-19 on economic output and inflation over a period of one year. While at the beginning of March 2020, the impact seems to be moderate, as time passes, by the end of March; private expenditure collapses to a great extent and the uncertainty results in a higher economic cost. The authors propose an adjustment of monetary policy to accommodate this change. Baker, Bloom, Davis, Kost, Sammon and Viratyosin (2020) studied the stock market movement since 1900 and stock market volatility since 1985 and concluded that none of the previous infectious diseases, including the Spanish flu has this unprecedented impact on the stock market like Covid-19 does. Sansa (2020) investigates the impact of Covid-19 on the stock market performance of China and the US. For the purpose of the study, daily data on Covid-19 active cases from 1st March to 25th March 2020 is compared with stock index values of Shanghai Stock Exchange (SSE) Composite Index (China) and Dow Jones (US) during the same period. A simple linear regression model is used to estimate the relationship and it is observed that Covid-19 has a significantly positive relationship with the stock market performance in these two countries. Zeren and Hizarci (2020) in their paper aim to reveal the long term relationship between Covid-19 and

select stock market performances with data on number of deaths and active cases of Covid-19 and stock market indices values in select countries from 23rd January 2020 to 13th March 2020 using Maki's cointegration test (Maki, 2012). The results show that deaths in Covid-19 have a long run relationship with stock market performance in all countries. However, the number of active Covid-19 cases has a long run relationship with the performances of SSE, KOSPI and IBEX35. However, no long run relationship is observed in cases of FTSE MIB, CAC40 and DAX30. The authors propose that securities investors shift their investments in gold, crypto currencies or derivatives till the shock persists. Al-Awadhi, Alsaifi, Al-Awadhi and Alhammadi (2020) investigate the effect of the contagious disease caused by Covid-19 on stock market performance of a country with special reference to China using panel data analysis. It is observed that growth in the total number of active cases and total number of deaths hasasignificant negative impact on the stock market returns. Liu, Manzoor, Wang, Zhang, and Manzoor (2020) in their paper evaluated the short-term impact of the Covid-19 outbreak on stock market sentiments with reference to the affected countries of the world, such as Japan, Korea, Singapore, the USA, Germany, Italy and the United Kingdom (UK). Event study and panel fixed effect regressions support the authors' conclusions that the stock market falls immediately after the outbreak and the situation is worst in Asian countries. The paper also shows that Covid-19 active cases adversely impact the abnormal returns from the market due to pessimistic sentiments of investors on future returns. Ahmar and Val (2020) aim to predict the short term movement of Covid-19 cases in Spain and their stock market index IBEX 35 using the Sutte ARIMA method, which is more appropriate than ARIMA based on the mean absolute percentage error (MAPE) estimate of forecasting accuracy. The data during the period 12th February 2020 to 9th April 2020 is obtained from Worldometer and Yahoo Finance. Daily forecasts have been made for Covid-19 confirmed cases from 10th April to 12th April 202; and for IBEX 35 from 14th April to 16th April 2020.

In the literature reviewed so far, it has been observed that the short run impact of Covid-19 on the stock returns of major economies of the world has been ignored to some extent. While studies have been conducted with economies with higher contagious effects (e.g. USA, India), how the leading economies apart from the USA and India have been dealing with it and whether they are at all impacted by it are required to be investigated. Quite a

few studies have used panel data regression to identify the short-run relationship between Covid-19 and stock return. However, application of economic tools, like vector auto regression (VAR) was comparatively less. Keeping this gap in view, the current study is made with the following broad objectives.

3. Objectives of the Study

The broad objectives of the study are :

i) To analyse the stationarity of the data representing the stock market movements in these five countries during the study period (Refer to Section 5.1)

ii) To explore the direction of causality among stock market returns, growth of Covid cases and growth of Covid deaths in select countries (Refer to Section 5.2).

iii) To estimate the impulse response of select stock markets returns to growth in number of cases and growth in number of deaths from Covid-19 (Refer to Section 5.3).

4. Data and Methodology

4.1. Sample Selection

In order to analyse the short-run causality and impulse responses of stock market returns to Covid-19, stock markets represent the top five developed and developing economies of the world based on the 2019 estimate of their nominal gross domestic product (GDP) by the International Monetary Fund (IMF, 2019) have been sampled out. These countries are—the United States of America, the People's Republic of China (China), Japan, the Federal Republic of Germany (Germany) and India. Out of those five countries, the Covid-19 outbreak first began in China in December 2019. In the USA, a considerable proportion (1.31 per cent) of the population was affected in the first wave of Covid-19. However, the proportion of population affected in Germany (0.25 per cent) and India (0.15 per cent) was not as low as well (WHO, 2020). The inclusion of Japan, a less affected country, makes the sample a balanced one. The sample economies are also representatives of different continental zones. While the USA represents American-zone, Germany represents the Euro-zone; the other three economies, China, Japan and India, are from the Asia-zone.

Now, the largest stock exchange in each country has been selected based on their market capitalisation [World Federation of Exchanges (WEF), 2019]. Accordingly, the New York Stock Exchange (NYSE) in the US; Shanghai Stock Exchange (SSE) in China; Tokyo Stock Exchange (TSE) in Japan; Frankfurt Stock Exchange (FSE) in Germany;

and Bombay Stock Exchange (BSE) in India have been selected. One representative stock index having worldwide recognition and prominence has then been selected for the study. Thus, Standard & Poor's (S&P) 500 (NYSE, USA); SSE Composite Index (SSE, China); Nikkei 225 (Nikkei) (TSE, Japan); DAX 30 (DAX) (FSE, Germany); and Sensitivity Index (SENSEX) (BSE, India) are the stock indices selected for calculation of stock returns. Hence, the judgement sampling method has been used for selection of sample companies.

4.2. Time Frame of the Study

The first case of Covid-19 was registered in December 2019 in China. Since then, the pandemic is looming over different parts of the globe. However, the effect of Covid-19 did not start to show instantaneously over the stock market. In fact, noticeably, after the first wave, almost all the select stock indices started to show signs of recession from mid-February, 2020 and reached a minimum level during end-March, 2020. From mid-April, 2020 the market started to show signs of recovery when governments in different countries declared economic stimulus to cope with the situation (Yahoo Finance, 2020). With a view to capturing this entire recession phase in the world market, the study considers it appropriate to evaluate the short run causality and impulse response of market return to Covid-19 based on data from1st February to 30th April 2020.

4.3. Data Collection

The data on indices values of five select stock indices during the study period has been collected from Yahoo Finance, while data on daily cases of infection and death from Covid-19 in select five countries during the study period are collected from the WHO Covid dashboard.

4.4. Data Mining

Following the collection of the data, it was seen that the stock markets did not perform on the same dates due to weekends or public holidays in the various nations studied. With a view to ensuring consistency in the dataset, the index with the fewest days of operation was used as a basis and data on additional days of operation of other stock indices was eliminated until the all the stock indices were operating on the same dates. The study is finally done with 50 observations that are consistent across the markets. While daily statistics (1st February to 30th April 2020) on number of cases and deaths from Covid-19 are available, they have been shortened corresponding to the dates on which stock indices values of all the five nations are available in order to maintain uniformity.

4.5. Econometric Tools

4.5.1 Stationarity of the Data Series

Stationarity of the data series is tested using the Augmented Dickey Fuller (ADF) test. ADF is an extension to the Dickey Fuller (DF) test to estimate the stationarity of the data. A time series (Y_t) depends upon its lagged value is represented as :

$$\Rightarrow \Delta Y_t = \delta Y_{t-1} + u_t$$

Where, $\delta = \rho - 1$ where, ρ is the autocorrelation between Y_t and Y_{t-1}.

Stationarity of the series is tested based on $H_0 : \delta = 0$. In order to test the above hypothesis, under DF test, the test statistics are calculated as : $\frac{\hat{\delta}}{SE(\hat{\delta})}$ which is compared to its critical values to take decision about H_0 (McKinnon 1991). ADF tests are same as that of DF tests, excepting the DF regressions are augmented by including 'm' lags of the dependent variable to correct serial correlation in the disturbance term. The appropriate lag length (m) = Int. $12*(T/100)^{1/4}$.

A non-stationary series may take three different forms : (a) pure random walk (RW); (b) RW with drift; and (c) RW with trend and drift. Initially, the ADF test is to be conducted on an estimated drift in the series for the following model :

$$\Rightarrow \Delta Y_t = \alpha + \delta Y_t + \sum_{i=1}^{m} Y_i \Delta Y_{r-1} + \mu_t$$

If the H_0 is accepted, ADF test is conducted to estimate pure RW based on the following model :

$$\Rightarrow \Delta Y_t = \delta Y_t + \sum_{i=1}^{m} Y_i \Delta Y_{r-1} + \mu_t$$

But if it is rejected, then ADF test is conducted to estimate RW with trend and drift based on the following model :

$$\Rightarrow \Delta Y_t = \alpha + \beta t + \delta Y_t + \sum_{i=1}^{m} Y_i \Delta Y_{r-1} + \mu_t$$

If the result of ADF (none) is accepted, the series is considered to be a pure RW. But if it is rejected, ADF (intercept) is to be conducted. If the result of this new test is accepted, the series is RW with drift and if it is rejected, ADF (trend and intercept) is conducted. If this new ADF test result is accepted the series is RW with trend and drift and if it is rejected, the series is stationary (Enders, 2004).

4.5.2 Direction of Causality among Stock Returns, Growth of Covid Cases and Covid Deaths

Direction of causality among select variables is measured using (a) Block Exogeneity Wald Test (with underlying VAR); (b) Granger causality (F) tests. The research methods of these two tests are as follows :

(a) Block Exogeneity Wald Test

In the VAR model, there is no prior distinction between endogenous and exogenous variables (Sims, 1972). Hence, VAR involves simultaneous equations where the value of a variable is represented as a linear function of the lagged values of that variable and all other variables included in the model. In the present study, there are three variables in each country—stock return, growth of new cases and growth of new deaths. Hence, for each country, three equations are to be estimated, keeping all these three variables as dependent variables (DV). However, VAR equations with growth of new cases and growth of new deaths as DV will not be valid from a research point of view, since stock return cannot possibly have an impact on the growth of new cases and new deaths. While three equations will be estimated, for the purpose of the current study, only one equation with stock return as DV will be considered for the purpose of identifying the causal effect of growth of new cases and deaths on stock return. VAR equations under five models for five select countries are as follows :

Single VAR Equations under Specified Models

Model-1 : USA

$$SP\_R_t = \alpha_1 + \sum_{j=1}^{p}\beta_j SP\_R_{t-j} +$$

$$+ \sum_{j=1}^{p}\gamma_j USCC\_G_{t-j} + \sum_{j=1}^{p}\delta_j USCD\_G_{t-j} + u_{1t}$$

Model-2 : China

$$SSE\_R_t = \alpha_1 + \sum_{j=1}^{p}\beta_j SSE\_R_{t-j} +$$

$$\sum_{j=1}^{p}\gamma_j CHINACC\_G_{t-j} + \sum_{j=1}^{p}\delta_j CHINACD\_G_{t-j} + u_{1t}$$

Model-3 : Japan

$$NIKKEI\_R_t = \alpha_1 + \sum_{j=1}^{p}\beta_j NIKKEI\_R_{t-j} +$$

$$\sum_{j=1}^{p}\gamma_j JAPANCC\_G_{t-j} + \sum_{j=1}^{p}\delta_j JAPANCD\_G_{t-j} + u_{1t}$$

Model-4 : Germany

$$DAX\_R_t = \alpha_1 + \sum_{j=1}^{p}\beta_j DAX\_R_{t-j} +$$

$$\sum_{j=1}^{p}\gamma_j GERMANYCC\_G_{t-j} + \sum_{j=1}^{p}\delta_j GERMANYCD\_G_{t-j} + u_{1t}$$

Model-5 : India

$$SENSEX\_R_t = \alpha_1 + \sum_{j=1}^{p}\beta_j SENSEX\_R_{t-j} +$$

$$\sum_{j=1}^{p}\gamma_j INDIACC\_G_{t-j} + \sum_{j=1}^{p}\delta_j INDIACD\_G_{t-j} + u_{1t}$$

Where, SP_R : Return on S&P 500; SSE_R: Return on SSE Composite Index; NIKKEI_R: Return on Nikkei 225; DAX_R: Return on DAX 30; SENSEX_R: Return on SENSEX.

USCC_G : Growth of new cases in the USA; CHINACC_G : Growth of new cases in China; JAPANCC_G : Growth of new cases in Japan; GERMANYCC_G : Growth of new cases in Germany; INDIA CC_G : Growth of new cases in India

USCD_G : Growth of new deaths in the USA; CHINACD_G : Growth of new deaths in China; JAPANCD_G : Growth of new deaths in Japan; GERMANYCD_G : Growth of new deaths in Germany; INDIACD_G : Growth of new deaths in India.

The methods used for selection of appropriate lags in a VAR model are – (a) Akaike Information Criterion (AIC); (b) Schwarz Bayesian Criterion (SBC); and (c) Hannan-Quinn Criterion (HQC). In the context of linear models, the criterions are computed as follows :

AIC = $e^{2k/n}$ (RSS/n); SBC = $e^{k/n}$ (RSS/n); HQC = (ln n) $^{2k/n}$ (RSS/n)

Where, RSS = residual sum of squares; k = number of parameters estimated (including the intercept); and n = number of observations.

While selecting an appropriate lag for the VAR model, the lag having the minimum value in these criteria is selected as the appropriate one. However, if there is any contradiction between AIC and SBC values, the lag selected as per HQC model should be the most appropriate one. The VAR model allows testing the direction of causality between variables. Hence, the Block Exogeneity Wald Test (also known as Granger causality test in VAR) can be performed using the VAR equations. It is based on testing the joint significance of the lags of each variable, apart from its own lags. Hence, in this test, causality among two variables is analysed based on following hypothesis :

$\Rightarrow$ H_0 : one variable Granger causes the other

$\Rightarrow$ H_1 : one variable does not Granger cause the other

The test statistics follow a chi-square distribution. At 5 per cent level of significance, if the probability of obtaining the test statistic in the chi-square distribution table is less than 0.05, H_0 is rejected and vice versa. If H_0 is rejected, one variable Granger causes the other. However, the reverse may not be true. If there are more than two variables in a VAR model, Granger causality in VAR is conducted to estimate causality between each pair of variables individually and causality of all the variables jointly with one variable.

(b) Granger Causality

The test basically measures the direction of the relationship between two variables. If only the variable Granger causes the other, it is called unidirectional causality. However, if both the variables Granger causes one another, it is called bidirectional causality. If none of the variable Granger causes the other, then they are said to be independent of one another. However, in the

present study, causal effect of growth of new cases and deaths on stock returns will only be evaluated. The underlying equations have already been mentioned in Section 4.5.2 (a). Causality among the variables is tested based on the following hypothesis :

$\Rightarrow$ H_0 : One variable does not Granger cause the other variable

$\Rightarrow$ H_1 : One variable Granger causes the other variable

The H_0 is tested based on following test statistics :

$\Rightarrow F = (RSS_R - RSS_{UR})*(n-k)/RSS_{UR}*m$

Where, m = number of lagged terms

k = number of parameters estimated in the unrestricted model.

RSS_R = residual sum of square of the equation where one variable is regressed against the lagged values of the same variable without incorporating the other variable

RSS_{UR} = residual sum of square of the equation where one variable is regressed against the lagged values of that variable and the other variable under consideration

At (m, n-k) degrees of freedom and 5 per cent level of significance, if the probability of obtaining calculated of F in the F distribution table is less than 0.05, H_0 is rejected and vice versa. If H_0 is rejected, the one variable Granger causes the other. The variables for the Granger causality test have to be stationary.

4.5.3 Impulse Response of Growth of Covid Cases and Deaths on Stock Market Returns

With a view to understanding shock in one variable of the VAR model impulse response function (IRF) is used. In a stable model, the shock would ultimately die away. A shock is usually introduced in the error term of one variable. The period for which, the variable related to error term and other variables in the system respond to the shock is detected by the impulse response function. If the period is high, it proves that the shock impacts the variables for a long period of time and vice versa. If there are k variables in the system K^2, IRFs could be generated. IRFs are basically a graphical representation of the responses of the endogenous variable to a shock.

5. Results and Analysis

5.1. Analysing the Stationarity of the Data Representing the Stock Market Movements in these Five Countries during the Study Period [Addressing Objective (i)]

The stationarity of the data is tested using the ADF test for stock market

returns (Table-1), growth of new cases (Table-2) and growth of new deaths (Table-3). Based on the results obtained, it may be inferred that the data series of stock market returns, growth of new cases and growth of new deaths in five countries under consideration are stationary level.

5.2. Exploring the Direction of Causality among Stock Market Returns, Growth of Covid Cases and Growth of Covid Deaths in Select Countries [Addressing Objective (ii)]

Direction of causality among select variables is measured using (a) Block Exogeneity Wald test (Granger causality in VAR); (b) Granger causality (F) tests. The results of these two tests are as follows :

5.2.1. Block Exogeneity Wald Test (Granger causality in VAR)

The data of stock market returns and growth in number of cases and growth in number of deaths in select countries are at a stationary level. Hence, in order to estimate the short run causality between them, an unrestricted VAR model is applied. Hence, five VAR models are required to be estimated. In order to estimate the VAR models, it is imperative to identify the appropriate lags based on AIC, SBC and HQC values (Table-4).

Leaving aside from the USA model, in all other models, appropriate lag length is 1. With a view to estimating the short-run causality of each model, the Block Exogeneity Wald Test is conducted. While it estimates the causality of all the variables in the model against each other, the causal effect of stock market return on growth in number of cases and growth in number of deaths would not make any sense from a research point of view. Hence, the results of the test with stock returns as Dependent Variable (DV) and growth in the number of cases and deaths individually and together as Independent Variables (IVs) for all the five VAR models at appropriate lag length are shown below (Table-5).

It is observed that barring India, in all other countries under consideration, growth in the number of cases individually does not Granger cause stock returns. However, in all the countries apart from China, growth in the number of deaths individually and growth in number of cases and growth in number of deaths together Granger causes the stock return. Truly speaking, securities investors in all the select countries felt anxious about the news of soaring deaths and cases from Covid-19. It might have led them to defer their investment until things got back to normal that caused decline in the stock returns.

Table-1 : Augmented Dickey Fuller (ADF) Test of Stationarity of Stock Market Returns (at Level)

Test Series	Model	Test Statistics	Critical Value at 5%	Decision Rule Based on Critical Values	Decision on H_0	Nature of Series
S&P 500	Intercept	-3.84015	-2.92378	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
S&P 500	Trend and Intercept	-10.8559	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
SSE Composite	Intercept	-6.71208	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
SSE Composite	Trend and Intercept	-6.72421	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Nikkei	Intercept	-5.49002	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Nikkei	Trend and Intercept	-5.53402	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
DAX	Intercept	-6.43079	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
DAX	Trend and Intercept	-6.53575	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
SENSEX	Intercept	-7.28461	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
SENSEX	Trend and Intercept	-7.33715	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary

Source : Compilation based on secondary data using EViews 9.5

Table-2 : Augmented Dickey Fuller (ADF) Test of Stationarity of Growth of Individual Cases in Covid-19 (at Level)

Test Series	Model	Test Statistics	Critical Values at 5%	Decision Rule Based on Critical Values	Decision on H_0	Nature of Series
USA	Intercept	-7.24062	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
USA	Trend and Intercept	-7.19476	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
China	Intercept	-8.13563	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
China	Trend and Intercept	-8.05435	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Japan	Intercept	-2.96654	-2.92378	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Japan	Trend and Intercept	-3.50637	-3.30692	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Germany	Intercept	-6.37007	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Germany	Trend and Intercept	-6.33888	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
India	Intercept	-6.9153	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
India	Trend and Intercept	-6.99338	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary

Source : Compilation based on secondary data using EViews 9.5

Table-3 : Augmented Dickey Fuller (ADF) Test of Stationarity of Growth of Number of Deaths in Covid-19 (at Level)

Test Series	Model	Test Statistics	Critical Values at 5%	Decision Rule Based on Critical Values	Decision on H_0	Nature of Series
USA	Intercept	-8.49837	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
USA	Trend and Intercept	-8.40634	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
China	Intercept	-8.40634	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
China	Trend and Intercept	-8.10154	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Japan	Intercept	-5.55846	-2.93899	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Japan	Trend and Intercept	-4.52564	-3.52079	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Germany	Intercept	-4.52564	-3.52079	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
Germany	Trend and Intercept	-6.7213	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
India	Intercept	-8.07905	-2.92245	Absolute values of test statistics>Absolute critical values	Rejected	Stationary
India	Trend and Intercept	-8.32014	-3.50433	Absolute values of test statistics>Absolute critical values	Rejected	Stationary

Source : Compilation based on secondary data using EViews 9.5

Table-4 : Identification of Appropriate Lag

Model	Variables	Lag Where Minimum Value Appears			Appropriate Lag Length
		AIC	SBC	HQC	
USA	SP_R, USCC_G, USCD_G	4	1	4	4
China	SSE_R, CHINACC_G, CHINACD_G	1	1	1	1
Japan	NIKKEI_R, JAPANCC_G, JAPANCD_G	1	4	1	1
Germany	DAX_R, GERMANYCC_G, GERMANYCD_G	1	1	1	1
India	SENSEX_R, INDIACC_G, INDIACD_G	1	1	1	1

Source : Compilation based on secondary data using EViews 9.5

Table-5 : Results of Block Exogeneity Wald Test

Model-1 : USA						
DV	**IVs**	**Chi-square**	**df**	**P-Value**	**Decision Rule**	**Decision**
SP_R	USCC_G	5.529845	4	0.2371	P-Value>0.05	USCC_G does not Granger cause SP_R (USCC_G ⟶ SP_R)
	USCD_G	18.36394	4	0.0010	P-Value<0.05	USCD_G Granger causes SP_R (USCD_G ⟶ SP_R)
	All	22.76641	8	0.0037	P-Value<0.05	Together they Granger cause SP_R (All ⟶ SP_R)
Model-2 : China						
SSE_R	CHINA CC_G	0.025357	1	0.8735	P-Value>0.05	CHINACC_G does not Granger cause SSE_R (CHINACC_G ⟶ SSE_R)
	CHINA CD_G	0.065978	1	0.7973	P-Value>0.05	CHINACD_G does not Granger cause SSE_R (CHINACD_G ⟶ SSE_R)
	All	0.107524	2	0.9477	P-Value>0.05	Together they do not Granger causes SSE_R (All ⟶ SSE_R)

(Contd...)

