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Aims and Objectives : The Indian Journal of Commerce, started in 1947, is the quarterly publication of the All India Commerce Association to disseminate knowledge and information in the area of trade, commerce, business and management practices. The Journal focusses on theoretical, applied and interdisciplinary research in commerce, business studies and management. It provides a forum for debate and deliberations of academics, industrialists and practitioners.

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Macroeconomic Factors and Indian Stock Market Testing Linkages using ARDL Approach

DEEPA MANGALA AND ANITA

Abstract: Stock markets are extremely sensitive to expected changes in fundamentals of an economy. There are numerous domestic economic indicators causing variation in stock prices. Due to globalisation and development of information technology, the relevance of worldwide factors in determining changes in stock prices has also increased. Therefore, it is extremely important to identify the movements of stock market with respect to an economy's macroeconomic variables and international factors like movement in exchange rates and crude oil prices. The present paper applies Bounds test based Autoregressive Distributed lag model to explore how macroeconomic factors influence the Indian stock market. The analysis is done over a time window of eleven years from April 2007 to March 2018. The results illustrate that money supply and FII positively whereas gold price negatively influencing stock prices in the long run whereas in short run, oil and gold prices and exchange rate negatively and foreign exchange reserves and FII positively influence stock prices.

Keywords: Macroeconomic variables, Indian stock market, ARDL approach

Introduction

Indian economy is growing steadily and is a bright spot in the world economy due to strong macroeconomic fundamentals. It has been declared as the sixth largest economy in the world with the nominal GDP of 2.6 trillion in 2017-18 and third largest by purchasing power parity (PPP) of 9.5 trillion in 2017-18 as per the World Economic Outlook (2018) Report of International Monetary Fund (IMF). Structural reforms in the recent past including demonetisation and implementation of Goods and Services tax (GST) in 2017 are exemplary initiatives in international economic history which shook the entire financial system. Despite this, the Indian economy continued to grow at a reasonable rate when compared to other economies around the world. According to a survey conducted by Bloomberg, "India has been rated as the second-most attractive emerging market for equities

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in 2019".

History has shown that the stock prices reflect dynamics of an economy. The direction of stock indices serves as a leading indicator of what is really happening within an economy. They reflect mood of the society and are responsive to changes in policies at macro-economic level. The state of an economy has a bearing on stock prices. There are various macroeconomic factors such as (GDP) gross domestic product, inflation, interest rate, index of industrial production, trade barriers, balance of payment, money supply, gold prices, savings etc. Due to globalisation and the development of information technology, now a country not only gets affected by changes in its own economy but also gets influenced by the change in international market. Therefore, it is extremely important to identify the movements of stock prices in relation to an economy's fundamentals and at the international front, market participants should also monitor the movement of market with respect to other key factors such as exchange rates, investment trends by overseas investors and crude oil prices etc. The study of macroeconomic variables and their impact on stock prices has been an area of intense interest among academicians, investors since 1970s. Several studies adopting unique methodologies have produced contradictory results regarding the relationship between stock market and macroeconomic variables across the world.

Review of Literature

The influence of economic factors on stock market has been well examined in the financial economics literature. Arbitrage pricing theory (APT) as proposed by Ross (1976) is based on the assumption that expected returns depend on macroeconomic factors although the range of those factors has not been specified in the initial theory. Later in 1980, Roll and Ross stated that unexpected variations in inflation, risk premiums, term structure of interest rates and industrial production influence stock returns. Chen et al. (1986) examin the validity of APT in US market and found that variables such as industrial production, inflation and yield spread between the long and short term government bonds are significant in explaining stock returns which refutes the validity of semi-strong efficiency in US market. Later numerous studies across the world examined the influence of economic factors on stock prices and returns.The review of literature for macro-economic factors is categorised for each variable separately.

Index of Industrial Production

The index of industrial production is measure of real economic activity. This index details out the growth of different sectors of economy like mining, manufacturing and electricity. Ibrahim and Aziz (2003) in Malaysia and Maghayereh (2003) and Al-Sharkas (2004) in Jordan stock market suggest the

positive association between level of real economic activity as proxied by index of industrial production (IIP) which is explained through the effect of industrial production on expected cash flows of companies. Yusof and Majid (2007) and Liu and Shrestha (2008) also suggest positive relationship between IIP and stock prices. Raju and Khanapuri (2009) show the evidence of influence of IIP in case of both manufacturing and financial service sector of India. The results of Sohail and Hussain (2009) revealed the long run relationship between macroeconomic variables and stock prices and found that index of industrial production positively impact stock prices. There is some evidence of insignificant influence of index of industrial production such as Hosseini et al