Model-3 : Japan						
NIKKEI_R	JAPAN CC_G	0.730561	1	0.3927	P-Value>0.05	JAPANCC_G does not Granger cause NIKKEI_R (JAPANCC_G ⟶ NIKKEI_R)
	JAPAN CD_G	9.371555	1	0.0022	P-Value<0.05	JAPANCD_G Granger causes NIKKEI_R (JAPANCD_G ⟶ NIKKEI_R)
	All	10.59505	2	0.0050	P-Value<0.05	Together they Granger cause NIKKEI_R (All ⟶ NIKKEI_R)
Model-4 : Germany						
DAX_R	GERMANY CC_G	0.952216	1	0.3292	P-Value>0.05	GERMANYCC_G does not Granger cause DAX_R (GERMANYCC_G → DAX_R)
	GERMANY CD_G	7.416923	1	0.0065	P-Value < 0.05	GERMANYCD_G Granger causes DAX_R (GERMANY CD_G→ DAX_R)
	All	7.749730	2	0.0208	P-Value < 0.05	Together they Granger cause DAX_R (All → DAX_R)
Model-5 : India						
Sensex_R	INDIA CC_G	6.761656	1	0.0093	P-Value<0.05	INDIACC_G Granger causes Sensex_R (INDIACC_G→Sensex_R)
	INDIA CD_G	4.701919	1	0.0301	P-Value<0.05	INDIACD_G Granger causes causes SENSEX_R (INDIACD_G→Sensex_R)
	All	8.543130	2	0.0140	P-Value<0.05	Together they Granger cause SENSEX_R (All→Sensex_R)

Source : Compilation based on secondary data using EViews 9.5

5.2.2. Granger Causality (F) Test

The results of the test are shown in the following table (Table-6).

It is evident that the growth of Covid deaths in the USA, Japan and Germany Granger caused the stock market returns in those countries. The striking point is that the current result is in conformity with the result of Block Exogeneity Wald Test. However, the growth of Covid cases and growth of

Table-6 : Results of Granger Causality (F) Test

Model	Hypothesis (H_0)	F-Statistics	P-Value	Decision Rule	Decision on H_0	Remarks
USA	USCC_G does not Granger Cause SP_R	0.79283	0.5374	P-Value>0.05	Accepted	USCC_G→SP_R
	USCD_G does not Granger Cause SP_R	4.13805	0.0072	P-Value<0.05	Rejected	USCD_G→SP_R
China	CHINACC_G does not Granger Cause SSE_R	0.04241	0.8378	P-Value>0.05	Accepted	CHINACC_G→ SSE_R
	CHINACD_G does not Granger Cause SSE_R	0.08395	0.7733	P-Value>0.05	Accepted	CHINACD_G→ SSE_R
Japan	JAPANCC_G does not Granger Cause NIKKEI_R	1.03512	0.3143	P-Value>0.05	Accepted	JAPANCC_G→ NIKKEI_R
	JAPANCD_G does not Granger Cause NIKKEI_R	9.92261	0.0029	P-Value<0.05	Rejected	JAPANCD_G→ NIKKEI_R
Germany	GERMANYCC_G does not Granger Cause DAX_R	0.29206	0.5915	P-Value>0.05	Accepted	GERMANYCC_G →DAX_R
	GERMANYCD_G does not Granger Cause DAX_R	6.80458	0.0122	P-Value<0.05	Rejected	GERMANYCD_G →DAX_R
India	INDIACC_G does not Granger Cause SENSEX_R	3.55511	0.0657	P-Value>0.05	Accepted	INDIACC_G→ SENSEX_R
	INDIACD_G does not Granger Cause SENSEX_R	1.58318	0.2147	P-Value>0.05	Accepted	INDIACD_G→ SENSEX_R

Source : Compilation based on secondary data using EViews 9.5

deaths in India do not Granger cause the return of Sensex. This result is not in line with the result of the Block Exogeneity Wald Test.

5.3. Estimate the Impulse Response of Select Stock Markets Returns to Growth of Number of Cases and Deaths from Covid-19 [Addressing Objective (iii)]

Impulse response of select stocks returns to a sudden shock to the growth in number of cases and growth in number of deaths is estimated based on underlying VAR models. Impulse response function (IRF) represents the percentage change in the stock returns for all the models (Table-7 & Chart-1) due to 1 standard deviation (SD) change in the growth of number of cases and deaths. It is observed that the impulse response of the S&P 500 to growth in number of cases in the USA is comparatively more volatile as compared to other countries. It continues till 10th period. However, in the case of death, the impulse response is there till 7th period and then it starts to die away. On the contrary, the impulse response of SSE Composite in China, to the growth in the number of cases in China is initially negative. However, it died away after the 3rd period. The impulse response of SSE Composites to the growth in the number of deaths in China is initially positive. It, too, died downat the end of the 3rd period. The impulse response of Nikkei to change in growth of the number of cases in Japan falls down till the end of the 2nd period. Then it started to rise, finally dying down in the 4th period. Though the impulse response of the Nikkei to an increase in the number of deaths in Japan is initially growing up; it started to fall after the 2nd period, finally dying away at the end of the 5th period. The impulse responses of DAX to growth in the number of cases in Germany are initially negative. It dies away after the 3rd period. Impulse response of DAX to the growth of number of deaths in Germany are initially positive and rising till the end of the 2nd period, following which it starts to fall, finally dying away at the end of the 5th period. It is evident that the impulse response of Sensex in India to the growth in the number of cases is initially negative, whileit is finally dying away at the end of the 5th period. The impulse responses of Sensex growth in number of deaths in India are initially positive and then it turns down to the base at the end of the 5th period.

6. Areas of Further Research

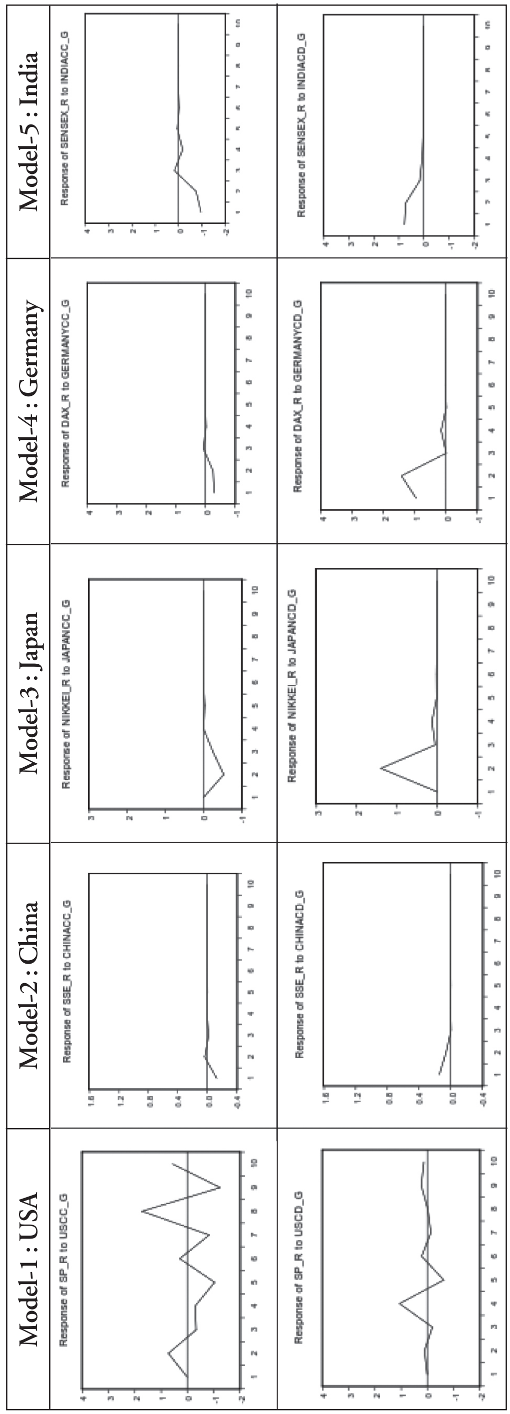
There are a few areas which remain unattended and may be addressed in further research in this field. The study only considers the five major economies of the world. However, the situation of stock markets of other countries with greater infection rates has not been considered. Market situations following the second wave of Covid-19 can

Table-7 : Impulse Response of Stock Return to Change in Growth of Number of Cases and Deaths

Periods	Response of SP_R to		Responses of SSE_R to		Responses of NIKKEI_R to		Responses of DAX_R to		Responses of SENSEX_R to	
	USCC_G	USCD_G	China CC_G	China CD_G	Japan CC_G	Japan CD_G	Germany CC_G	Germany CD_G	India CC_G	India CD_G
1	-0.777946	-0.413893	-0.128483	0.145938	-0.034385	-0.153351	-0.301645	0.946592	-0.974216	0.775680
2	0.688949	0.076053	0.037048	0.060271	-0.541433	1.357825	-0.259956	1.421052	-0.761836	0.714846
3	-0.555001	-0.305400	-0.019292	-0.004866	-0.253568	0.033827	0.066491	-0.019034	0.170814	0.161000
4	-0.163010	1.127775	0.004568	0.002254	-0.005391	0.121528	-0.025602	0.147047	-0.178178	0.069108
5	-1.169750	-0.675663	-0.001335	-0.000574	-0.032692	0.004016	0.010519	-0.019215	0.045847	0.025143
6	0.410713	0.271382	0.000370	0.000164	0.001201	0.011512	-0.003660	0.016640	-0.029282	0.006945
7	-1.030110	-0.231742	-0.000104	-4.56E-05	-0.003458	0.000336	0.001481	-0.003911	0.007858	0.003538
8	1.846022	0.019064	2.90E-05	1.28E-05	0.000196	0.001113	-0.000535	0.002088	-0.004277	0.000722
9	-1.498455	0.121716	-8.11E-06	-3.57E-06	-0.000348	2.34E-05	0.000209	-0.000636	0.001176	0.000474
10	0.692750	0.192425	2.27E-06	9.99E-07	2.41E-05	0.000108	-7.75E-05	0.000280	-0.000592	7.70E-05

Source : Compilation based on secondary data using EViews 9.5

Chart-1 : Impulse Response of Stock Return to Change in Growth of Number of Cases and Deaths



Source : Compilation based on secondary data using EViews 9.5

also be studied in future studies. The long-run relationship between stock market performances with Covid-19 has also not been addressed in the current study. The study did not incorporate the impact of the pandemic on stock returns using panel data regression. The behaviour of the stock market in Covid-19 could also be compared with the behaviour of the stock market in other pandemics (e.g. Spanish Flu) that has already happened across the world. Future studies in this field may also incorporate the calculation of abnormal returns from the market due to Covid-19. A forecast of future market movements amid Covid-19 is also a further area for research.

7. Policy Issues

In the wake of Covid-19, the Government of India came up with a five-phase economic stimulus package of ₹20 lakhs crores to help the Indian economy regain its strength. However, the study proposes a few policy issues that may be considered by the regulators to combat this situation as under :

a) ***Escalating Investment in Public Heath :*** Since the pandemic has proved to have a casual relationship with stock market return, increasing investment in public health and health reforms seems to be an elegant move. Currently, India spends 1.28 per cent of the GDP on public health, which is much lower than the minimum percentage spending of a lower income country (1.57 per cent) (Indian Express, November 21, 2019). While the government has committed a substantial amount to health measures, focus should be on escalating the percentage of GDP on health reforms.

b) ***Protection of Livelihood :*** Pay-cuts and lay-offs amid Covid-19 have been leading the investors away from the stock market. Several measures could have been taken to ensure pay-protection and employment generation. Other countries have taken a few positive steps, such as ensuring at least 60 per cent of the total pay (Germany) (Euronews, June 2020), enactment of a separate act only to deal with this issue and ensuring economic impact payments to all citizens, etc. (USA) (US Department of the Treasury, March 2020). While Indian government has increased the allocation of Mahatma Gandhi National Rural Employment Schemes (MGNREGS), it may seem to be inadequate as compared to other countries.

c) ***Support to Small-Scale Businesses :*** The stability ofthe stock market depends upon overall economic growth, which is possible through promoting micro small and medium

scale enterprises (MSMEs) and new start-ups. While the government has promised collateral free loans to MSMEs and other support to the start-ups, it has not been well received by the sector (Saluja, May 29, 2020).

d) ***Improvement in Supply Chain Network :*** The pandemic has disrupted the supply chain network in the country, leading to price asymmetry in food and essential items in different parts of the country. China has made it a part of their stimulus package (Shen, 2020). The Indian government may well think about it too.

e) ***Revamping Insurance Sector :*** Both life and general insurance have proven their worth in recent times. However, the current industry structure was perhaps not adequate to address the pandemic satisfactorily. Hence, the Insurance Regulatory and Development Authority (IRDA) should take appropriate measures to revamp the insurance sector.

f) ***Boosting Tourism/Hospitality Sector :*** The tourism and hospitality sectors are badly hit as a result of Covid-19. Regulators should take appropriate measures to promote these sectors once the pandemic comes to an end.

g) ***Awareness of Stock Market :*** Herd instinct and lack of awareness about market performance led the investors to leave the market as soon as Covid-19 hit India. However, investors' resilience to such unprecedented shock may help the stock market thrive. Hence, the Securities and Exchange Board of India (SEBI) may plan webinars and online courses to make investors aware of their responsibilities in similar situations in the future.

h) ***Education Sector :*** The education system as a whole has been largely disrupted during the lockdown. The current public expenditure on education in India is around 4.43 per cent of the GDP. While the Government should have increased the percentage of allocation much earlier, during Covid-19, the Government has proposed to augment the percentage of allocation to 6 per cent of the GDP in the newly introduced National Education Policy (NEP). Moreover, during this pandemic, the government has also promoted technology driven education (PM-e-Vidya) since traditional in-person modes of education are not possible (GoI, 2020).

8. Conclusion

Any causal relationship could not be established between growth in the

number of cases and growth in the number of deaths in China with their stock market return. Interestingly, impulse responses of the stock return are also very short-lived. On the contrary, a causal relationship in a few countries, like the USA, Germany and Japan, is explored between the growth of Covid-19 cases and the stock market returns. The impulse response of the US market is the highest among the five countries under consideration. Growth in the number of cases and growth in the number of deaths from Covid-19 in India have a causal relationship with its stock market return. All this evidence goes onto prove that the Chinese market recovered from the shock very quickly as compared to the other markets even after being the first country to endure the shock. Against this backdrop, a few crucial research questions may be invoked in order to explore : (a) how has China been able to devise their action plan so promptly, while the other affected countries failed to do so? (b) does the absence of a multi-party political system facilitate the government in implementing their decisions? However, because of proactive measures adopted by the Chinese government, the corona virus possibly did not spread severally, the way it did in other countries.

References

Ahmar, A., & Val, E. (2020). SutteARIMA : Short-term forecasting method, a case : Covid-19 and stock market in Spain. *Science of the Total Environment,* 729, 138883.

Al-Awadhi, A., Alsaifi, K., Al-Awadhi & A. Alhammadi, S. (2020). Death and contagious infectious diseases : Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance,* 7, 100326.

Alsaifi, K., Elnahass, M. & Salama, A. (2020). Market responses to firm's voluntary carbon disclosure : Empirical evidence from the United Kingdom. *Journal of Clean Production,* 262, 121377.

Baker, S., Bloom, N. & Terry, S. (2020). Using disasters to estimate the impact of uncertainty. Available at : http://people. bu.edu/ stephent/files/BBT.pdf accessed on October 1, 2021.

Baker, S., Bloom, N., Davis, R., Kost, K., Sammon, M. &Viratyosin, T. (2020). The unprecedented stock market impact of Covid-19. Working paper 26945. *National Bureau of Economic Research,* Cambridge, MA.

Baker, S., Bloom, N., Davis, S. & Terry, S. (2020). Covid-induced economic uncertainty. Working paper 26983. *National Bureau of Economic Research,* Cambridge, MA.

Bash, A., & Alsaifi, K. (2019). Fear from uncertainty : An event study of Khasoggi and stock market returns. *Journal of Behavioral and Experimental Finance,* 18, 85-93.

Buhagiar, R., Cortis, D., & Newall, P. (2018). Why do some soccer bettor lose more money than others? *Journal of Behavioral and Experimental Finance,* 23, 54-58.

Chen, M., Jang, S. & Kim, W. (2007). The impact of the SARS outbreak on Taiwanese hotel stock performance : An event study approach. *International Journal of Hospitality Management,* 26:1, 200-212.

Dietrich, A., Kuester, K., Muller, G. & Schoenle, R. (2020). *News and uncertainty about Covid-19 : Survey evidence and short-run economic impact.* Working Paper 20-12. Federal Reserve Bank of Cleveland.

Enders, W. (2004). *Applied econometric time* series (2nd Ed.). USA : John Wiley and Sons.

Euronews (June 4, 2020). Germany announces €130 billion stimulus package as unemployment rises in Europe.

Ichev, R., & Marinc, M. (2018). Stock prices and geographic proximity of information : Evidence from Ebola outbreak. *International Review of Financial Analysis,* 56, 153-166.

IMF (2019). World economic outlook. Available at : https://www.imf.org/external/datamapper/datasets/WEO/1/accessed on October 5, 2021.

Indian Express (November 21, 2020). India's public expenditure on health less than Lower Income Countries : Government data.

Kowalewski, O., & Spiewanowski, P. (2020). Stock market response to potash mine disaster. *Journal of Commodities Market,* 100, 124.

Lee, J., & McKibbin, W. (2004). Estimating global economic cost of SARS. In S. Knobler, A. Mahmoud, S. Lemon, A. Mack, L. Sivitz, & K. Oberholtzer (Eds.). *"Learning from SARS : Preparing for the next outbreak".* Washington DC : National Academic Press.

Liu, H., Manzoor, A., CangYu, W., Zhang, L. & Manzoor, Z. (2020). The COVID-19 outbreak and affected countries stock market responses. *International Journal of Environmental Research and Public Health,* 17, 2800.

Liu, Z., & Hu, B. (2020). China's economy under COVID-19 : Short-term shocks and long term changes. *Modern Economy,* 11, 908-919.

Maki, D. (2012). Tests for cointegration allowing for an unknown number of breaks. *Economic Modelling,* 29, 2011-2015.

McKibbin, W., & Fernando, R. (2020). The global macroeconomic impacts of COVID-19 : Seven scenarios. Working paper 19/2020, *Centre for Applied Macroeconomic Analysis.*

McKibbin, W., & Soderinko, A. (2006). Global macroeconomic analysis of pandemic influenza. *Lowy Institute Analysis.*

Government of India (2020). National Education Policy-2020, Ministry of Human Resource Development, New Development.

Saha, S.S. (2021), Indian financial system : Financial markets, institutions and services (2nd Ed.), McGraw-Hill, New Delhi.

Saluja, N. (May 29, 2020). 44% MSMEs feel stimulus package not good enough. *Economic Times.*

Sansa, N. (2020). The impact of covid-19 on financial markets : Evidence from China and USA. *Electronic Research Journal of Social Science and Humanities,* 2:2, 29-39.

Shen, J. (2020). China's 'six priorities' and fiscal stimulus will spearhead its COVID-19 recovery. *World Economic Forum.*

Sims, C. (1972). Money, *income and causality. American Economic Review,* 62:4. 540-552.

US Department of the Treasury (March 2020). The CARES Act 2020.

WEF (2019). Statistics. Available at : https://statistics.world-exchanges.org//accessed on September 29, 2021.

WHO (2020). Coronavirus disease (Covid-19) dashboard. Available at: https://covid19.who.int//accessed on September 28, 2021.

Yahoo Finance (2020). World indices. Available at: https://finance.yahoo.com/world-indices/accessed on September 25, 2021.

Yang, Y., Peng, F., Wang, R., Guan, K., Jiang, T., Xu, G., Sun, J. & Chang, C. (2020). The deadly corona viruses : The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. *Journal of Autoimmunity,* 102434.

Zeren, F., & Hizarci, E. (2020). The impact of COVID-19 coronavirus on stock markets : Evidence from select countries. *Bulletin of Accounting and Finance Reviews,* 3:1, 78-84.

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Measuring Digitalization in Banking and its Impact on Productivity of Commercial Banks in India

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This paper examines the impact of digital banking services (usage) on the Productivity of Indian commercial banks. The study develops an index known as the Digital Usage Index (DDI) to measure the degree of banks' digitization and examines its impact on Total Factor Productivity (TFP) as estimated by the non-parametric DEA technique. Results identify on an average productivity regress on the part of sample banks. Such a regress is mainly accounted for by the decline in the technological change index. Further, the study associated the digital usage index with the Malmquist TFP index with the help of a fixed effect panel data regression model. Apart from the digital usage index, the regression model includes bank specific as well as country specific variables. Results revealed TFP decline was driven primarily by a decline in technological change index while a strong positive association was identified between TFP and DUI.

Keywords : Digitization, Digital Usage Index, DEA, TFP.

Background and Motivation

The Indian banking sector has displayed many major transformations, especially after reforms which have proceeded since 1991. The sector is characterized by rapid technological development featured by network technology and the Internet. Time and again, technological innovations in the sector have gained renewed importance, especially with the opening up of the sector to foreign counterparts. With the thrust to building up a resilient banking sector, emphasis was also made to make the banks efficient and productive. Of late, finance related technology (FinTech) firms have added a new face to banking operations by bringing about technologically enabled solutions like cost optimization, financial inclusion and improved customer services. India has emerged as the fastest growing fin-tech market and the third largest fin-tech ecosystem in the world (Mankotia, 2020). Such a move on one hand is expected to enhance competitiveness and improve efficiency

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on the other. Also, with technological progress in the sector, much of the banking businesses are gradually routed through virtual modes, adding more convenience to the customers. This is replacing the traditional business model with an innovative technology-enabled business model. Existing literature suggests that any change/reforms in the banking sector should be gauged through the lenses of productivity and efficiency. Thus, it is imperative to examine the impact of technological progress, more specifically, increasing digital usage on the productivity of banks. Existing literature either measures efficiency of the banks in response to some policy change or makes across-comparison of efficiency based on ownership type or makes a cross-country comparison of efficiency (Berger & Deyoung (1997), Hassan, (2019), Shamshur and Weill (2019), Swami, (2020), Barth, et al. (2013), Aysan, & Cyhan (2008)) There are yet some set of studies devoted to identify determinants of efficiency (Fernandiz, 2019), Bãdin, Daraio and Simar (2014), Dietsch & Lozano-Vivas (2000)). But studies relating to efficiency and technology based banking operations are far fewer. A recent study by Wang, Xiuping, and Zhang (2021) investigated the potential impact of fintech on the efficiency of the banking industry in China. For this purpose, a fintech index is constructed to link the association with Total Factor Productivity (TFP). Results indicated that development of fin-tech has increased profitability, led to innovations, and improved risk control for commercial banks. This study remains the motivation for our present study. However, unlike this study, the present study instead of examining the impact of fin-tech, measures the impact of digital usage on TFP of banks. For this purpose, the study developed an index based on the digital banking usage/ transactions. At the first stage, we attempt to estimate TFP with the non-parametric DEA technique and at the second stage we regress TFP over certain explanatory variables. The explanatory variables include the self-constructed Digital Usage Index (DUI) indicating the degree of digital banking transactions/usage and other bank specific and macro-economic indicators.

The current study has five sections and proceeds as follows. Section-1 provides a brief overview of the digital ecosystem in India. Section-2 reviews the literature. Section-3 describes the methodology. Section-4 discusses the results and Section-5 with concluding remarks.

1. Digital Usage and Digital Eco-System of Indian Banking Sector

Digital usage encompasses all those banking services delivered through secured digital channels like the internet. In

other words, it refers to banking services carried through digital modes. The Reserve Bank of India (RBI) Ombudsman scheme for digital transactions defines digital transaction as "a means by which a payment transaction in a seamless system is effected without the need for cash at least on one of the two legs, if not both. This includes transactions made through digital/electronic modes wherein both the originator and beneficiary use digital/electronic medium to send or receive money". Digital transactions in India are facilitated mainly through National Electronic Fund Transfer (NEFT), Real-Time Gross Settlement System (RTGS) and cheque. Further, there also exist cards, non-card and other payment related systems. Card based payment is facilitated through debit and credit cards mainly operated through Automated Teller Machines (ATMs), White Label ATMS (WLAs), National Common Mobility Cards (NCMCs) and Point of Sales (PoS's). The Non-Card (card-less) modes take the form of an Immediate Payment Service (IMPS) and other platforms like Electronic Clearing Services (ECS), National Automated Clearing House (NACH) and Bharat Interface for Money (BHIM). Besides, there are other payment related system such as, Bharat Bill Payment System (BBPS), Bharat QR (BQR) code and National Unified USSD Platform (NUUP) or *99#.

If we draw our attention to the country's digital infrastructure/ecosystem, it consists of interconnected sets of services and various actors offering such services to add to customer convenience and value. Some leading players in the Indian digital banking market are SAP, Infosys, Innofis, D3 Banking Technology, Alkami, Misys, Q2 ebanking, API, TCS, Accenture, etc. As per the reports of RBI, the digital payment ecosystem is currently dominated by large technology players (Fin-Tech) including Paytm, PhonePe, Google Pay, and the recently launched WhatsApp payments. Digitization of banking services has spread wings predominantly on the payment system. To cite, per capita digital payments in the country experienced a steady growth from 2.4 digital transactions per capita per annum to 22.42 in 2019. Also, the ratio of digital payments to GDP reflected growth from 561 percent in 2014-15 to 796 percent in 2019. Currency in circulation as a percentage of GDP declined from 12 percent in 2015 to 9 percent in 2018 with a rise to 11 percent in 2019. The country also experienced a fall in the cost of printing currency notes during 2014-2018. All these facts reveal the country's endeavor towards building up a sound and strong digital ecosystem.

2. Select Review of Literature

Badunenko and Kumbhakar (2017) studied the persistent and time varying efficiency of Indian banks and their determinants. Additionally, their study also identified the regulatory impact on efficiency. The study also identified diseconomies of scale in the case of foreign banks, while private sector banks exhibited economies of scale. Further, state-owned banks were able to improve their cost efficiency, while private banks, and especially foreign banks, were found to be lagging behind their cost frontiers. The study by Goyal, et al. (2019), highlights intra sector bank efficiency using a meta frontier approach in the Indian context and their study revealed lackadaisical performance of public sector banks and, therefore, the study affirmed the government's move to consolidate public sector banks and retain a few but healthier banks. Wang and Zang (2019) using the DEA BCC model evaluated the technological innovation efficiency of big data enterprises. Analysis of results suggest that big data enterprises should expand their scale to match enterprise size commensurate to the scale of inputs and outputs. Liu and Chen (2012) used a meta frontier approach for comparing efficiency differences of banks in Indonesia, Malaysia and Thailand. Results reveal that the average cost efficiency of the Indonesian banks is higher than that of the other two countries. However, the cost efficiency of the Indonesian banks deteriorated over the years while that of the Thai banks improved consistently. Chen and Yang (2010) using meta frontier Mmalmquist productivity index made a comparative assessment of productivity growth of Taiwan and China. Their results highlighted the scale of inefficiency resulting in decreasing productivity of banks. Kumbhakar and Sarkar (2004) used Cost Frontier Analysis and attempted to evaluate the efficiency of banks in India. Their study was based on panel data on public and private sector banks for the period 1986-2000 covering both pre-and post-reform years. The authors reported the prevalence of cost inefficiency in Indian banks and relatively higher efficiency of private banks than that of public banks. Chelo and Manlagnit (2011) examined the cost efficiency of Philippine commercial banks using stochastic frontier analysis. The analysis was done with special reference to risk and asset quality. Results identified inefficiencies prevailing in the domestic banks owing to the Asian financial crisis of 1997. Risk and asset quality was found to be impacting the cost efficiency of banks.

Though studies on bank efficiency have enriched the banking literature from time to time, limited attention to studying the impact on efficiency and

productivity is proffered owing to digital usage or increasing digital transactions. This study attempts to fill this gap by linking digital usage with the productivity of banks. Accordingly, the following research questions are raised?

- Does the Indian bank exhibit productivity growth over the study period?
- Does digital usage induce productivity growth in the sector?

3. Methodology

3.1 Measurement of Productivity

The present study makes use of the Malmquist (1953) Total Factor Productivity Index (MTFPI) to measure the productivity changes. The MTFPI measures changes in total output relative to inputs. It is one of the most frequently used methods for evaluating productivity change. The MTFPI measures the TFP change between two data points by calculating the ratio of the distances of each data point relative to a common technology. The Malmquist input oriented TFP change index between the base period t and the following period, t+1 is defined as :

$$M_0(Y_s, X_s, Y_t X_t) = \sqrt{\left[\frac{d_0^s(Y_t, X_t) * d_0^t(Y_t, X_t)}{d_1^s(Y_s, X_s) * d_1^t(Y_s, X_s)}\right]} \quad .....(3)$$

Thus, the Malmquist Productivity Index is a product of two : (i) Change in Technical Efficiency (TE) or how close a bank is to the efficient frontier (Catching-Up Index) and (ii) Technological Change i.e., the change in best practice index or how much the benchmark production function shifts at each bank's observed input mix (Innovations and Shocks), which is also termed as the 'frontier shift' effect. Thus, equation (3) can be decomposed into :

$$\text{Efficiency change} = \frac{d_1^t(Y_t, X_t)}{d_0^s(Y_s, X_s)} \quad .....(4)$$

and Technological change =

$$\sqrt{\left[\frac{d_0^s(Y_t, X_t) * d_1^s(Y_s, X_s)}{d_0^s(Y_t, X_t) * d_1^t(Y_s, X_s)}\right]} \quad .....(5)$$

If the Malmquist Productivity Index is greater than one, it represents progress in TFP and if it is less than one it indicates a decline in TFP. Productivity changes reflect changes in technological progress as well as technical efficiency : M=(E)X(T) where E and T stand for technical efficiency change and technology change respectively. The study estimates the TFP with the Data Envelopment Analysis approach. DEA is a powerful tool to evaluate the performance of decision-making units that uses homogeneous inputs to produce homogeneous outputs. It is used in diverse research areas, e.g., in evaluating efficiencies in universities, schools, bank branches, hospitals, power plants, police

stations, tax offices, etc., considered as DMUs. DMUs are directly compared against a peer or a group of peers. DEA is also good at estimating the "relative" efficiency of a DMU. Unlike the stochastic cost frontier, DEA has the advantage of not imposing a specific functional form of costs but assumes that there are no random errors.

3.2 Measuring Digital Usage

Our objective here is to assess the degree of digitization measured through an index which we call the Digital Usage Index (DUI). Though there exists to our knowledge no such established index, the Reserve Bank of India (RBI) has very recently devised an index named Digital Payment Index (DPI) as announced on January 1, 2021. But it would deem 2018 as the base year. For the purpose of computation of a composite index, we consider four payment modes, viz; Volume of MB (Mobile Banking) transactions, volume of NEFT (National Electronic Fund Transfer) transactions, volume of RTGS (Real Time Gross Settlement) transactions, and the volume of DC (Debit Card) transactions as the indicators of digitization. Data from the RBI source related to the variables required for constructing the index for the period between 2012 and 2019 is collected.

Table-1 presents the description of the variables used for the construction of the index.

4. Data, Variables and Estimates

4.1 Data Source, Variables and Sample

Our study is based on unbalanced panel data of commercial banks in the public and private sector from the year 2012 to 2019. Our panel includes 124 observations covering 23 Indian public and private banks. Foreign banks are excluded from the study due to non-availability of data on digital banking variables as required for the analysis. The data source is the official website of the Reserve Bank of India (Statistical tables relating to banks in India) (www.rbi.org). Estimation of productivity requires specification of input and output variables. There are two broad approaches to the selection of inputs and outputs for a bank viz,the production approach and the intermediation approach. The former considers banks to be producing deposits and advances with the help of inputs like labor (employees) and capital (fixed assets), whereas the intermediation approach considers bank to be an intermediary which mobilizes deposits and produces advances. Thus, the difference between the two approaches lies in how deposits come to terms. The former views deposit as output whereas the latter treats deposits as an input variable. We follow the intermediation approach and

Table-1 : Description of Variables of the Digital Usage Index

Variables	Descriptions	Data Source
Mobile Banking (INR thousands) (x_1)	Mobile Banking- Mobile enabled financial transactions	Reserve Bank of India
NEFT Outward INR Million) (x_2)	National Electronic Fund Transfer- An electronic fund tranfer system with a minimum of Re.1 and maximum upto ₹2 lakhs transaction volume. Settlement carried on in lot basis Reserve Bank of India	Reserve Bank of India
RTGS (INR billion) (x_3)	Real Time Gross Settlement System - An electronic fund tranfer system with a minimum of ₹2 lakhs and maximum ₹10 lakhs transaction volume. Settlement carried on in a real time basis	Reserve Bank of India
Amount of DC Transactions (INR. millions) (x_4)	Debit Card Transaction - A plastic payment card used for fund transfer used mainly to facilitate cash withdrawls and deposits as well as use in PoS (Point of Sale)	Reserve Bank of India

Source : Authors' own specification.

accordingly deposits, the number of employees and fixed assets are viewed as input and advances, where as interest income and non-interest income are noted as output. Table-2 presents the descriptive statistics of the input output variables.

TFP of Indian Commercial Banks

Table-3 presents the results of TFP of the selected commercial banks over the study period (2012-2019). that on average there is a productivity decline of 7.6 percent as reflected by the tfpch. The decline in productivity is mainly accounted for by the decline in the technological change index (techch) which reflected a decline of 8.9 percent. Thus, it can be concluded here that the TFP decline in the sector is mainly driven by a decline in techch index while there exists growth in technical efficiency change (effch) on an average. Further, the decomposition of techch into pure technical efficiency change (pech) and scale efficiency change (sech) reveal growth in both the indices. Further, it can be seen from Figure-1 that most firms report productivity decline and only a few firms report productivity growth.

Table-2 : Descriptive Statistics of Input-Output Variables, TFP and DUI

Variables	Description	Obs	Mean	Standard Deviation	Max	Min
Input (X1)	Deposits (DEPO) (in INR crores)	124	227427	377559.6	3596989	44.7052
Input (X2)	Personnel (EMPL) (in Numbers)	124	27211.49	37785.78	264041	718
Input(X3)	Fixed Assets (FA) (in INR crores)	124	2279.395	4309.474	42918.92	32.7123
Output (Y1)	Advances (ADV) (in INR crores)	124	166419.8	251853.9	2185877	3515.747
Output (Y2)	Interest Income (INT) (in INR crores)	124	20386.26	28585.41	242868.7	392.7123
Output (Y3)	Non-Interest Income (NII) (in INR crores)	124	3048.203	5199.571	44600.69	29.0949

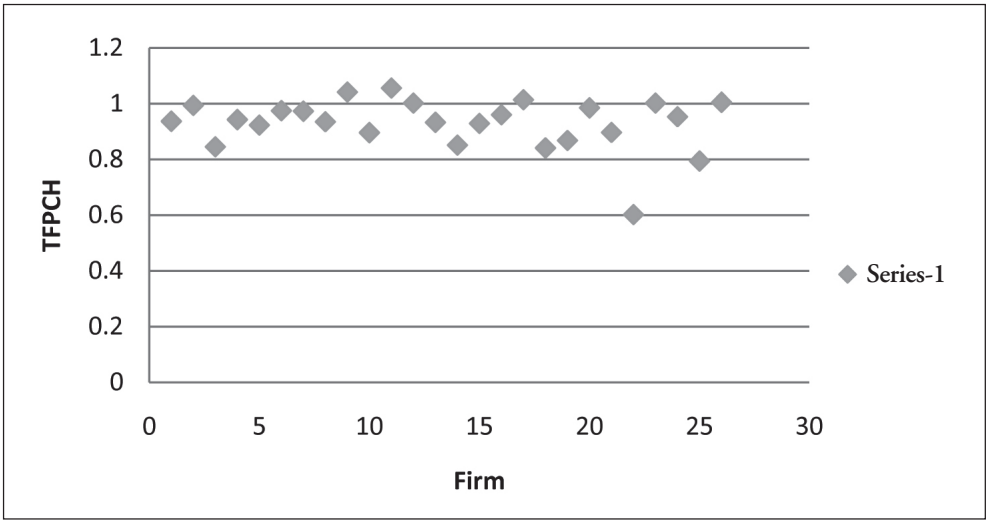
Source : Authors' own computation based on data from RBI (www.rbi.org).

Table-3 : Malmquist Summary of Annual Means

Year	effch	techch	pech	sech	tfpch
2	1.171	0.547	1.067	1.098	0.641
3	1.014	0.99	1.015	0.999	1.004
4	0.984	1.018	0.984	1	1.002
5	0.935	1.082	0.938	0.997	1.011
6	1.077	0.816	1.068	1.008	0.879
7	0.971	1.033	0.978	0.993	1.003
8	0.966	1.034	0.971	0.994	0.999
Mean	1.014	0.911	1.002	1.0124	0.924

Source : Authors' own computation based on data from RBI (www.rbi.org)

Figure-1 : Malmquist Index for Firm Mean



4.3 Digital Usage Index

Based on these variables listed in Table-1, we constructed our self-developed "*Digital Usage Index*". We adopt the "Dimensional Indexing" method of indexing. As we deal with panel data having both cross-sectional and time-series dimension and because of a wide range of values of the variables, we take the log-transformation of the variables to compress the scale to minimize the heteroscedasticity problem. The dimension index for each dimension/ variable is calculated by using the following formula :

Dimension Index =

$$= \frac{Actual\ value - Minimum\ value}{Maximum\ value - Minimum\ value}$$

It is noteworthy that both the maximum and minimum values are influenced by the values of the variables. After calculation of the dimension index for each variable separately, we combine them by taking the weighted arithmetic mean, with equal weight (one-fourth) for all dimensions. After calculating the "*Digital Usage Index*" following the above methodology, we have calculated the simple average for each panel to obtain the "*Panel Digital Usage Index*" for taking in including the commercial banks. A value close to zero would imply a greater degree of digitization and a value close to 1 would imply greater degree of rationalization.

Table-4 presents the DUI of the sector over the study period 2012 to 2019. There exists a consistent increase in the

Table-4 : Panel Digital Usage Index

Year	Digital Usage Index (DUI)
2012	0.389
2013	0.437
2014	0.535
2015	0.504
2016	0.549
2017	0.592
2018	0.645
2019	0.644

Source : Authors' own calculation based on the data from Reserve Bank of India (www.rbi.org)

index value ranging from .39 in 2012 to .65 in 2019. This reveals the growing popularity of digital modes of transaction over the years.

Digital Usage Index and TFP : Analyzing the Association

In this section, we attempt to ascertain the association of the DUI with that of the TFP index. Considering the panel nature of data, we use the panel regression method. To check the precise model for panel data regression, Hausman test was conducted and Random Effect model was found appropriate. In order to identify the association between the DUI and the TFP scores, the following explanatory variables which can potentially influence the productivity scores are mentioned in Table-5.

Thus, the empirical model of our analysis can be specified as below :

$$TFP_{it} = \alpha + \gamma DUI_{it} + \beta_1 PPB_{it} + \beta_2 IPR_{it} + \beta_3 OWN_{it} + \beta_4 GDP_{it} + \mu_{it}.$$

The DUI is expected to be positively associated with TFP. This is so because, as the intensity of use of digital modes of banking enhances, it results in reduction in cost as well as improvement in operational efficiency, leading to productivity growth. Increased usage of digital technology would not only permit bank personnel to reduce time per transaction but would also allow them to parti-cipate in multiple tasks, again elevating their level of productivity. Further, increasing digital usage would reduce the operational cost of the banks significantly yielding greater productivity of capital. *Internet penetration Rate (IPR)*

Table-5 : Dependent and Independent Variables for Regression

Dependent Variable	Cost Efficiency (CE) Scores as Estimated Using Output Oriented Variable Return to Scale DEA Model				
	Variable	Description	Mean	SD	Data Source
Independent Variable	DUI	Digital Usage Index	0.537	0.092	Self-Computed with the help of data from RBI
	Internet Penetration Rate (IPR)	Percentage of population having accessibility to internet services	28.6	0.118	Extracted from www.ststista.com
	Ownership (OWN)	Vector of dummy variable whereby 1 representing banks in the Public sector and 0 otherwise	-	-	Reserve Bank of India
	GDP	Gross Domestic Product Growth Rate			World Bank (data.worldbank.org)

at the macro level also influences banks' efficiency. A higher percentage of the population covered by internet services renders the popularity of digital banking services for implementation. Banks can be in a position to offer many of their services in the electronic format in a cost effective manner. This would increase the productivity at the bank level. Ownership (OWN) is a dummy variable representing the owner-ship category of the bank, whereby it is of interest to see whether public sector banks are more productive than banks in the private sector. The Gross Domestic Product (GDP) growth rate indicates a country's level of development and, thus, with elevation in development it is likely to have built-in digital as well as other infrastructure, thereby increasing bank level productivity.

4.5 Results and Discussion

Results of the analysis are reported in Table-7. Since the data is in the nature of a panel data set, it is appropriate to use panel data regression. Prior to this, the multicollinearity check has gone through where the Variance Inflation Factor (VIF) is computed and the inference depicted in Table-6. Since all the explanatory variables are within the threshold limit of 10, there exists no multi-collinearity problem with the data set.

Table-6 : Collinearity Statistics

Variable	VIF	1/VIF
dui	1.46	0.902632
ipr	1.11	0.68314
gdp	1.37	0.731234
own	1.7	0.574713

Source : Own Calculation.

Table-7 : Results of Regression

Number of Obs=161
Number of groups = 23
R-Square
Within = 0.1375
Between= 0.0158
Overall = 0.0406

Variables	Fixed Effect (within) Regression	
	Coefficient	P>t
DUI	1.042044	0.050
IPR	0.3397205	0.241
GDP	0.0500853	0.002
OWN	0.125632	0.125
CONS	-0.0436807	0.873

Source : Authors' own calculation using STATA-13.

In order to test between the random and fixed effect models, the Hausman test was carried out and, since the p-value is found to be less than 0.05, the null hypothesis stands rejected and, the fixed effect is found to be the best model.

DUI is found to be having a positive association with the TFP. This is also found to be statistically significant. Thus, the increasing digital density has a commensurate benefit in terms of enhancing the productivity of banks. GDP is also found to be positively

associated with TFP and, correspondingly, the variable is also found statistically significant. Thus, the country's level of development induces TFP growth. Other variables in the model are found statistically insignificant. Thus, our analysis reveals a significant impact of DUI on TFP of commercial banks in India. Thus, the use of digitized modes of payment system allows banks to deliver the services efficiently leading to improved productivity. At the same time, the country's level of development as reflected by GDP also impacts TFP positively. The findings of the study highlight a strong positive correlation of digital usage of banking operations with total factor productivity growth. Thus, it is imperative for the country to develop a sound digital ecosystem. Being at the infant stage of digitization, it is inevitable to spread technological accessibility to the masses so that digitization would benefit banks at the micro-level through improved efficiency and productivity and, in turn, the country as a whole benefit from technological innovations and competitiveness.

5. Conclusion

This paper attempts to study the impact of the increasing digitization of banking on the productivity growth of the Indian banking sector. As part of the first objective, the study Malmquist TFP growth of the banks was estimated using the non-parametric DEA methodology. Results revealed the TFP decline was primarily driven by a decline in the technological change index. In order to ascertain the association between digital usage and TFP, a digital usage index was created covering four broad dimensions of the digital usage index and the results of analysis reveal an upward trend in the index value. The association between TFP and DUI is studied with the help of panel data regression with fixed effect. Results reveal a positive association between DUI and TFP. Also GDP as indicator of country's level of development is also found to be positively associated with TFP.

The study recommends initiatives to build up the digital infrastructure of the country through policy measures. Being at the infant stage of digitization, large-scale initiatives are required to spread awareness amongst the masses to adopt digital banking practices. Besides, governmental efforts to build up digital villages, promoting the growth of fintech firms and technological collaborations are deemed crucial for elevating digital usage.

References

Chen, K.H., & Yang, H.Y. (2011). A cross-country comparison of productivity growth using the generalized metafrontier Malmquist productivity index : with application to banking industries in Taiwan and China. *Journal of Productivity Analysis*, 35(3), 197-212.

Das, A., Ray, S.C & Nag, A. (2009). Labor-use efficiency in Indian banking : A branch – level analysis. *Omega,* 37(2), 411-425.

Farrell, M.J. (1957). The measurement of productive efficiency. *Journal of Royal Statistical Society, Series A (General),* 120(3*),* 253-290.

Goyal, J., Singh, M., Singh, R. & Aggarwal, A. (2019). Efficiency and technology gaps in Indian banking sector : Application of meta-frontier directional distance functional DEA approach. *The Journal of Finance and Data Science*, 5 (3), 156-172.

Kiyota, H. (2009). Efficiency of commercial banks in Sub-Saharan Africa: a comparative analysis of domestic and foreign banks. Paper presented at the CSAE conference 2009 on Economic Development in Africa.

Kumbhakar, S.C., & Sarkar, S. (2004). Deregulation, ownership and efficiency change in Indian banking : an application of stochastic frontier analysis. Retrieved from http://www.igid.ac.in.pdf.

Lin, B., & Long, H. (2015). A stochastic frontier analysis of energy efficiency of China's chemical industry. *Journal of Cleaner Production,* 87, 235-244. doi: 10.1016/j.jclepro.2014.08.104.

Liu, Y.C., & Chen, Y.H., (2010). A meta frontier approach for comparing bank efficiency differences between Indonesian, Malaysian and Thailand. *Journal of Applied Finance & Banking*,2(6),131-150.

Manlagñit, Maria Chelo V. (2011). Cost efficiency, determinants and risk preferences in banking : A case of stochastic frontier analysis in Philippines. *Journal of Asian Economics,* 22(1), 23-35.

Mankotia, A. (2020). BFSI – Fintech & financial services. Retrieved from http://www.investindia.gov.in.

Mohan, R., & Ray, S. (2004). Comparing performance of public and private sector banks : a revenue maximisation efficiency approach. Retrieved from http://www.epw.org.in.

Ncube, M. (2009). Efficiency of banking sector in South African Banking Sector. African Economic Conference, Addis Ababa-Ethiopia.

Ray, S.C., (2004). Data Envelopment Analysis-Theory and techniques for economic and operations research. Cambridge University Press.

Ray, S.C., Das, A., & Mukherjee, K. (2017). Labour cost efficiency with undesirable outputs and inputs : A study of Indian bank branches. Working papers 2017-04, Department of Economics,University of Connecticut.

Ray, S.C. (2014). Branching efficiency in Indian banking : an analysis of a demand-constrained network. Working papers 2014-34, Department of Economics, University of Connecticut.

Rezvanian, R., Ariss, R.K. & Mehdian, S.M. (2007). Cost efficiency technological progress and productivity growth of banks in GCC countries. *International Journal of Business,* 12 (4), 471-491. doi:10.1080/09603107.2010.532110.

Sathye, M. (2005). Privatization, performance and efficiency : a study of Indian banks. *Vikalpa*, 30(1). Retrieved from www.iimahd.ernet.in.

Shirai, S. (2001). Assessment of India's banking sector reform from the perspective of the governance of the banking system. Paper presented at the ESCAP-ADB Joint Workshop on Mobilizing Domestic Finance for Development, Bangkok, 21-23 November. Retrieved from http://www.imf.org/external/pubs/ft/wp/2005/wp0510.pdf.

Toit, E.D., & Cuba, Y.Z. (2018). Cost and profit efficiency of listed South African banks pre and post financial crisis. *Research in International Business and Finance,* 45(C), 435-445.

Wang, X., & Zang, M. (2019). Evaluation of technology innovation efficiency of big data enterprises based on DEA. *Journal of Risk Analysis and Crisis Response*, 9(3), 145-148. doi:10.2991/jracr.k.191024.004.

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A Sub-National Analysis of Causality between Public Expenditure and Economic Growth in India - 1990 Onwards

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This paper investigates the relationship between public expenditure and economic growth in India using time series data, in the post-1990-91 period. The study is sub-national in character and has been conducted on three states, Haryana, Andhra Pradesh and Bihar, which represent high, medium and low Gross State Domestic Product (GSDP), respectively. The variables, Per Capita Net State Domestic Product (PCNSDP) and Net State Domestic Product (NSDP) are used to depict economic growth and total expenditure (TE) by the state government. The paper examines if causality differs among the states and therefore among the major economic divisions of the country. For the same reason, first, the Augmented Dickey-Fuller Test has been applied, followed by the Johansen Cointegration Test and finally, Granger Causality has been employed. Results show that in Haryana, higher economic growth leads to higher government expenditure and is consistent with Wagner's Law, whereas in Bihar, increased government expenditure leads to increased economic growth, pointing towards the Keynesian Theory of increased role of the government. However, no relation has been found in Andhra Pradesh.

Keywords : Public Expenditure, Economic Growth, Causality, GSDP, PCNSDP.

Introduction

The relationship between public expenditure and economic growth has been widely studied. However, there is a lack of unanimity over the issue of whether increased economic growth causes increased public expenditure or increased public expenditure causes higher economic growth. Within economic analysis itself, 'the relationship between public expenditure and national income has been treated in characteristically dissimilar manner in two major areas. While public finance studies have generally postulated that growth in public expenditure over time is caused by growth in national income, most

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macro-econometric models have tended to take the opposite view' (Sahni & Singh, 1984). Thus, the causal relationship between economic growth and public expenditure warrants a deeper understanding. Among all the theories of the relationship between public expenditure and economic growth in economics, the Keynesian Theory and Wagner's Law, are widely accepted, yet are contrasting in their propositions.

During the Great Depression in 1930, Classical economists were unable to give any constructive solution to emerge out of the situation of drastic decline in output, severe unemployment and acute deflation that was being faced in almost every country in the world. Consequently, Keynesian economics led by the views of John Maynard Keynes served as the standard model to emerge out of the depression and the post-World War II expansion. In his work, General Theory of Employment, Interest and Money (1936), Keynes favoured government intervention by way of an increase in public expenditure which increases aggregate demand and sets in motion the multiplier effect.His theory prescribes public expenditure as a fundamental determinant of economic growth. As per Keynes, since we are all dead in the long run, the depression needed government intervention as a short-term solution.In the words of Srinivasan (2013), Keynesian theory expressed that government expenditure, as a fiscal policy instrument, is useful for achieving short-term stability and higher long-run growth rate. His theory suggested that increasing savings would not help but increasing spending would, by giving individuals purchasing power, producers would produce more, thus creating more employment. As per Keynes, public expenditure is an exogenous variable, and a policy instrument that can generate economic growth. Accordingly, he believed the role of the government to be a crucial policy instrument by way of fiscal policy, to stimulate development and hence economic growth to avoid depression. Thus, the Keynesian theory posits that an increase in public expenditure leads to an increase in national income, hence economic growth.

The Wagner's Law has been given by Adolph Wagner (1890). He formulated the famous law based on historical evidence from several industrialized countries such as Germany, France and Japan, that there is a long-run tendency for government expenditure to rise as per capita income increases. As per Liu, Hsu and Younis (2008), he is probably the first scholar to find a positive correlation between economic growth and the growth of government activities. The Wagner's Law of increasing state activities states that there is an inherent tendency for the functions of

different layers of a government (Central, State and local) to increase both intensively and extensively in response to an increase in economic growth. As time passes, various levels of government undertake new functions and extend their range of activities, due to the persistent rise in social problems, traditional functions of the state, population, urbanization, prices, etc treating public expenditure as endogenous. The law applies only to modern progressive governments which are interested in expanding the public sector of the economy for its overall benefits, and public expenditure would thus grow faster than output. As per Toye (1981), the three influences that would augment the demand for state activity are (a) for the protective and administrative services of the state, as a society became more complex; (b) for cultural and welfare services (including income redistribution through transfer payments); and (c) for the takeover by the state of those industries which private entrepreneurship was unable to operate on the scale or the technology that was (in some undefined sense) required. Interpretation of Wagner's Law in terms of elasticity suggests greater than unitary income elasticity for several public goods and services, i.e., the percentage increase in public expenditure is greater than the percentage increase in national income. Thus, it posits that economic growth is the fundamental determinant of an increase in public expenditure.

Both in the developed and the developing countries alike, there is continuous and ever-increasing growth in public expenditure. The role of government expenditure is considered crucial during the failure of the market mechanism to ensure macro-economic goals of full employment, income inequality and social welfare. Looking back at the post-World War II era, regardless of the nature of the political and economic systems, there has been an enduring growth of public expenditure across nations. Public expenditure in India, before independence, was comparatively small due to the absence of planning, which can be attributed to the lack of effort on the part of the British government to establish a welfare state. However, for nearly forty years of planned economic development in India up to 1991-92, there was a consistent rise in public expenditure. Since independence, India has assigned a significant role to the government by adopting the mixed economy model where the public and the private sectors coexist. In such a set-up of a market economy, increased public expenditure boosts propensities of the private sector to save and invest,which further enables private investment. In other words, in an economy that has unemployed

resources, an increase in government spending increases the aggregate demand in the economy, which may induce the private sector to increase their investment in new machinery to cater to the increased demand, and hence put the unused resources to productive uses. This may have a multiplier effect on aggregate demand, resulting in higher growth rates (Eisner, 1994). When faced with the Asian Financial Crisis (1997-98), even though India's public expenditure growth slowed down in real terms, an expansionary fiscal policy that focused on infrastructure development was adopted by the government. Expenditure by the government increased consistently, which imparted the required push for growth and take off, and an average of a three percentage point increase in public expenditure was achieved in the three successive years that followed. Instances like these highlight that government expenditure streamlines productivity and enables the economy in reaching higher growth trajectory, and debt sustainability is ensured along the way.

The process of economic growth and development necessitate gross domestic product (GDP) growth along with growth in public expenditure. Looking at India's growth performance since Independence, Tejani and Sinha (2004) have found a long-term trend growth in GDP which appears to be breaking upwards around 1980-81. There has been widespread debate on the reasons for the same. While Bradford DeLong (2001) states the 'license raj' as the reason for the upward break, others like Panagariya (2004) counter the former's contention and argue that the growth trends of the 1980s would not have been sustainable without the 1990s liberalization while contending that the process of liberalization actually began in the 1980s. The Indian economy has grown at a growth rate between five and six per cent since the 1980s, however, post 2003-04, the GDP growth rate rose to nearly eight per cent for the years to follow consistently until the global financial crisis had its effects on the Indian economy in 2009. During 2009, though the GDP growth fell, despite this, the continued momentum in manufacturing and a rebound in the agricultural sector led to the earlier growth rate of eight per cent being recovered eventually. In recent years, GDP growth in India has witnessed upswings and downswings, but the coexistence of the private and the public sector under the mixed economy model has proved to be a boon. As regards public expenditure, overall government expenditure has been expanding from 15.09 per cent of GDP from 1960-61 to its peak of 28.27 per cent of GDP (Premchand & Chattopadhyay 2004; Bagchi 2005; Srivastava 2005; Pattnaik 2009) in

1986-87 post which there was a steady fall till 22.94 per cent in 1996-97. With respect to public expenditure, relative to GDP, the same has been declining since 1991. Central government expenditure gradually declined from 17 per cent to 13 per cent in 2015 which can be attributed to increased financial devolution to states from the centre as was conferred by the 14th Finance Commission (Muthuramu & Maheshwari, 2017).

Existing literature reveals a well-established debate on the topic of causality without reaching any unanimous conclusion. Various studies have been conducted on causality in different countries, over diverse time periods, and have used different methodologies and all of them yield an array of results which hold true for that specific country, for a particular time period alone. Given the same, the current study is an attempt to determine the causality between economic growth and public expenditure at the sub-national level in India, among the three chosen states of Haryana, Andhra Pradesh and Bihar in the post-reform era (1990 onwards). The next section is a summary of some of the existing literature that yields diverse results.

Literature Review

A study of a multitude of works previously done on the same subject reveals any of the four results : (a)The causality either follows the Keynesian Theory or (b) the Wagnerian Law or it follows (c) none, i.e., no such relationship exists or (d) there is a bi-directional relationship. The Wagnerian Law has been tested in the study of Demirbas (1999) in Turkey from 1950-1990 and no empirical support for the law has been found. Sahni and Singh (1984), in their study of India and Canada as representing developing and developed economies respectively, from 1950-81 found out that neither the Wagnerian Law followed nor the Keynesian view. They found the causal process to be of a feedback sort on the aggregate level for both countries. Similarly, Ahsan et al (1992) fail to detect any causality in their study conducted on the G-7 countries; Canada, France, Germany, Italy, Japan, the U.K. and the United States. On the other hand, the study undertaken by Younis, Hsu and Liu (2008) employed Granger causality on US Federal Government data from 1947-2002 and found the causality to be more consistent with the Keynesian theory for aggregate data. As for disaggregate data, diverse relationships were found in the five sub-categories of federal government expenditure. Pradhan and Bagchi (2013) studied the effect of transport infrastructure on economic growth from 1970 to 2010 in India and found bidirectional causality between road transportation

and capital formation and unidirectional causality from rail transport to economic growth. Babatunde (2008) studied the Wagner's Law for West Africa from 1970 to 2005 using annual time series data. Results of the Bounds test indicated no long-term relationship between government expenditure and output in Nigeria, Gambia and Sierre Leone. However, Ogbonna (2012), studied Nigeria for the same, from 1950 to 2008, and supports the existence of Wagner's Law during the period under review. Srinivasan (2013) analysed the period between 1973 and 2012 in India,and his results confirmed the Wagnerian Law of public expenditure. Abbas and Afzal (2009) too studied time series data of Pakistan from 1960 to 2007. No long-run relationship between public expenditure and economic growth was found but the Law held for the period between 1981 and 1991. The study by Bojanic (2013) examined nine parameters for the existence of the Wagner's Law in Bolivia for the period 1940 to 2010. Being the longest such study in Bolivia, results were consistent with the Wagnerian proposition, and bidirectional causality was found in six parameters.

After the discussion about the theoretical background of the Keynesian Theory and the Wagnerian Law and the review of the literature post, the following relevant hypothesis have been constructed and the same will be tested in the empirical analysis section that follows :

1) **H0 :** There is no significant relationship between economic growth and public expenditure in India at the sub-national level.

   H1 : An increase in economic growth causes an increase in public expenditure in India at the sub-national level.

2) **H0 :** There is no significant relationship between public expenditure and economic growth in India at the sub-national level.

   H1 : An increase in public expenditure causes an increase in economic growth in India at the sub-national level.

Data and Methodology

The study uses data from the Reserve Bank of India : Handbook on Statistics of various states as well as Economic Survey of various years, Ministry of Finance, Government of India. The empirical analysis uses annual data on PCNSDP, NSDP and total expenditure at constant prices, 1990-91 onwards. Data have been spliced to reach the common base year of 2011-12. All the data has been transformed to the logarithmic form and then used.

Major general category Indian states have been ranked based on their average per capita net state domestic product from 2013-14 till 2015-16, with 2011-12 as the base year, in descending order. The states have then been divided into three categories viz. high, medium and low NSDP, comprising five states each. For analysis, Haryana has been chosen as the state with the highest NSDP and Bihar has the least. The average NSDP of Andhra Pradesh is closest to the All-India average over the selected period. The chosen states for the sub-national analysis are thus, Haryana, Andhra Pradesh and Bihar. The variables chosen to represent economic growth are net state domestic product and per capita net state domestic product, and total expenditure represents public expenditure throughout the study.

The study makes use of time series econometrics on data from 1990-91 to 2018-19 and Granger Test has been employed to validate the existence of Wagnerian Law, Keynesian Theory or a bi-directional causality. To analyse the application of Wagner's Law, and the causality and the direction between the NSDP and public expenditure in the state, cointegration technique and Granger Causality test will be used.

Stationarity, Cointegration and Causality

To find out about cointegration, the first step is to check if the two series are stationary or not using the Unit Root Test developed by Dickey and Fuller (1979). If they are stationary, then the level of stationarity is checked. For this Augmented Dickey-Fuller (ADF) test will be used as reported by Mackinnon (1991). The ADF test is based on the estimate of the following regression equation :

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{p} y_j \Delta Y_{t-j} + \varepsilon_t$$

Cointegration is relevant if both the series are stationary at the same level. Therefore, after checking stationarity, the Johansen Co-Integration test will be applied. Finally, Granger Causality is checked using Error Correction Models (VECM Models).

'Residuals from the above regression equationwill be tested for the presence of a unitroot using the ADF test. If the residuals, from the regression, are 1(0), i.e. stationary, then variables are said to be co-integrated and hence interrelated with each other in the long-run' (Gujarati, 2009).

For the standard Granger (1969) Causality Test, the variables must be used in their first-difference form.

To investigate the direction of causality between public expenditure and NSDP using Granger Causality, the following equations will be used :

$$\Delta EXP_t = \lambda_1 + \sum_{i=1}^{p} \beta_{i1} \Delta EXP_{t-i} + \sum_{i=1}^{q} \alpha_{i1} \Delta GDP_{t-i} + \mu_t$$

$$\Delta GDP_t = \lambda_2 + \sum_{i=1}^{l} \beta_{i2} \Delta EXP_{t-1} + \sum_{i=1}^{m} \alpha_{i2} \Delta GDP_{t-1} + \varepsilon_t$$

Depending on the outcome of the Granger Causality test, it shall be concluded whether the public expenditure is causing economic growth or vice-versa or both. It is imperative here to establish properties of time series for the said variables from 1990-91 – 2018-19. Testing for stationarity is essential as it is the first step of econometric analysis and the existence of non-stationarity may have important econometric implications. In general, a variable is said to be integrated of order one, I (1), if it is non-stationary at first difference.

Table-1 : Augmented Dicky Fuller (ADF) Unit Root Tests

	Level		First Difference	
	ADF Stat	p Value	ADF	Stat P Value
Haryana				
NSDP	2.821305	1.00000	-4.674261	0.0009
PCNSDP	3.318169	1.00000	-4.185561	0.0030
TE	-0.705773	0.8294	-5.919909	0.0000
Andhra Pradesh				
NSDP	0.932093	0.9945	-6.256327	0.0000
PCNSDP	1.332605	0.9982	-5.903930	0.0000
TE	-1.77308	0.3854	-4.663525	0.0010
Bihar				
NSDP	1.125881	0.3854	-7.783263	0.0000
PCNSDP	1.326315	0.9980	-3.776846	0.0083
TE	0.596261	0.9870	-4.794364	0.0007

Source : Authors' own calculations.

As seen in Table-1, at level, p-value of NSDP, PCNSDP and TE exceeds 0.05 for Haryana. Hence the null hypothesis is rejected for all the variables, implying that each of the series is non-stationary. However, at the first difference, all three series are stationary and can be called integrated at order 1, i.e. I(1) or having unit root. Similarly, in Andhra Pradesh and Bihar too, NSDP, PCNSDP and TE are non-stationary at level but become stationary at first difference.

Table-1 therefore shows that non-stationarity cannot be rejected for the levels of all variables i.e., NSDP, PCNSDP and TE using the ADF test for all the three states, Haryana, Andhra Pradesh and Bihar. However, when the data are differenced, non-stationarity can be rejected for all data series studies which indicates that all data series are integrated of order one, or I(1).

The Autoregressive Distributed Lag (ARDL) cointegration under the Johansen Test involves a comparison of the calculated trace value against the critical value. Given that the trace value is sensitive to the number of lags, Akaike Information Criteria (AIC) has been used to select the optimal number of lags in Table- 2. The appropriate lag

Table-2 : Johansen Cointegration Test Results

	Trace Statistic	Critical Value	p Value
Haryana			
1) PCNSDP, TE (VAR lag=1)			
H0: r = 0	21.00	15.495	0.007
H1: r <1	3.160	3.841	0.075
2) NSDP, TE (VAR lag=1)			
H0: r = 0	16.757	15.495	0.032
H1: r <1	3.277	3.841	0.702
3) TE, NSDP (VAR lag=1)			
H0: r = 0	16.757	15.495	0.032
H1: r <1	3.277	3.841	0.702
4) TE, PCNSDP (VAR lag=1)			
H0: r = 0	21.00	15.495	0.007
H1: r <1	3.160	3.841	0.075

	Trace Statistic	Critical Value	p Value
Andhra Pradesh			
1) PCNSDP, TE (VAR lag=1)			
H0: r = 0	7.287	15.495	0.544
H1: r <1	0.033	3.841	0.857
2) NSDP, TE (VAR lag=1)			
H0: r = 0	6.688	15.495	0.614
H1: r <1	0.503	3.841	0.822
3) TE, NSDP (VAR lag=1)			
H0: r = 0	6.688	15.495	0.614
H1: r <1	0.503	3.841	0.823
4) TE, PCNSDP (VAR lag=1)			
H0: r = 0	7.287	15.495	0.545
H1: r <1	0.033	3.841	0.857
Bihar			
1) PCNSDP, TE (VAR lag=2)			
H0: r = 0	10.231	15.495	0.263
H1: r <1	1.701	3.841	0.192
2) NSDP, TE (VAR lag=2)			
H0: r = 0	11.656	15.495	0.174
H1: r <1	1.027	3.841	0.319
3) TE, NSDP (VAR lag=2)			
H0: r = 0	11.656	15.495	0.174
H1: r <1	1.027	3.841	0.310
4) TE, PCNSDP (VAR lag=2)			
H0: r = 0	10.230	15.495	0.263
H1: r <1	1.072	3.841	0.192

Source : Authors' own calculations.

for Bihar is two, whereas for Andhra Pradesh and Haryana it is one.

The null hypothesis of no cointegration or no long-run relationship is accepted for both Bihar and Andhra Pradesh since the critical value exceeds the trace statistic, implying that neither the Wagnerian nor the Keynesian hypothesis (NSDP/PCNSDP-TE, TE-NSDP/PCNSDP) holds for either of the two states.

The null hypothesis of no cointegration is rejected for Haryana since trace statistic values are larger than the critical values (alternatively probability value or p-value is less than 0.05) and thus all the variables are cointegrated into the model, as is seen in Table-2. Cointegration implies a long-run relationship between the variables which can be seen in both the Keynesian and Wagner's hypotheses. Finally, the Granger Causality test will be used to describe the direction of the relationship between the variables.

Table-3 : Granger Causality Test Results

Null Hypothesis	Obs	F-Statistic	Prob.
Bihar			
TE does not Granger Cause PCNSDP	27	12.0515	0.0003
PCNSDP does not Granger Cause TE		0.73209	0.4923
NSDP does not Granger Cause TE	27	4.60735	0.0213
TE does not Granger Cause NSDP		7.41395	0.0035
Andhra Pradesh			
NSDP does not Granger Cause EXPN	27	0.99760	0.3848
TE does not Granger Cause NSDP		0.30381	0.7410
TE does not Granger Cause PCNSDP	27	0.55618	0.5813
PCNSDP does not Granger Cause TE		0.69771	0.5084
Haryana			
NSDP does not Granger Cause EXPN	27	3.79225	0.0385
TE does not Granger Cause NSDP		1.99465	0.1599
TE does not Granger Cause PCNSDP	27	2.84028	0.0799
PCNSDP does not Granger Cause TE		3.13976	0.0632

Source : Authors' own calculations.

The Granger Causality has been checked using the Error Correction Mechanism, Vector Error Correction Mechanism (VECM). If the calculated p-value is less than 0.05, the null hypothesis of no Granger Causality among variables is rejected.

For Bihar, since the p-value is 0.0003, the null hypothesis that TE does not Granger cause PCNSDP and NSDP are rejected, which implies the validity of the Keynesian theory of economic growth as an outcome of public expenditure growth. However, there is also the existence of reverse causality as the hypothesis NSDP does not Granger cause TE is rejected, thus confirming the existence of the Wagnerian hypothesis too. Hence, a bidirectional causality exists between economic growth and public expenditure, whereas the Keynesian relationship holds for the per capita economic growth and public expenditure. As regards Andhra Pradesh, no causality exists between public expenditure growth and economic growth for the said period, since all p-values exceed 0.05 and hence the null hypothesis of no causality is accepted. In Haryana, the Granger Causality test result reveals that the null hypothesis that NSDP does not Granger causes TE cannot be rejected with p-value of 0.385. In the case of the alternate hypothesis, since the p-value is 0.0385, the same is rejected and thus the existence of Wagner's hypothesis is proved i.e., increased economic growth (NSDP) is the cause of public expenditure growth (TE) and that there exists only unidirectional causality in Haryana.

Conclusion

The sub-national studies of India for the selected states of Haryana, Andhra Pradesh and Bihar over the time period of 1990-91 to 2018-19, checks the existence of causality among public expenditure and economic growth (Wagnerian Law or the Keynesian theory) by employing the Granger causality test on time series data. Results of the same confirm the validity of the alternative hypotheses that have been constructed within the study. Granger causality results reveal unidirectional causality in Haryana where increased economic growth is leading to increased public expenditure, thus confirming the existence of the Wagnerian Law in Haryana, representing the above-average Indian states in terms of their NSDP. However, Granger causality test results show that an increase in public expenditure leads to an increase in per capita economic growth and, thus the Keynesian theory is valid in Bihar. With regard to economic growth (NSDP) and public expenditure, bidirectional causality has been found. As regards Andhra Pradesh, which represents average NSDP state, no causality has been found in either direction. Granger

causality test results show that an increase in public expenditure leads to an increase in per capita economic growth and thus the Keynesian Theory is validated in Bihar. With regard to the economically weaker Indian states, the state government through the budgets allocated by the central government, must incur public expenditure in investment. This will act as a catalyst for economic growth, as the multiplier effect will be set into motion. The study makes it clear that public expenditure and economic growth are interdependent variables and may not follow the same causality for all nations/states. Passing through the different phases of economic development, either or no causality is deemed to exist.

References

Afzal, M., & Abbas, Q. (2009). Wagners law in Pakistan : Another look. *Journal of Economics and International Finance*, 2(1), 012-019.

Ahsan, S.M., Kwan, A.C., & Sahni, B. S. (1992). Public expenditure and national income causality: Further evidence on the role of omitted variables. *Southern Economic Journal*, 58(3), 623-634.

Babatunde, M. A. (2008). Establishing Wagner's law in the West Africa Monetary Zone (WAMZ) : Investigation using the bounds test. *The Indian Economic Journal*, 56(3), 109-123.

Brooks, C. (2014). *Introductory econometrics for finance*. Cambridge University Press.

De Luca, R. (2012). Understanding public debt dynamics. *Revista Brasileira de Ensino de Física,* 34(4).

Demirbas, S. (1999). *Cointegration analysis-causality testing and Wagner's law : The case of Turkey, 1950-1990.* Discussion Papers in Economics 99/3, Division of Economics, School of Business, University of Leicester.

Heston, A. (1984). Public expenditure and Indian development policy, 1960-1970. *Journal of Development Economics,* 16(3), 334-335.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in gaussian vector autoregressive models. *Econometrica*, 59(6), 1551–1580.

Keynes, J.M. (1937). The general theory of employment. *The Quarterly Journal of Economics*, 51(2), 209-223.

Lall, S. (1969). A note on government expenditures in developing countries. *The Economic Journal*, 79(314), 413-417.

Liu, L.C., Hsu, C.E., & Younis, M.Z. (2008). The association between government expenditure and economic growth : Granger causality test of US data, 1947-2002. *Journal of Public Budgeting, Accounting* & *Financial Management*, *20*(4), 439-452.

Musgrave, R.A., & Peacock, A.T. (1958). *Classics in the theory of public finance.* St. Martin's Press. Muthuramu, P., & Maheswari, T.U. (2017). Preview of public expenditure in India in the recent past decades. *International Journal of Arts, Science and Humanities,* 4(3), 39-44.

Ogbonna, B.C. (2012). Does the Wagner's law hold for Nigeria? 1950-2008. *Journal of Research in National Development*, 10(2), 290-299.

Pradhan, R.P., & Bagchi, T.P. (2013). Effect of transportation infrastructure on economic growth in India : The VECM approach. *Research in Transportation Economics*, 38(1), 139-148.

Sahni, B.S., & Singh, B. (1984). On the causal directions between national income and government expenditure in Canada. *Public Finance = Finances Publiques*, 39(3), 359-393.

Singh, B., & Sahni, B.S. (1984). Causality between public expenditure and national income. *The Review of Economics and Statistics*, 66(4), 630-644.

Singh, B., & Sahni, B.S. (1986). Patterns and directions of causality between government expenditure and national income in the United States. *Journal of Quantitative Economics*, 2(2), 630-44.

Sinha, A., & Tejani, S. (2004). Trend break in India's GDP growth rate : Some comments. *Economic & Political Weekly*, 39(52), 5634-5639.

Srinivasan, P. (2013). Causality between public expenditure and economic growth : The Indian case. *International Journal of Economics and Management*, 7(2), 335-347.

Toda, H.Y., & Yamamoto, T. (1995). Statistical inference in vector auto regressions with possibly integrated processes. *Journal of econometrics*, 66(1-2), 225-250.

Williamson, J.G. (1961). Public expenditure and revenue : An international comparison. *The Manchester School*, 29(1), 43-56.

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A Fixed and Random Effect Approach : An Empirical Analysis of Industrial Gross Value-Added and Energy Consumption of Indian Manufacturing Industries

Justin John Stephen* & Rakesh Kumar S.Manjhi**

Energy as an input plays a significant role in the outputs generated by major industries. Moreover, among the other traditional factors of production, energy has an influential relationship with economic figures. The present paper investigates the functional linkages between industrial gross value-added and energy consumption in India during the period from 1998 to 2018. The study is conducted on 11 clusters of varied manufacturing industries. The prime objective of this paper is to test the relationship between industrial output production and energy input at aggregate levels statistically. This relationship is analyzed as a function of the industrial fuel consumption for basic energy sources such as coal, electricity, petroleum and other miscellaneous fuels, through a series of empirical frameworks such as the Panel Unit-Root Test, Johansen's Co-integration Test, Fixed and Random Effect Models. The findings from the analysis through the Fixed Effect Model showed that the per unit increase in fuel consumption leads to an increase in the industrial gross value-added by 0.58818 at 1% level of significance with the R^2 of 0.9802.

Keywords : Panel Unit-Root Test, Co-integration, Industrial Energy Input, Industrial Gross Value-Added, Fixed Effect and Random Effect Model.

Introduction

With the implementation of the Second-Five-Year-Plan during the years 1956-61, there was a rapid increase in industrialization in India that caused an enormous demand for energy use. The energy consumption of industries is around 42.7 per cent of energy availability as the Indian industrial sector is becoming more and more competent in the world economy (Energy Balance Statistics, 2021). This is also due to the constant increase in investment in basic and energy-intensive industries, which stresses achieving self-reliance during the past development plans

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(Tata Energy Research Institute). Albeit, there is a constant increase in energy consumption, which has a major impact on green house gas, including CO_2.

In India, heavy industries such as iron and steel, aluminum, cement, fertilizer, refining and pulp and paper are more energy intensive (Bhattacharya & Copper 2010). The industries such as food processing, textiles, wood products, printing and publishing, and metal processing account for lesser final energy consumption. The former and latter industries mentioned making a contribution of 29 per cent to the GDP at the current price. The GDP earned per unit of energy used increases the use of energy rapidly and thus gives way to more energy-intensive industries. At the same time, it is also prudent to improve consumption patterns with minimal usage to have a drastic reduction in energy intensities. It is also noteworthy, that India committed at the Conference of Parties (CoP26) to reduce India's total estimated carbon emission by 1 billion tonnes by the year 2030 and cut down the carbon intensity of the country's economy by less than 45 per cent by the end of the decade and net-zero carbon emissions by 2070. Considering this, it becomes all the more imperative to analyze the energy consumption and industrial outputs of energy-intensive industries such as basic metals, beverages, chemical products, coke and refinery, fabricated metals, machinery and equipment, textiles, non-metallic mineral products, paper and paper products and pharmaceutical medical products, in the Indian context.

Objectives

1. To understand the functional relationship between industrial gross value-added and energy consumption.
2. To study the influence of fixed capital and labor on industrial gross value-added.
3. To test whether the Random or Fixed Model fits the data well in measuring the energy consumption and industrial gross value-added for Indian industries.

Hypotheses

The following are the main hypotheses of this paper :

1. Greater energy consumption leads to higher industrial output.
2. The fixed-effect model facilitates better results than the Random Effect.

Data Source

The main source of data for the analysis is the 'Annual Survey of Industries of India' database between the period 1992 and 2018. The data of manufacturing industry-wise consumption of energy

input such as coal, natural gas, petroleum products and electricity is collected in the form of physical units. The data of labour employed, fixed capital and gross value-added is consi-dered on a monetary basis, cited by various official data sources such as Petroleum and Natural Gas Statistics published by the Ministry of Petroleum and Natural Gas, Government of India; and Energy Statistics of various years, by the Ministry of Statistics and Programme Implementation, Government of India.

Review of Related Literature

For a long time, the classical growth theories asserted that economic growth is dependent on labour and capital only, but the oil embargo of 1973-74 and the continued rise in the energy prices challenged this thought and brought out a significant role of energy resources in the industrial production processes (Pindyck, 1979). Georgescu (1972) was one of the first to emphasize energy as a critical input in manufacturing activities. According to him, optimum energy use improves efficiency and productivity. Since then, several studies have been undertaken to analyze the nexus between energy input and economic output. Kraft and Kraft (1978) conducted one of the pioneering works on the causal relationship between energy input and economic growth using the time series data for the United States economy from the year 1947 to 1974. He used a bi-variate causality test to determine the causality between energy input and economic growth. He identified a positive relationship between GNP growth and an increase in energy use. In another study, Yu and Erol (1987) studied the cause-and-effect relationship between energy consumption and real G.N.P. for developed countries like Canada, France, Germany, the UK, Italy, and Japan. By employing the Granger and Sims test of causality methods, they found a bi-directional causality between two variables in the Japanese economy and no causal relationship between the two variables for developed countries like the UK and France. Whereas, the study on Germany and Italy, found that increased GNP led to increased energy consumption and this was vice versa in the case of Canada.

Similarly, many other studies have been undertaken globally to investigate the relationship between energy consumption and industrial output vis-à-vis economic growth. Some of these studies like Glasure (1998), Soytas and Sari (2003), Lee (2006), and Zamani (2009) for various periods for economies such as South Korea, Singapore, Turkey, Argentina, United Nations, and Iran saw a bi-directional relationship between energy and output.

These studies mostly used models such as the Engle-Granger Causality Test, Error Correction Model, and ARDL bound test. In contrast, other researchers like Hondroyiannis et al. (2002), Lee (2006), Jorbert and Karanfil (2007) used Engle-Granger, Granger Causality Test, Johansen's Multivariate Co-integration Technique, Co-integration and Vector Error Correction Model (VECM), for economies such as the UK, France, Sweden, Germany, U.S.A. and Turkey. They found no difference between energy consumption and output. However, few other studies done by Bradley and Ugur (2007) for economies such as Japan, Turkey, and the United States for different research periods have shown uni-directional causality between energy and output.

Apart from the above-cited studies at global levels, researchers have also endeavoured to study and predict the relationship between energy consumption and industrial output concerning India's GDP at the local level. In one such study, Ghosh (2002) using time series data on variables such as electricity use and economic growth (per capita), observed that there is a long-run causality occurring from output to energy consumption. As opposed to this, Bhattacharya and Paul (2004) applied alternative econometric time series models such as Engle-Granger, Granger Causality Test, and Johansen's Multivariate Co-integration Technique. They found that a bi-directional causality exists between energy consumption and economic growth. Tiwari (2011) using the time series data between the sample period 1970 and 2007 came out with the result that in the long-run, there is a causal relationship between GDP and energy consumption. Govindaraju and Tang (2013) for the sample period from 1965 to 2009 studied the linkages between coal consumption and real GDP per capita, where the results indicated no long-run relationship between energy and income. Still, there is a short-run relationship between income and energy.

Vidyarthi (2013) analyzed the period between 1971 and 2009, adopting the Johansen approach to time series data of energy consumption, real GDP and carbon emissions. The results indicated that there is a long-run linkage from energy to income, but a short-run linkage from income to energy. Abbas and Choudhary (2013) studied the area between the period 1972 and 2008 and pointed out that the aggregate level increase in GDP demanded more energy consumption both in the long-run and in the short-run whereas, at the disaggregated level, they found bi-directional causality between income and energy consumption. Bildirici and Bakirtas (2014), between 1980 and 2011, used a combination of different energy sources, such as coal, natural gas, and oil consumption

with real GDP by applying the ARDL model. Their results indicated a bi-directional relationship running from energy to output for coal and oil. Nain, Ahmad and Kamaiah (2015), on the other hand, used time-series data at aggregate and disaggregate levels of electricity consumption and real GDP by applying the ARDL bound test. Their results indicated that there was no long-run relationship at the aggregate level, but a short-run relationship between energy and income.

The Economic Survey of India (2018-19) reveals that "India with a per capita energy consumption of about one-third of the global average, will have to increase its per capita energy consumption at least 2.5 times to increase its real per capita GDP by USD 5,000 per capita, in 2010 prices, to enter the upper-middle income group." Similarly, if India increased its per capita energy consumption by four times the current consumption, it could achieve a higher Human Development Index.

Kamaljit Singh and Vashishta (2020) examined the relationships between per capita energy consumption and per capita GDP in India for the reference period from 1971 to 2015. The empirical analysis was conducted using the three-stage Johansen Co-integration, Vector Auto-regression and Granger Causality Test. The outcome of the study showed unidirectional causality occurring from per capita GDP per unit capita energy consumption, and this was absent in the long-term equilibrium relationship between per capita energy consumption and per capita GDP in India.

Tirwari, Leena Mary Eapen and Sthanu R Nair (2021) exa-mined the direction of the Granger-causal relationship between electricity consumption and economic growth at the State and sectorial levels in India. In the investigation, the Panel Co-inte-gration Tests with the structural break, the Heterogeneous Panel Causality Test, and the Panel VAR-based impulse-response model have been used. The study evaluated agricultural and industrial sectors on their energy dependence and contribution to output for eighteen major Indian states for the reference period from 1961 to 2015. The results prove a long-term relationship between economic growth and electricity consumption only in the agricultural sector. Further, the results disclose the presence of unidirectional Granger-causality running in the direction of overall economic growth in electricity consumption at the aggregate State level. However, focus on the sectoral level depicts a unidirectional causal relationship flowing from electricity consumption to economic growth for the agriculture sector and economic growth to electricity consumption for the industrial sector.

The survey of the literature of past studies shows heterogeneity between the energy input relationship with economic growth/industrial output. The findings of multiple studies vary at large. These differences could be accorded to different methodologies used, sets of variables and various individual research periods. Further, the previous studies mostly covered the sample period up to 2015 and primarily used the ARDL model. The earlier studies were mainly undertaken for heavy industries such as steel, aluminium, cement, paper, etc. It is in this context that the present study aims to investigate the energy use and industrial gross value-added relationship using the Fixed and Random Effect Model both at aggregate levels, covering eleven clusters of industries listed in the Annual Survey of Industries.

Methodology of Analysis

The panel data used here include variables such as fuel intensity, fuel consumption, fixed capital, labour, profit and net value-added. Data pertaining to the above variables have been taken from the Annual Survey of Industries for the reporting period from 1999 to 2018. It is a long panel and has many time periods (large T) but limited industries (Cameron & Trivedi, 2009 : 230). The data is balanced on a balanced panel. All industries have measurements in all time periods. In a contingency table of cross-sectional and time-series variables, each cell has only one frequency. Therefore, the total number of observations is eleven industries over twenty years (11*20) and it is a fixed panel. (Greene 2008 : 184).

First, descriptive statistics of the panel data have been explored to obtain a summary of the statistics. The analysis began by using the pooled (OLS), which is a linear regression with no fixed or random effect and assumes a constant intercept and slopes regardless of group and time period.

OLS : Industrial Gross Value Added$_i$ (IGVA)

$= \beta_0 + \beta_1$ fuel consumed$_i$ $+ \beta_2$ fixed capital$_i$ $+ \beta_3$ labour$_i$ $+ \varepsilon_i$

The pooled OLS model was found to be fitting the data well at the 0.05 significance level (F=996.35) and P<001). R^2 of 0.9401 denotes that this model accounts for 93 per cent of the total variance in the gross value-added in the industry. However, we need to worry if each industry or year has a different return of gross industrial value-added, and its intercept differs from other industries. This has led to three types of fixed effect estimations : One, (LSDV-with dropping a dummy; two, LSDV1-no intercept but all the dummies and three, LSDV2-subject to constraint).

On the other hand, what if the disturbance term alters across industries and years. This makes it a prerequisite to conducting a random effect model.

Hence, first the Least Square Dummy Variable (LSDV) model has been conducted by introducing group (industries) dummy variables D1 to D11. The D11 was omitted to avoid multi-collinearity. The regressors and dummies are allowed to be correlated in fixed-effect estimation.

LSDV model : Gross Industrial Value Added$_i$ = $\beta_0 + \beta_1$ fuel$_i$ + β_2 fixed capital$_i$ + β_3 labour$_i$ + $u_1d_1 + u_2d_2 + u_3d_3 + u_4d_4 + u_5d_5 + u_6d_6 + \ldots\ldots + u_{11}d_{11} + \varepsilon_i$

The U_1-U_{11} are respective parameter estimates of group dummy variables D_1-D_{11}.

Secondly, estimation of LSDV1 is undertaken, with an inclusion of all dummies but with suppressed intercept (i.e., intercept to be zero). Its functional form is,

Gross Industrial Value Added$_i$

= $\beta_0 + \beta_1$ fuel$_i$ + β_2 fixed capital$_i$ + β_3 labour$_i$ + $\mu_1d_1 + \mu_2d_2 + \mu_3d_3 + \mu_4d_4 + \mu_5d_5 + \ldots\ldots + \mu_{11}d_{11} + \varepsilon_i$

Thirdly, the estimation of LSDV2 is worked upon that includes the intercept and all dummies but with a restriction that the sum of parameters of all dummies is equal to zero. The functional form of LSDV2 is,

Gross Industrial Value Added$_i$

= $\beta_0 + \beta_1$ fuel$_i$ + β_2 fixed capital$_i$ + β_3 labour$_i$ + $\mu_1d_1 + \mu_2d_2 + \mu_3d_3 + \mu_4d_4 + \mu_5d_5 + \ldots\ldots + \mu_{11}d_{11} + \varepsilon_i$

Subject to : $\mu_1d_1 + \mu_2d_2 + \mu_3d_3 + \mu_4d_4 + \mu_5d_5 + \ldots\ldots + \mu_{11}d_{11} = 0$

Among all the three estimates of fixed effect models, the LSDV with its return stands robust. As LSDV fits the data better than the pooled (OLS) model, it can be understood from the statistical outcome of the F-statistic that showed a decrease from 996.35 to 784.84 ($p<.0001$); SSE (sum of squares due to error or residual) showed a decrease from 5.178 to 1.520; and R^2 showed an increase from 0.93 to 0.98. By including group dummies, this model loses 10 degrees of freedom (from 216 to 210). The parameter estimates individual regressors that are slightly different from those in the pooled OLS. For instance, the coefficient of fuel consumed changed from negative -0.4728 to positive 0.5881, but its statistical significance remained almost unchanged ($p<0.0001$).

Further, the question arises as to which estimation is the most valid. If the analysis is done on the basis of the outcome from the LSDV, it seems to be more robust in estimation than others. At the same time, it is imperative to find out the significant fixed effects of LSDV.

Therefore, the F-test has been conducted. The F-test reveals that the null hypothesis of this F-test is that all dummy parameters except for one are zero : $H_0 : u_1 = ... u_{n-1} = 0$. Thus, the outcome of the F-test conducted for fixed effects is 784.84. This Figure looks large enough to reject the null hypothesis. It also indicates that a fixed effect model is appropriate to deal with the data. Further, to refine the result, a better random effect model has been constructed. This is to solve the doubt whether differences across industries in any way influence the dependent variable "Gross Industrial Value Added".

The random effects model is :

$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it}$

u_{it} = between entity error

ε_{it} = Within entity error

The outcome of random effects estimation is surprising, as it seemingly suits the data better with the pooled OLS model. Therefore, the important test was conducted using Breuschand Pagan Lagrangian Multiplier Test. The test resulted in a larger chi-squared (1)150.48, and proved to reject the null hypothesis in favour of the random group effect model ($p < 0.0001$) which also indicates that the random effect model is more statistically viable to deal with the data.

These results further create a dilemma as both models demonstrate validation. Therefore, the decision, of which model is better than the other, becomes challenging. However, the Hausman specification test was performed to find out the most significant estimation. The Hausman Specification test resulted in 50.80, which is statistically significant at 0.01 significance as the P-value is ($p<0.0001$). Moreover, the data succeeds in meeting the asymptotic assumptions. Here, the chi-squares score is large enough to reject the null hypothesis;

H_0 : A random effect model, rather than a fixed-effect model, is appropriate

H_1 : The random effect model is not appropriate.

Thus, in conclusion, the fixed effect model is analytically better than its Random effect counterpart.

Descriptive Analysis

Firstly, descriptive statistics (Table-1) of the panel data have been explored to obtain a summary of statistics. Here, the total number of observations is 220 from 11 industries for a 20-year period. The overall mean of industrial gross value-added is (12.70854) while the standard deviation is (1.363902). Similarly, the mean and standard deviation of fuel consumption, fixed capital and labour are given below.

There are three types of statistical outcomes, such as overall, between and within. "Overall" statistics are the ordinary statistics that are based on the 220 observations. Whereas, the "between" statistics are calculated based on the summary data of 11 industries regardless of the time, while the "within" statistics by summary statistics of 20 years period but without regarding the industries.

Table-2 on the correlation matrix shows a positive high correlation (0.85) bet-ween fuel consumption and industrial gross value-added.

Table-1 : Descriptive Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
GVA	Overall	12.70854	1.363902	10.02076	16.5013	N = 220
	Between		1.170181	11.1546	15.45267	n = 11
	Within		0.780835	10.69235	13.99423	T = 20
FC	Overall	11.33093	1.518107	8.138039	15.0677	N = 220
	Between		1.410913	9.414552	14.137	n = 11
	Within		0.697624	9.305213	12.63327	T = 20
FK	Overall	13.38327	1.407375	10.38921	1.73E+01	N = 220
	Between		1.246564	11.7261	1.61E+01	n = 11
	Within		0.749398	11.91037	14.86239	T = 20
L	Overall	13.19902	1.254213	11.12548	1.66E+01	N = 220
	Between		1.28111	11.48588	16.18302	n = 11
	Within		0.272394	12.6297	13.87001	T = 20

Source : Author's Calculation.

Table-2 : Correlation Matrix

	IGVA	Fuel consumed	Fixed capital	Labour
Gross I-Value added	1.00			
Fuel consumed	0.85	1.00		
Fixed capital	0.95	0.94	1.00	
Labour	0.73	0.79	0.73	1.00

Source : Author's Calculation.

Analysis through Pooled Linear Regression Model

The pooled OLS is a pooled linear regression without fixed or random effects. It assumes there is no difference in intercept and slopes across all the groups and time period.

$Y_{it} = \alpha + X_{it}\beta + \varepsilon_{it}$ $(u_i = 0)$

Gross Industrial Value Added$_i$

$= \beta_0 + \beta_1$ fuel consumed$_i$ $+ \beta_2$ fixed capital$_i$ $+ \beta_3$ labour$_i$ $+ \varepsilon_i$

β_0 = is the intercept

β_1 = is the slope (coefficient or parameter estimate) of fuel consumed

β_2 = is the slope of fixed capital

β_3 = is the slope of labour used

ε_i = is the error term

The pooled OLS model fits the data well at the 0.05 significance level (F=996.35) and P<0.0001). R^2 of 0.93 denotes that this model accounts for 99 per cent of the total variance in the gross value-added in the industries.

The regression equation is,

Gross Value Added =

= –0.7307–0.4728*fuel+ 1.255*fixed capital + 0.3306*labour

The P-values given below are the results of t-tests for individual parameters.

In the case of zero fuel consumption, zero fixed capital and zero labour in each industry is expected to have -0.7307 amount of change in gross value-added (p<0.0001). For one unit increase in fuel consumed, the gross value-added is expected to change by -0.4728, holding all other variables constant (p<0.0001). Whenever fixed capital increases by one unit, gross value-added increases by 1.255units, holding all the other variables constant (p<0.0001).

Although the pooled OLS model fits well with a given data, we need to consider Y-intercept same for all the industries. This creates room for adopting fixed effects models. On the other hand, the question arises about the disturbance term. What if it varies across the industries and time series? Hence, to solve such queries, an attempt is made to conduct fixed and random effects.

Analysis through Fixed Effect Model

The LSDV (fixed effect) model is -

Gross Industrial Value Added$_i$

$= \beta_0 + \beta_1$ fuel$_i$ $+ \beta_2$ fixed capital$_i$ $+ \beta_3$ labour$_i$ $+ u_1d_1 + u_2d_2 + u_3d_3 + u_4d_4 + u_5d_5 + u_6d_6 + \ldots\ldots + u_{11}d_{11} + \varepsilon_i$

In the above-specified model, eleven groups (industry) dummies have been introduced. The eleventh dummy has been dropped to avoid perfect

multi-collinearity. The dummy variables and regressors are allowed to be correlated in a fixed-effect model. u_1–u_{11} are respective parameter estimates of group dummy variables d_1–d_{11}.

This LSDV fits the data better than the pooled OLS model. The F statistic shows a decrease from 996.35 to 784.84 ($p<0.0001$); SSE (sum of squares due to error or residual) shows a decrease from 5.1784 to 1.520, and R^2 shows an increase from 0.93 to 0.98. By including group dummies, this model loses 10 degrees of freedom (from 216 to 206). The parameter estimates that individual regressors are slightly different from those in the pooled OLS. For instance, the coefficient of fuel consumed changed from negative -0.47287 to positive 0.5881, but its statistical significance remained almost unchanged ($p<0.0001$).This fixed effect model shows that each Industry has its intercept, but the slopes of regressors are the same for all industries (i.e., fuel consumed, fixed capital, labour). Now, an attempt has been made to derive industry-specific intercepts that interpret the dummy coefficients u_1–u_{11} and report regression equations in LSDV.

The parameter estimate of d_{11} (dropped dummy) is obtained in the LSDV intercept (-2.6169), which is the baseline intercept (reference point). Each of u_1–u_{11} represents the deviation of its group-specific intercept from the baseline intercept (-2.6169) of Industry11. For instance, $u_1 = 0.2364$ means that the intercept of basic metal industry is 0.2364, which is greater than the baseline intercept (-2.6169). Hence, the intercept of the basic metal industry can be derived as -2.3805 = -2.6169 + 0.2364. Similarly, when the intercepts of each group is analyzed, it is observed that the intercept is deviating from that of the baseline intercept.

Further, a comparison has been made to find out the advantage and dis-advantages of choosing between Pooled OLS, LSDV, LSDV1, LSDV2; and to understand the outcome of using group dummies and individual intercepts for each group, later check the significance of adding dummies to the model.

Estimating LSDV1 includes all dummies but suppresses the intercept (i.e., intercept to be zero). Its functional form is,

Gross Industrial Value Added$_i$

$= \beta_0 + \beta_1$ fuel$_i$ $+ \beta_2$ fixed capital$_i$ $+ \beta_3$ labour$_i$ $+ \mu_1 d_1 + \mu_2 d_2 + \mu_3 d_3 + \mu_4 d_4 + \mu_5 d_5 + \ldots\ldots + \mu_{11} d_{11} + \varepsilon_i$

Estimating LSDV1, it is noticed, that all parameter estimates of regressors are more or less the same as those in LSDV. The coefficients of eleven industrial group dummies represent their group intercepts. At its core, it need not calculate the individual group intercepts. This is advantageous in LSDV1, however,

Table-3 : Comparing Pooled OLS; LSDV, LSDV1and LSDV2 (Fixed Effect Model)

	Pooled OLS		LSDV		LSDV1		LSDV2	
Fuel consumed	-.47287 (.0526)	(p<.001)	.58814 (.0680)	(p<.001)	.5881 (.0680)	(p<.001)	0.5997	(p<.001)
Fixed capital	1.2553 (.5090)	(p<.001)	.29315 (.0740)	(p<.001)	0.2931 (.0740)	(p<.001)	0.4542	(p<.001)
Labour	.22338 (.0316)	(p<.001)	.52091 (.1348)	(p<.001)	0.5209 (.1348)	(p<.001)	-.0228	(p<.048)
Overall intercept (baseline intercept)	-.73070 (.1386)	(p<.001)	-2.6169 (.6415)	(p<.001)	Suppressed		.01435	(p<.088)
Basic Metal (deviation from the baseline)	-	-	.2364 (.1253)	(p<.001)	-	-	-.2748 (.0232)	(p<.001)
Beverages (deviation from the baseline)	-	-	.9288 (.1824)	(p<.001)	-	-	.1785 (.0233)	(p<.001)
Chemical Products (deviation from the baseline)	-	-	.4759 (.1281)	(p<.001)	-	-	-.0481 (.0214)	(p<.005)
Coke& refinery produ (deviation from the baseline)	-	-	1.188 (.2298)	(p<.001)	-	-	.2479 (.0383)	(p<.001)
Fabricated metal produ (deviation from the baseline)	-	-	.6980 (.1135)	(p<.001)	-	-	.2370 (.0236)	(p<.001)
Machinery and equipment (deviation from the baseline)	-	-	.9194 (.1098)	(p<.001)	-	-	.4832 (.0327)	(p<.001)

(Contd...)

Textiles (deviation from the baseline)	-	-	.1366 (.0761)	(p<.074)	-	-	-.1642 (.0239)	(p<.001)
Nonmetallic mineral product (deviation from the baseline)			.1838 (.1141)	(p<.001)	-	-	-.2768 (.0270)	(p<.001)
Paper& paper product (deviation from the baseline)			.3975 (.1602)	(p<.109)	-	-	-.2613 (.0211)	(p<.001)
Pharmaceuticals Medicinal (deviation from the baseline)			.9073 (.1337)	(p<.001)	-	-	.3618 (.0248)	(p<.001)
F-test	996.35	(p<.001)	784.84	(p<.000)	65574.67	(p<.001)	787.28	(p<.001)
Degrees of freedom (error)	216		206		206			
SSE (Sum of squares error)	5.1784		1.5206		1.5206			
Root MSE	.15484		.08592		0.8592		0.0892	
R2	0.9326		0.9802		0.9998			
Adjusted R2	0.9317		0.9790		0.9998			
N	220		220		220		220	

Source : Author's Calculation.

the result outcome denotes an inflated R^2 (0.9998 > 0.9808) and F (very large 65574.67). Unsurprisingly, getting R^2 of 0.9998 may not be similar. The reason behind this is that the X matrix does not permit the suppressed intercept, which has a column vector of 1 and produces incorrect sums of squares of the model (Uyar & Erdem, 1990:298). However, the sum of squares of errors (SSE) and their standard errors of parameter estimates are correct and the same in any LSDV.

Estimating LSDV2 includes the intercept and all dummies but with a restriction that the sum of parameters of all dummies are equal to zero. The functional form of LSDV2 is,

Gross Industrial Value Added$_i$

$= \beta_0 + \beta_1$ fuel$_i$ $+ \beta_2$ fixed capital$_i$ $+ \beta_3$ labour$_i$ $+ \mu_1 d_1 + \mu_2 d_2 + \mu_3 d_3 + \mu_4 d_4 + \mu_5 d_5 + \ldots\ldots + \mu_{11} d_{11} + \varepsilon_i$

Subject to : $\mu_1 d_1 + \mu_2 d_2 + \mu_3 d_3 + \mu_4 d_4 + \mu_5 d_5 + \ldots\ldots + \mu_{11} d_{11} = 0$

All the above results end up fitting the same model and giving the same parameter estimates of predictors and their standard errors. Approaches like LSDV and LSDV2 give accurate R^2 while LSDV1 gives inflated R^2 but unfit SSE and MSE. The actual difference between above approaches rests on the outcome between the intercept and dummy coefficients. The LSDV reveals the dummy coefficient and the extent to which the actual intercept of the group deviates from the overall baseline intercept. The null hypothesis of the t-test is that the deviation from the reference group is zero. Whereas, the LSDV2 approach denotes that its actual parameter is far from the average group effect (Suits 1984:178), therefore, in this case, the null hypothesis is that the deviation of a group intercept from the average intercept is zero. On summarizing the above three approaches, it can be said that LSDV is a model that fits the best. It is because of constructing the LSDV model, the analysis seems to be less cumbersome.

Table-4 brings the output of pooled OLS and four other fixed estimations (i.e., LSDV .xtreg, .areg & the within effect model), their result is almost the same. However, there is a bit of change in standard error and R^2. Now the question arises as to which estimation is the best. When we go with the outcome of the LSDV, it seems to be better in estimation than others. However, it is imperative to find out the significance of the fixed effect of LSDV for which F-test has been conducted. The F-test reveals that the null hypothesis of this F-test is that all dummy parameters except for one are zero : $H_0 : u_1 = \ldots u_{n-1} = 0$.

The F-test conducted for fixed effects was 49.55. It looks large enough to reject

Table-4 : Comparison of OLS, LSDV, and Within Effect Models

	OLS	LSDV	.xtreg	.areg
Fuel consumed	-.47287** (.0526)	.58814** (.0680)	.5881** (.0680)	.5881** (.0680)
Fixed capital	1.2553** (.5090)	.29315** (.0740)	.2931** (.0740)	.2931** (.0740)
Labour	.22338** (.0316)	.52091** (.1348)	.5209** (.1348)	.5209** (.1348)
Overall intercept (deviation from the baseline) (baseline intercept)	-.73070** (.1386)	-2.6169** (.6415)	-2.0648 (.5207)	-2.0648** (.5207)
Basic Metal (deviation from the baseline) (dummy)	-	.2364** (.1253)	-	-
Beverages(deviation from the baseline) (dummy)	-	.9288** (.1824)	-	-
Chemical Products (deviation from the baseline) (dummy)	-	.4759** (.1281)	-	-
Coke& refinery product (deviation from the baseline) (dummy)	-	1.188** (.2298)	-	-
Fabricated metal product (deviation from the baseline) (dummy)	-	.6980** (.1135)	-	-
Machinery and equipment (deviation from the baseline)(dummy)	-	.9194** (.1098)	-	-
Textiles (deviation from the baseline) (dummy)	-	.1366** (.0761)	-	-
Nonmetallic mineral product (deviation from the baseline) (dummy)	-	.1838*** (.1141)	-	-
Paper & paper product (deviation from the baseline) (dummy)	-	.3975** (.1602)	-	-
Pharmaceuticals Medicinal (deviation from the baseline)	-	.9073** (.1337)	-	-
F-test	996.35	784.84	1068.54	1068.54
Degrees of freedom (error)	216	206		568

(Contd...)

SSM (Model)			23.663	1.5206
SSE (Sum of squares error)	5.1784	1.5206	.5206	.3178
Root MSE(SEE)	.15484	.08592	.0859	0.0859
R2	0.9326	0.9802	0.9396	0.98
Adjusted R2	0.9317	0.9790	0.9358	0.97
F-test (fixed effect)	-	-	49.55	49.55
N	220	220	220	220

Standard errors in parenthesis; Statistics hidden in macros are italicized; Statistical significance : *<.05, **<.01, **<10

Source : Author's Calculation.

the null hypothesis, which indicates that a fixed effect model is appropriate to deal with the data using random effect estimation. Unlike the fixed effects model, the random effect estimation assumes the variation across industries to be random and uncorrelated with the predictor. In that case, it permits time-invariant variables to play a vital role as explanatory variables.

Analysis through Random Effect Model

The random effects model is :

$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it}$

u_{it} = Between entity error

ε_{it} = Within entity error

The random effect model is worked out to solve the questions, whether differences across industries are in any way influenced by the dependent variable "Industrial Gross Value-Added".

This random effect estimation also, seemingly fits the data better with the pooled OLS model. Whereas, the F statistic shows an increase from 996.35 to 2483.83 ($p<0.0001$); SSE (sum of squares due to error or residual) has changed from 5.1784 to 0.0859; and R^2 shows a reduction from 0.9326 to 0.9321. However, overall the model fits the data better. Hence, the Breusch and Pagan Lagrangian multiplier tests were used to check the significance of the random variables.

Breusch and Pagan Lagrangian Multiplier Test

Breusch and Pagan Lagrangian Multiplier Test for random effects result with a larger Chi-squared (1)150.48, appears strong enough to reject the null hypothesis in favour of the random group effect model ($p<0.001$) which further indicates that the random effect model is appropriate to deal with the data.

Table-5 : Comparison of OLS and Various Random Effect Estimations

	OLS	Random Effect	.xtmixed	.xtregmle
Fuel consumed	-.47287** (.0526)	.3575** (.0728)	.5649** (.0672)	.5649** (.0681)
Fixed capital	1.2553** (.5090)	.6386** (.0675)	.3633** (.0700)	.3633** (.0755)
Labor	.22338** (.0316)	.0515** (.0731)	.3654** (.1176)	.3654** (.1313)
over all intercept	-.73070** (.1386)	-.2482** (.2909)	-1.467** (.465)	-1.467** (.516)
F, Wald, LR test	996.35	2483.83	3239.05	-
SEE	5.1784	.0859	.0856	.0856
$\hat{\sigma}_{\mu}$	-	.0883	.3268	.3268
Θ	-	.7874	-	-
R2	0.9326	0.9321	-	-
Adjusted R2	0.9317	-	-	-
LR Test	-	-	194.15	593.70

Standard errors in parenthesis; Statistical significance : *<.05, **<.01

Source : Author's Calculation .

Hausman Specification Test

Since the outcome results of fixed and random effects are significant, there emerges decision-making as to which model is better than the other. The Hausman specification test is worked out to ascertain the most significant estimation. The Hausman test checks if the individual effects are not-correlated with other regressors in the model. In case, the individual effects are correlated with any other regressor, the random effect model violates Gauss-Markov assumption and is no longer Best Linear Unbiased Estimate (BLUE). It is because individual effects are part of the error term in a random effect model. Therefore, if the null hypothesis is rejected, a fixed-effect model is favoured over the random effect model. In a fixed-effect model, individual effects are parts of the intercept and the correlation between the intercept and regressors does not violate any Gauss-Markov assumption; a fixed effect model is still BLUE.

Table-6 : Hausman Specification Test

	(b)	(B)	(b-B)	Sqrt(diag(V_b-V_B))
	Random	**Fixed**	**Difference**	**S.E.**
Fuel consumed	.3575825	.5881467	-.2305642	.0261428
Fixed capital	.6386944	.2931516	.3455428	-
Labour	.0515636	.5209128	-.4693493	-
	chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)			
Chi-squared	50.80 **	(p<.001)		

Source : Author's Calculation.

The Hausman Specification test returns 50.80, which is statistically significant at 0.01 significance as the P-value is ($p<0.001$). Moreover, the data succeeds in meeting the asymptotic assumptions. Here, the chi-squares score is large enough to reject the null hypothesis;

H_0 : A random effect model rather than a fixed-model is appropriate

H_1 : The Random effect model is not appropriate.

We may now conclude that the 'Fixed' effect model is better than its 'Random' counterpart.

Conclusion

The above investigation into the eleven groups of manufacturing industries reveals that there is a positive relationship between fuel consumption and gross industrial value-added. The results have been obtained by conducting various models. Among the fixed and random models, the fixed-effect model fits the data better and results in outcomes that are significant and effective for economic theories. The slope coefficient of the fuel consumed under fixed-effect model indicates that per unit increase in fuel consumption leads to an increase in industrial gross value-added by 0.58814 at 1 per cent level of significance with the R^2 of 0.9802. The slope coefficient of fixed capital drives the industrial gross value-added to change by 0.29315 for every one unit change in fixed capital. Similarly, the coefficient of the labor influences the industrial gross value-added by 0.52091 for every unit change in labour. The statistical representation of the slope coefficient of fuel consumption is large enough to impact on the industrial gross value-added. Hence, there has been a substantial influence of energy on industrial gross value-added.

Table-7 : Comparison of Pooled OLS, Fixed Effect and Random Effect Models Results

	OLS	Fixed Effect	Random Effect
Fuel consumed	-.47287** (.0526)	.58814** (.0680)	.3575** (.0728)
Fixed capital	1.2553** (.5090)	.29315** (.0740)	.6386** (.0675)
Labour	.22338** (.0316)	.52091** (.1348)	.0515** (.0731)
over all intercept	-.73070** (.1386)	-2.6169** (.6415)	-.2482** (.2909)
F, Wald, LR test	996.35	784.84	2483.83
SEE	5.1784	1.5206	.0859
$\hat{\sigma}_{\mu}$	-	-	.0883
Θ	-	-	.7874
R2	0.9326	0.9802	0.9321
Adjusted R^2	0.9317	0.9790	-

Standard errors in parenthesis; Statistical significance: * <.05, **<.01

Source : Author's Calculation.

References

Abbas, F., & Choudhury, N. (2013). Electricity consumption-economic growth nexus : an aggregated and disaggregated causality analysis in India and Pakistan, *Journal of Policy Modeling*, 35(4), 538-553.

Bildirici, M.E., & Bakirtas, T. (2014). The relationship among oil, natural gas and coal consumption and economic growth in BRICTS (Brazil, Russian, India, China, Turkey and South Africa) countries, *Energy*, 65(C), 134-144.

Georgescu-Roegenm, N. (1975). Energy and economic myths, *Southern Economic Journal*, January, 41(3), 347-381.

Ghosh, S. (2002). Electricity consumption and economic growth in India. *Energy Policy*, 30(2), 125-129.

Government of India (2019). *Economic Survey.* Department of Economic Affairs, Economic Division, Ministry of Finance, New Delhi.

Chandran Govindaraju, V.G.R. & Tang, C.F. (2013). The dynamic links between CO2 emissions, economic growth and coal consumption in China and India. *Applied Energy,* 104(C), 310-318.

Hondroyiannis, G., Lolos, S., & Papapetrou, E. (2002). Energy consumption and economic growth : Assessing the evidence from Greece Energy Economics, *Journal of Science, Technology and Sustainable Development*, 10(4), 278-287.

Karanfil., & Thomas, J. (2007). Sectoral energy consumption by source and economic growth in Turkey, *Energy Policy*, 345(11), 5447-5456.

Kraft, J., & Kraft, A. (1978). On the relationship between energy and GNP, *Journal of Energy and Development,* 3(2), 401-403.

Mehdi, A., & Rafaa, M. (2014). Energy consumption and industrial production : Evidence from Tunisia at both aggregated and disaggregated Levels, *Journal of Knowledge Economics,* 6, 1123-1137.

Nain, M.Z., Ahmad, W. & Kamaiah, B. (2017). Economic growth, energy consumption and CO_2 emissions in India : A disaggregated causal analysis, *International Journal of Sustainable Energy,* 36(8), 807-824.

Paul, S., & Bhattacharya, R.N. (2004). Causality between energy consumption and economic growth in India : a note on conflicting results, *Energy Economics,* 26(6), 977-983.

Pindyck, R.S. (1979). The structure of world energy demand, *M.I. T.Press*, Cambridge.

Roegen, R.M. (1974). Intergenerational equity and exhaustible resources, *Review of Economic Studies 41 : Symposium on the Economics of Exhaustible Resources*, 41(5), 29-45.

Sari, R., & Soytas, U. (2003). Energy consumption and GDP : causality relationship in G-7 and emerging markets, *Energy Economics,* 25(1), 33-37.

Seema, N., Thai-Ha Le, Rath, B.N., & Doytch, N. (2019). Petroleum consumption and economic growth relationship : evidence from the Indian states, *Asia-Pacific Sustainable Development Journal*, 26(1), 21-65.

Singh K., & Vashishta (2020). Does any relationship between energy consumption and economic growth exist in India? A var model analysis, *OPEC Energy Reviews*, 44(3), 334-347.

Tiwari, A.K., & Eapen, L.M. & Nair, S.R. (2021). Electricity consumption and economic growth at the state and sectoral level in India : Evidence using heterogeneous panel data methods. *Energy Economics,* 94(C), 105064.

Tiwari, A. (2011). Energy consumption, CO_2 emissions and economic growth : evidence from India. *Journal of International Business and Economy*, 12(1), 85-122.

Vidyarthi, H. (2013). Energy consumption, carbon emissions and economic growth in India. *World Journal of Science, Technology and Sustainable Development,* 10(4), 538-553.

Yu, E.S.H., & Erol, U. (1987a). Time series analysis of the causal relationships between U.S. energy and employment, *Resources and Energy,* 9(1), 75-89.

Y.U, L., & Glasure, A.R. (1998). Co-integration, error correction, and the relationship between G.D.P. and energy : the case of South Korea and Singapore, *Resource and Energy Economics,* 20(1), 17-25.

Zamani, M.(2007). Energy consumption and economic activities in Iran, *Energy Economics*, 29(6), 1135-1140.

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Municipal Finances of Urban Local Bodies of Jammu and Kashmir : An Overview

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Urban Local Bodies (ULBs) act as urban service providers in city areas across the world. Globally, these institutions of governance are known by different nomenclature. In developing countries like India, ULBs face a lot of challenges in managing their finances because of inadequate financial resources at their disposal. Whereas, their civic responsibilities are increasing as the urban population has been increasing day-by-day. The present study seeks to analyse the municipal finances of the urban local bodies of Jammu and Kashmir. The study used a qualitative research approach followed by a descriptive research design. Findings from the study revealed that ULBs of J&K are lagging in terms of providing good governance to the local citizens. The finance-related aspects of ULBs are not up to the mark. Central grants were not released to ULBs several times, as the traditional budgeting practices were followed in the financial devolution process. The aforementioned factors have contributed to the deterioration of the urban infrastructure in particular and Urban governance in general in J&K.

Keywords : Local Government, Municipal Finance, Financial Administration, Urban Governance.

Introduction

Organisations are an amalgamation of men, materials and money; each having its own importance and each playing a vital role in sustaining them. However, their proper management and interconnection are prerequisites for the success of an organisation, whether public or private (Zenger & Folkman, 2019). Finance acts as fuel for the engine of organisations. In the field of public administration, finance is an integral part of the administration and without sound finance and sound administration, no organisation can achieve its determined objectives (Bahrisales & Rasooli, 2019). Hence, financial administration is necessary at all levels of administration, viz. central, state, and local. Finance has been considered the 'Fuel of Administration', by virtue of which the machinery of government runs. Sound financial administration is

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the mantra of efficient administration of government operations (Bisogno et al., 2019). Kautilya in 'Arthashastra', stated that 'the entire administration of the country can be controlled through financial administration. So, utmost priority must be given to it (Manrai & Goel, 2017). Financial administration relates to the system which generates, regulates and distributes the monetary resources needed for the sustenance and growth of an organisation. In this background, financial administration is similar to the circulatory system in complex living organisms (Thavaraj, 1978). The government at all levels has to satisfy their needs and aspirations, and for this, it requires a lot of resources in monetary form (Kröger, 2019). Financing the expenditure of the government is now a matter of universal concern. What is true of the finance for the Central and State governments is also true and the same for local governments like Municipalities, Municipal Councils and Municipal Corporations. Without finance, the local administration would come to a standstill and democracy at the grass-root level will become meaningless. Finance, thus, constitutes the lubricant for the wheel of the local government. Without financial independence, a local authority leads to a subdued life (Rai & Varmani, 2007).

India, being a federal country, has three different tiers of government viz., Central, State and Local government. As per the provisions of powers defined under the Indian Constitution, all these three levels of government have different responsibilities and functions to perform to raise the resources which they require. The financial issues at the centre and state levels have more stability to some extent. However, the financial matters at the local level, especially in urban local governments, remain in doldrums, despite having constitutional status provided by the 74th Constitutional Amendment Act (CAA) (Bhattacharyya & Bandyopadhyay, 2012). Urban Local bodies in India face a lot of challenges in managing their finances due to unlimited demand for services and limited financial resources at their disposal.

Municipal financial administration refers to the process by which urban local bodies manage their day-to-day activities with the available financial resources. This process includes all sources of revenue from which local bodies earn- like grants from Central Government, State Government, taxes, fines, penalties, user charges, borrowings, etc. and how collected income is being spent on developmental activities in urban areas is called financial administration of urban local bodies.

Background of the Study Area

Jammu and Kashmir (J&K) was a princely state at the time of Independence of India in 1947. Armed tribesmen and troops from Pakistan's North-West Frontier Province crossed the border into Kashmir on 22 October 1947, aiming to capture Srinagar (summer Capital of J&K). The then Maharaja Hari Singh was unable to deal with this invasion and signed an Instrument of Accession with India on 26 October 1947. Thereby, J&K became the state of India (Kousar & Bhadra, 2021). Since then, J&K has been an integral part of India. On 5 August 2019, with the 'Reorganisation of Jammu and Kashmir Act 2019', J&K was divided into two separate Union Territories (UTs), the UT of Ladakh comprising two districts – Leh and Kargil, and the Union Territory of J&K, within which consists of administrative provinces, namely Jammu Province and Kashmir Province, each having ten districts.

The genesis of urban local bodies in J&K can be traced back to 1886 when the then Maharaja of J&K established two Municipal Committees for Jammu city and Srinagar city under J&K Municipal Act No. 16 of 1886 (Ali, 2018). These two municipal bodies were placed under the State Government, under the control of nominated officials. In 1913, with a landmark enactment, the provision for elected bodies was introduced at the urban local level (Ali, 2018). In 1956, both these municipalities were converted into Municipal Councils and finally upgraded to Municipal Corporations under the Jammu and Kashmir Municipal Corporation Act (2000). Besides, some other small urban local bodies were also established from time to time. At present, the newly created Union Territory of J&K has seventy-seven urban local bodies.

Review of Select Literature

The 21st century has witnessed a great shift of population from rural areas to urban areas irrespective of developed and developing countries across the world. This move has exerted a tremendous burden on the urban local bodies to provide a range of services from water to urban infrastructure and social justice at large. To meet the emerging urban challenges and to fulfil the aspirations of people therein, municipalities need adequate revenue and new sources of earning, and a proactive approach to municipal financial management (UN Habitat, 2009). Keeping in view the aforementioned issues and challenges, the review of the present study has been divided into the following sub-themes :

Urban Local Bodies and their Financial Scenario

Across the world, municipalities which are part of the local government, have been established with different nomenclature and are entitled to manage the affairs of cities. With the expansion of cities, economic activities have also increased, which further enhanced their contribution to the state revenue. Hence, modern cities are considered engines of economic growth (Chettry & Surawar, 2021). Urban local government is the level where the real and most effective economic activities and political exchange take place, which further acts as a driver of socio-economic transformations. Due to this, municipal finance has become the economic basis for such an exchange and an essential state for the harmonious and sustainable development of cities (Morunova et al., 2021). Yet, the irony of a developing nation like India is that they have ignored the municipal government and their finances, by placing them under the control of State governments (Bhattacharyya & Bandyopadhyay, 2012). The 74th Constitutional Amendment Act 1992, has given constitutional status to Indian ULBs. Consequently, ULBs were assigned eighteen functional items to perform under Article (243-W). But in the same legislation, no Article or provision was specified for the finance of ULBs (Bajpai, 2016). Urban areas in India being hotspots of wealth and income, face structural and service delivery challenges due to a lack of financial resources within the system. (Sharma & Allan, 2019).

Municipal Finance under Goods and Services Tax (GST) Regime

With the commencement of the Goods and Services Tax (GST) in 2017, many former taxes that were used to fund municipalities have been replaced. ULBs all over the states suffered a lot with this indirect taxation reform (Sharma & Allan, 2019). India's largest ULB, the Municipal Corporation of Greater Mumbai (MCGM), had to abolish Octroi, which had contributed almost 35 per cent of its annual total revenue on average. The loss can be analysed by the statistics available on the same; in 2015-16, the MCGM from Octroi earned ₹62,760 million, in 2016-17, ₹72,440 million, and in 2017-18, subsumed under GST (Mankikar, 2018). Moreover, the Indian Council for Research on International Economic Relations (ICRIER), in its report, highlighted that the total municipal revenue declined as per cent of Gross Domestic Product (GDP) from 0.49 per cent in 2012-13 to 0.45 per cent in 2017-18. Besides, the capacity of ULBs to raise their source of revenue, as per cent of the country's GDP, has also

taken a hit, declining from 0.33 per cent in 2012-13 to 0.23 per cent in 2017-18 (Gupta, 2020) thereby, rendering a loss of 0.1 per cent. Insufficient financial resources are reflected in the deprived public services delivery mechanism at the grass-root level, be it providing water or electricity, cleaning the streets, and removal of the garbage, etc. (Habitat, 2015).

Municipal Borrowing

Municipal borrowings are mostly obtained by issuing bonds or securities to investors. In developing countries like India, this process reached its zenith in 2005-06, when the municipalities raised the amount to ₹3,000 million, compared to ₹750 million in the year 2000 (Eltrudis & Monfardini, 2020). But within a year sudden decline was reported in 2007, wherein the total turnover was ₹300 million (Banerji et al., 2013). On the other hand, the urban population is rising day-by-day which further exerts pressure on the ULBs to provide basic amenities and civic services at the doorsteps of its citizens (Agarwal, 2020). However, the current urban infrastructure is not in a position to cater to the emerging urban issues and challenges. As per the Economic Survey of 2019-20, India requires a $1.4 trillion investment in developing urban infrastructure by 2024-25. Creating and building this required urban infrastructure requires multiple new sources of finance. In this regard, in accessing the borrowing option, the main challenges encountered by most of the smaller urban bodies are low credit worthiness (Sharma, 2020).

From the available literature, it has been observed that several studies have been conducted on different aspects of municipal bodies, like urbanization, urban governance and municipal finances. Nevertheless, relatively limited studies have been carried out on the financial position of ULBs in the study area. Among the few studies, an attempt has been made in this paper to emphasise several facets of J&K's municipal finance.

Research Methodology

The main objective of this paper is to examine the issues and challenges of municipal finances in Jammu and Kashmir and to understand the reasons behind them. The present study uses a qualitative research approach followed by a descriptive research design. The total population of the universe is seventy-seven, i.e. Two municipal corporations, namely Jammu Municipal Corporation (JMC) and Srinagar Municipal Corporation (SMC), 19 municipal councils, and 55 municipalities. Both corporations are comprised of

75 municipal wards, with varying populations. JMC serves 657,314, whereas SMC serves 1,180,570 inhabitants (Kuchay et al., 2016). Each municipal council has a population of almost 30,000. Moreover, Jammu province has 27 municipal committees and Srinagar province has 28 municipal committees. The data pertaining to this study has been collected from secondary sources, wherein the required data were extracted from the official websites of the Department of Finance and the Department of Housing and Urban Development, Government of J&K. Moreover, the data was collected from the budget archive, the Directorate of urban local bodies of both the provinces, Jammu Municipal Corporation and Srinagar Municipal Corporation, etc.

Issues and Challenges of Urban Local Bodies of J&K

From the available secondary data, it can be inferred that the municipal local bodies across the study area are facing numerous problems in their daily management, such as;

Tardy Finance and Minimal Attention to ULBs : ULBs of Jammu and Kashmir remain highly dependent upon the higher tier of government for financial assistance. Nonetheless, these ULBs do not have the power to impose property tax, which is the biggest source of their revenue, since their inception. Moreover, the legislation like the J&K Municipal Corporation Act, 2000, and the J&K Municipal Act, 2000 have not provided any provision for it (Daily Excelsior, 2020). On the other hand, central grants are also the biggest source of revenue at the ULBs level, but due to the non-conduction of ULB elections from 2010 to 2018, ULBs of J&K have lost ₹169.28 crore assistance under the 13th Finance Commission (Comptroller & Auditor General of India, 2015). Despite ULBs facing these problems, the Centre has also stopped the financial assistance of ₹125.30 crore under the 14th Finance Commission (Indian Express, 2016). This negligence has not stopped here, even the plan of allocation of local bodies has also fallen to 0.33 per cent during 2015-16 from 15.70 per cent during 2013-14. The Table mentioned below depicts the grants given to ULBs in the study area.

Table-1 presents the details of the financial devolution to the various administrative agencies of the urban local bodies of Jammu & Kashmir. Collectively, the total value (T.V) in the financial year 2015-16 was 872536.8 and the mean value (M.V) of this devolution was 174507.4, while in the 2016-17 financial year, it was 129967.7 and the M.V was 25993.54. Likewise, in 2017-18, T.V was 134697, in 2018-19,

Table-1: Financial Devolution to Urban Local Bodies of Jammu and Kashmir from 2015 to 2020

S.No.	Organisation	2015-16	2016-17	% Change in 2016-17	2017-18	%Change in 2017-18	2018-19	% Change in 2018-19	2019-20	% Change in 2019-20	Total Value	Mean Value
1	DHUD	61556.3	70381.2	14.3363	74497	5.84781	73248.4	-1.676	81162.5	10.8046	360845.4	72169.08
2	SMC	20166.5	23098	14.5368	23600	2.17326	23281	-1.3516	3330.83	-85.693	93476.34	18695.27
3	JMC	12542.9	14513.8	15.7137	14500	-0.0952	14330.8	-1.1668	12692.5	-11.432	68580.01	13716
4	D. ULBs Srinagar	11442.1	13157.1	14.988	13200	0.32629	13157.1	-0.3252	2293.72	-82.567	53249.98	10650
5	D.ULBs Jammu	766829	8817.61	14.988	8900	0.93438	8817.61	-0.925730	NA	NA	793364.2	198341.1
	Total Value	872536.8	129967.7	74.56271	134697	9.18652	132834.9	-4.51964	99479.59	-168.887	-	-
	Mean Value	174507.4	25993.54	14.91254	26939.39	1.837304	26566.98	-0.90393	19895.92	-33.7774	-	-

Source : Department of Housing and Urban Development, Department of Finance J&K, Srinagar Municipal Corporation, Jammu Municipal Corporation, Director Urban Local BodiesJammu, andDirector Urban Local Bodies Srinagar.

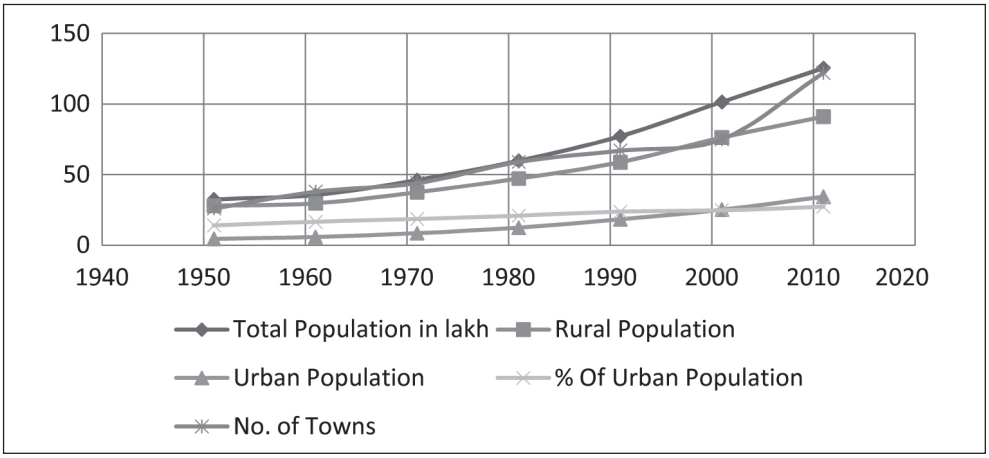
132834.9, and 2019-20, 99479.59, whereas, M.V in 2017-18, stood at 26939.39, 2018-19, 26566.98, and 2019-20, 19895.92. On the other hand, the percentage change in 2016-17, from the immediate previous financial year, was 74.56271 but in 2018-19, and 2019-20, -4.51964 and -168.8887 respectively. Horizontally, the Table shows the financial allocation to each agency from 2015-16 to 2019-20 with percentage change, Total Value (T.V) and Mean Value (M.V) to each agency. Precisely, from the above data, we can infer that the grants provided to the Department of Housing and Urban Development (DHUD) over the last five years are increasing at a slow pace. Even in the year 2018-19, the total percentage has decreased drastically. The department has the responsibility to manage and regulate ULBs in J&K and it is also responsible for developing the urban infrastructure at large in the study area. On the other hand, the data pertaining to Srinagar Municipal Corporation (SMC) also fluctuates and shows a decline two times since 2015, i.e., 2018-19 and 2019-20. The decline has been experienced in the total percentage of allotted grants. JMC has also experienced a decline in its financial allocation three times since 2015, viz., 2017-18, 2018-19 and 2019-20. The two Directorates- Director, Urban Local Bodies, Jammu and Director, Urban Local Bodies, Srinagar, which are entrusted with the responsibility of managing and controlling municipalities and municipal councils of both the provinces of J&K have also experienced a decline in the grants-in-aid in the two consecutive financial years, i.e., 2018-19 and 2019-20. Most of the urban areas of the study area are under the control of these two directorates.

Name-Sake Autonomy : In J&K, the story of the urban local government's autonomy is quite different for various reasons. The 74th CAA Act (1992), which accords constitutional status to urban local government,has not been implemented under the pretext of Article-370, (Panwar, 2019). Fixing the rates of civic services and other user charges was never in their domain. Until 2015, ULBs performed only eight functions, but through the enacted legislation, they have been provided with 18 functions to perform. Secondly, various sectors and jurisdictions, like the education sector, health sector, water supply, roads, etc., are originally and legally under ULBs' jurisdiction at the urban local level. However, these functions were not handed over to ULBs and even after the abrogation of Article-370, these areas and sectors have not been given to municipalities at large, like in other parts of the country.

Urbanization : Nevertheless, the urban population of the newly created union territory of Jammu and Kashmir displayed a lower level of urbanization, that is 27.38 per cent as compared to the national level of 31 per cent (Census 2011). However, the overall level of urbanization in J&K has increased from a mere 14.05 per cent in 1951 to 27.37 per cent in 2011, witnessing an almost two-fold increase in this period in all the 20 districts of J&K, and Srinagar district stood first with 98.6 per cent urban population, followed by Jammu district with 50 per cent urban population. However, the Ramban district, composed of 4.16 per cent of the urban population and Shopian with 6.5 per cent, is the least urbanized district (Khan & Mondal, 2018). The rapid increase in urban population across the J&K has put great pressure on the urban local bodies which are meant to provide civic services. On the other hand, past experiences have shown that J&K in general and ULBs, in particular, were merely dependent on state grants as other sources of municipal earnings are very meagre (Rai, 2019). Under the prevailing circumstances, it is very difficult to cope with urban challenges as well as to create and build the required urban infrastructure. Table-2 shows how J&K has undergone a population transition.

Table-2 : Jammu and Kashmir Aggregate Population along with its Rural and Urban Population between 1951 and 2001

(in Lakhs)



Source : Census of India 1961 -2011.

* In 1951, the J&K was excluded from the Census and its population was estimated on the basis of past Census figure.

* In 1991, the census was not held in J&K due to disturbed conditions.

Non-Utilization of Funds : The Comptroller and Auditor General of India (C&AG) has issued several notices to the Government of J&K over non-utilization certificates within the stipulated period. From 2014-15 to 2018-19, the ULBs of J&K failed to utilize the provided grants in a time-bound manner. In a precise manner, JMC was given ₹821.56 crores and SMC ₹578.89 crores. Similarly, the Directorate of ULBs, Jammu was also given ₹331.49 crores and Director ULBs Srinagar was given ₹312.14 crores (Verma, 2021). Moreover, the CAG has also asked the Government of J&K to consider discontinuing grants to these bodies as this is a grave violation of financial rules.

Discussion

From the analysis of the above-mentioned data many alarming realities have surfaced which have proven to be drastically detrimental to urban governance at large. Despite the adoption of the National E-Governance Plan 2006, and Digital India 2015, the websites of most municipal bodies have not been created. Due to this, the amount of funds given by the higher tier of government and the amount earned by the municipal bodies remains unknown. Whereas, in modern times, organisations, whether public or private, have linked their activities with an electronic mechanism which has the potential to bring, 'Simple, Moral, Accountable, Responsive and Transparent (SMART) governance. On the other hand, the ULBs, which have created their own websites, have not been updated in the past few years. This shows that the E-governance mechanism is not being used in municipal bodies, which acts as an impediment to providing good urban governance in the study area. The adoption of e-governance in municipal bodies would not only streamline the municipal services, revenue collection, expenditure management, dissemination of public information etc., but also has the potential to increase the tax base of municipalities, minimize tax evasion, direct benefit transfer, simplification of collection of user charges, fines, and administrative fees, etc., which can eventually enhance the fiscal health of ULBs (Giribabu et al., 2018). Furthermore, the traditional type of budgeting (incremental budgeting) is being used in the municipal annual financial process. Hence, modern techniques like performance-based budgeting and zero-based budgeting are not being used, which are very optimal nowadays in public and private organisations (Hammer, 2016). Further, the Public-Private Partnership (PPP) has disappeared from the study area through which municipal bodies can share their burden and can save their considerable

finances. At the same time, in other municipalities of the country, and across the world, this PPP approach is widely used in availing the expertise of other stakeholders in not only managing municipal solid waste management, municipal accounting and auditing and municipal civic services delivery mechanisms, but also saving their income for the development of their core areas (Devkar & Kalidindi, 2013). As far as the financial pattern is concerned, the non-conduct of urban local body elections has shown that ULBs have lost a chunk of central grants in the previous years. It is quite obvious that it has hurt the urban infrastructure at large in the study area. ULBs were always under the control of the state legislature, due to which they failed to obtain and collect appropriate user charges and other sources of earning. In short, the financial position of ULBs is not stable due to the minimal attention of the authorities. As a result, ULBs are not authorised to levy even a property tax. Moreover, state grants are not being provided appropriately (Basu, 2006). In a major finding of this study, it is observed that higher echelons of governments are not following universal patterns of financing to municipal bodies. In both the provinces, in the financial devolution process, authorities have nowhere mentioned which criteria are to be taken into consideration while financing ULBs. Their sources of earnings are very meagre, even the small municipalities rely on grants-in-aid to pay the salaries of their employees. The ULBs should find new means of earning to lead city areas towards growth and development and eventually act as an engine of growth (UN Habitat, 2009). In other parts of the world, it is the city area that contributes a major chunk of revenue to the nation's GDP. Like in Brazil, it is 7.4 per cent, in South Africa 6 per cent, and in India, it is only 1.03 per cent, (Kumar & Geneletti, 2015). However, here in the study area, ULBs, which have the responsibility to manage, have not even performed the 18 tasks for a very long time. Even the erstwhile state of J&K mostly remained dependent on central grants and has received 10 per cent of all central grants given to states over the 2000-2016 period, despite having only one per cent of the country's population. In contrast, Uttar Pradesh makes up about 13 per cent of the country's population, but has received only 8.2 per cent of central grants from 2000-2016. That means J&K, has a population of 12.55 million according to the 2011 Census, received ₹91,300 per person over the last sixteen years, while Uttar Pradesh only received ₹4,300 per person over the same period (Raghavan, 2016). This shows that the money received was not

properly spent and like all other sectors, ULBs are also neglected and barred from implementing the 74th CAA 1992, which gave constitutional status to ULBs. Consequently, urban governance was compromised on every front. Thus, the ULBs are in need of financial, administrative and functional autonomy so that democracy at the grass-root level can flourish. Also, there is a need to implement the 74th Constitutional Amendment Act (CAA) 1992, in all urban local bodies of J&K. Some provisions in line with the 74th CAA have been implemented only in two Municipal Corporations, whereas, 55 municipalities and 19 municipal councils have been barred from these changes.

Conclusion

The ULBs are the basic administrative units which have direct contact with the local masses and are well acquainted with the issues of the common masses. The ULBs are the institutions to strengthen the democracy and ethos of local self-government at the grass-root level in India. But financially, these institutions are dependent on the higher tier of government, which eventually deteriorated the urban governance process. This dependency should be minimized by strengthening their fiscal capacity and by recognising new means of earning. Moreover, there is a need for the fortification of municipal infrastructure in the study area to cope with the emerging urban issues and increasing urban population. The mechanism of e-governance should be implemented in such a manner so as to lead to an increase revenue, minimization of tax evasion, user charges evasion, and delay in the collection of administrative fees, fines, penalties, user charges, and advertisement charges, etc.

References

Agarwal, K. (2020, August 13). *India's population will be 1.52 billion by 2036, with 70% of increase in urban areas*. The Wire. https://thewire.in/government/india-population-growth-government-report-2036-projections-urban-migration.

Ali, R. (2018, January 8). *Jammu and Kashmir civic bodies and panchayat raj*. Social Science Research Network. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3098361

Bahrisales, J., & Rasooli, F. (2019). Top strategies for human resources management in the public sector studied : West Azarbaijan administration of economic affairs and finance. *Public Policy in Administration*, 10(35), 99-111. https://ijpa.srbiau.ac.ir/article_15116_en.html

Bajpai, B.K. (2016). *Functional and financial devolution to urban local bodies and their performance in India*. Eleventh Himalayan Policy Research Conference (HPRC 2016), Madison, Wisconsin.

Banerji, S., Gangopadhyay, K., Thampy, A., & Wong, Z. (2013, April). *Constraints and prospects of financing via municipal bonds in India : An analysis with case studies*. International Growth Centre. https://www.theigc.org/wp-content/uploads/2013/04/Banerji-Et-Al-2013-Working-Paper.pdf

Basu, S. (2006). Structural problems in financing development: Issues relating to India. *International Review of Applied Economics*, *20*(1), 85–101. https://doi.org/10.1080/02692170500362793.

Bhattacharyya, S., & Bandyopadhyay, G. (2012). Urban local bodies in India : Financial control for better financial performance. *Theoretical and Empirical Researches in Urban Management*, 7(3), 24-37. http://um.ase.ro/no73/2.pdf

Bisogno, M., Cuadrado-Ballesteros, B., Santis, S., &Citro, F. (2019). Budgetary solvency of Italian local governments : An assessment. *International Journal of Public Sector Management*, 32(2), 122–141. https://doi.org/10.1108/ijpsm-11-2017-0328

Chettry, V., & Surawar, M. (2021). Assessment of urban sprawl characteristics in Indian cities using remote sensing : Case studies of Patna, Ranchi, and Srinagar. *Environment, Development and Sustainability*, 23(8), 11913–11935. https://doi.org/10.1007/s10668-020-01149-3

Devkar, G.A., & Kalidindi, S.N. (2013). Competency development in urban local bodies for implementing public private partnership projects in India. *Journal of Construction Engineering and Project Management*, *3*(2), 35–48. https://doi.org/10.6106/jcepm.2013.3.2.035

Eltrudis, D., & Monfardini, P. (2020). Are central governmentrulesokay? Assessing the hidden costs of centralised discipline for municipal borrowing. *Sustainability*, 12(23), 9932. https://doi.org/10.3390/su12239932.

Giribabu, D., Rao, S.S., Reddy, C.S., & Rao, P. V.P. (2018). Coordination with the help of geographical coordinates : g-Governance in India. *Journal of Map & Geography Libraries*, 14(2), 75-100. https://doi.org/10.1080/15420353.2019.1623149

Gupta, M. D. (2020, January 15). *GST dealt 'big blow' to municipal finances, 15th Finance Commission study finds*. The Print. https://theprint.in/economy/gst-dealt-big-blow-to-municipal-finances-15th-finance-commission-study-finds/349769/

Hammer, J. (2016). The budgetary process with a use of modern approaches in cost management. *ActaUniversitatisAgriculturae et SilviculturaeMendelianaeBrunensis*, 64(3), 939-947. https://doi.org/10.11118/actaun201664030939

Khan, K.A., & Mondal, N.A. (2018). Urbanisation level and pattern in Jammu and Kashmir : A regional and district level analysis. *International Journal of Research and Analytical Reviews,* 5(3), 40-45. https://docslib.org/doc/9114539/urbanisation-level-and-pattern-in-jammu-and-kashmir-a-regional-and-district-level-analysis

Kousar, R., & Bhadra, S. (2021). Border conflict : understanding the impact on the education of the children in Jammu region. *Journal of Peace Education*, 18(1), 48-71. https://doi.org/10.1080/17400201.2021.1873756

Kröger, T. (2019). Local government in Scandinavia : autonomous or integrated into the welfare state? In J. Sipilä (Ed.), *Social Care Services : The Key to the Scandinavian Welfare Model* (1st ed., pp.14-25). Routledge. https://doi.org/10.4324/9780429437519

Kuchay, N.A., Bhat, M.S., &Nuzhat, S. (2016). Population growth, urban expansion and housing scenario in Srinagar City, J&K, India. *Journal of Geography and Regional Planning*, 9(1), 1-11. https://doi.org/10.5897/jgrp2015.0506

Kumar, N. (2019). *Challenges to implement peaceful reorganisation of Jammu & Kashmir*. The United Service Institution of India. https://usiofindia.org/publication/cs3-strategic-perspectives/challenges-to-implement-peaceful-reorganisation-of-jammu-kashmir/

Kumar, P., & Geneletti, D. (2015). How are climate change concerns addressed by spatial plans? An evaluation framework, and an application to Indian cities. *Land Use Policy*, *42*, 210-226. https://doi.org/10.1016/j.landusepol.2014.07.016

Mankikar, S. (2018, September 24). *The impact of GST on municipal finances in India : A case study of Mumbai*. ORF. https://www.orfonline.org/research/44250-the-impact-of-gst-on-municipal-finances-in-india-a-case-study-of-mumbai/#:%7E:text=In%20compliance %20with%20the%20new%20GST%20regime%2C%20the,responsible%20for% 20running%20Mumbai%2C %20the%20country%E2%80%99s%20financial%20capital.

Manrai, R., & Goel, U. (2017). Sustainable economic governance : learning from Kautilya's Arthashastra. *International Journal of Indian Culture and Business Management*, 15(2), 241-253. https://doi.org/10.1504/ijicbm.2017.086091

Morunova, G., Gorbushina, S., &Kolesnikova, T. (2021). Transformation of municipal finance in the context of globalization. *SHS Web of Conferences*, *92*, 30-42. https://doi.org/10.1051/shsconf/20219203019

Panwar, T.S. (2019, September 5). *Implementation of the 74th CAA in Kashmirjust a hoodwink*. News Click. https://www.newsclick.in/implementation-74th-caa-kashmir-just-hoodwink

Raghavan, T.C.A.S. (2016, October 18). *J&K gets 10% of central funds with only 1% of population*. The Hindu. https://www.thehindu.com/news/national/other-states/JampK-gets-10-of-Central-funds-with-only-1-of-population/article14506264.ece

Rai, D. (2019, August 6). *Despite autonomy, massive central aid, successive govts in J&K kept the state poor*. India Today. https://www.indiatoday.in/diu/story/despite-autonomy-massive-central-aid-successive-govts-in-j-k-kept-the-state-poor-1577999-2019-08-06

Rai, N., & Varmani, R. (2007). *Urban governance in India : challenges and prospects*. New Royal Book Company.

Sarma, N. (2020, July 13). *Municipal bonds : A sustainable source of finance for Indian cities*. Observer Research Foundation. https://www.orfonline.org/expert-speak/municipal-bonds-sustainable-source-finance-indian-cities-67646/

Sharma, U., & Allan, S. (2019, February 14). *India's municipal finance systems*. Carnegie India. https://carnegieindia.org/2019/02/14/india-s-municipal-finance-systems-event-7077

Thavaraj, M.J.K. (1978). Finances of local governments in India. *Indian Journal of Public Administration*, 24(3), 617-639. https://doi.org/10.1177/0019556119780305

UN-Habitat. (2015). *The challenge of local government financing in developing countries.* United Nations Human Settlements Programme. https://sustainabledevelopment.un.org/content/documents/1732The%20Challenge%20of%20Local%20G overnment%20Financing%20in%20Developing%20Countries%20_3.pdf

UN-Habitat. (2009). *Guide to municipal finance*. https://unhabitat.org/guide-to-municipal-finance

Verma, M. (2021, April 4). *CAG for 'discontinuing' grants to govtdeptts, bodies with high pendency of UCs*. Daily Excelsior. https://www.dailyexcelsior.com/cag-for-discontinuing-grants-to-govt-deptts-bodies-with-high-pendency-of-ucs/

Zenger, J., & Folkman, J. (2021, August 31). *The 3 elements of trust*. Harvard Business Review. https://hbr.org/2019/02/the-3-elements-of-trust

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BOOK REVIEW

Creating, Building and Sustaining an Institution : A Momentous Journey of Institute of Public Enterprise by R.K.Mishra and P.Geeta, Academic Foundation, New Delhi, 2022, pp.189, Price ₹1,295

Reviewed by : Dr.Prashant Raman, Assistant Professor, Institute of Public Enterprise, Hyderabad, 500007 (email: prashantraman@ipeindia.org)

Reading the book "Creating, Building and Sustaining an Institution" was in itself an enriching experience. The hard work and vision that some of the great men had, in creating this great institution are narrated in great detail by Prof.R.K.Mishra and Dr.Geeta Potaraju.

In the book, the authors have described how in 1963, in one of the seminars on "Management of Public Sector Enterprises" held at Osmania University (OU), which was attended by senior policymakers from Central and State governments and many eminent personalities from public and private sectors, the idea of setting up a specialized institute to train public sector personnel was mooted which led to the establishment of Institute of Public Enterprise (IPE) in 1964. The book encompasses 7 chapters and unfolds the growth of IPE from a tiny institute to a reputed institution with worldwide recognition.

The first chapter recounts the setting up of the institute. It was first housed within the Commerce Department of OU and later financial support of ₹One lakh was provided by the Government of India (GoI) and two acres of land was allotted by the State government for the construction of the building. Great stalwarts such as Dr.D.S.Reddy, the then Vice-Chancellor of Osmania University, and Prof.V.V.Ramanadam, a well-known economist were instrumental in the growth of the institution. An important milestone in the history of IPE came in 1976 when the Indian Council of Social Science Research (ICSSR), Government of India, recognized IPE as a "Center of Excellence" in Research. From 1983 to 1991, IPE began to look upwards. The institute made giant strides towards next-level growth. Under the able leadership of Mr.T.L.Sankar, the institute began to forge strategic alliances with numerous government departments and international academic institutions. To develop a long-term relationship at international levels, IPE encouraged its faculty to attend diversified programs in leading schools in the United Kingdom and the United States.

After a brief lull from 1993-2004, IPE witnessed a constant change in leadership and unstable financial conditions. Prof.R.K.Mishra was appointed as Director in charge in 2004 to navigate the institute from its volatile position. It was under the remarkable leadership of

Prof.R.K.Mishra that the new campus for IPE was planned, and resources were mobilized for making it happen.

The second chapter provides immense insights into the research activities undertaken by IPE. It offers in-depth information related to various sponsored research projects, doctoral research, and institutional research carried out by IPE. After Prof.R.K.Mishra took over the leadership role of IPE in 2004, he worked hard to expand its activities in different arenas which aided in establishing a link with global institutions and attaining worldwide recognition including Department for International Development (DFID), Organisation for Economic Co-operation and Development (OECD), and the World Bank. To accelerate and improve its research activities, IPE established specialized centers : the Center for Corporate Governance, the Center for Corporate Social Responsibility, the Center for Governance and Public Policy, and the Center for Sustainable Development.

The institute has been instrumental in completing around more than 280 research projects in the areas of public enterprises, public policy, human resource management, corporate social responsibility, gender studies, finance, marketing, banking, water management, and sustainable development. IPE in collaboration with ICSSR has awarded 95 PhDs and has also guided post-doctoral fellows to bolster research in Central Public Sector Enterprises (CPSE) reforms. Institute publishes seven journals which are very much appreciated nationally as well as internationally. The chapter also provides details of the annual lecture series organized by IPE as an initiative to publish lectures of eminent personalities and disseminate them as a rich source of knowledge to different stakeholders. Some of the eminent personalities who delivered lectures were Prof.K.N.Raj, Dr.I.G.Patel, Dr.A.K.Rath, Shri R.H.Khwaja, Dr.David Finegold, Dr.Nitish Sengupta, Prof.Sunil Mani, Mr.R.Shankar and many more.

The third chapter gives in detail the training programs offered at IPE which have been well acknowledged by both public sector enterprises and GoI. The Institute has been immensely appreciated for conducting training activities for the executives of public enterprises. IPE continuously nurtures a core group of cross-functional faculty to improve the quality and level of training activity. The training programs which encompassed various fields of operations like finance, human resource management, and IT were also conducted and were well-received. The training programs organized for the IAS officers of different state cadres were greatly appreciated. The training program of senior executives on the distinct theme in India and the study tour to Europe thereafter and collaborations with many countries in Asia has enabled to establish IPE as a global institute for providing training in research, advanced leadership skills, and other functional areas.

The fourth chapter showcases the growth in the consultancy assignments for IPE. The revenue from consultancy

projects for IPE was very nominal in the early years. But with a laser-focused approach and dedication, IPE saw its consultancy and research income increase from ₹13,000 in 1971-72 to ₹1.6 crores in 2019-20. This chapter throws light on the consulting assignments delegated to IPE by central and state government undertakings as well as other central government departments. The consultancy assignments were conducted for various funding agencies like the World Bank, and Asian Development Bank. Moreover, the institute also played a crucial role in conducting training needs assessment and training effectiveness of Goa Shipyard Ltd., and evaluation of Mee Seva Service delivery systems in Andhra Pradesh. IPE has been hugely involved in carrying out some of the major projects sanctioned by different state governments in India.

The fifth chapter elaborates on the diversification of IPE into management education programs. The chapter beautifully narrates the transformational journey of IPE from being a research and training institution for public sector enterprises to a well-established B-School. In the year 1978, the PGDPEM (Post Graduate Diploma in Public Enterprise Management) course was started which was affiliated with Osmania University. Gradually, IPE forayed into long-term management education and in 1995, it started a two-year full-time Post Graduate Diploma in Business Management (PGDBM) program. Over the next two decades, IPE launched many industry-oriented post-graduate programs to cater to the needs of the private sector companies, thus making it a highly coveted Business School.

The sixth chapter discusses the financial sustainability and transparency of IPE. The chapter focuses on the ups and downs of the institute in terms of financial resources and how made it through the difficult times. This section highlights the implementation of different financial strategies, mechanisms to optimize resources, and ways to ensure financial discipline in the institute. With the necessary financial measures in place, the institute moved towards self-sustainability and financial independence.

The book fondly remembers and acknowledges the guidance of many prominent persons who helped in shaping the institute. The authors Prof.R.K.Mishra and Dr.Geeta Potaraju have captured IPE's illustrious journey of 50 years facilitating the readers to carry back to the time of institutional set-up and have been made a part of their journey to the present day. The authors have provided detailed information about the journey of IPE from its inception in 1963 to 2020. Any individual who is passionate about the education industry or wants to understand the intricacies of building an institution from scratch should read this book.

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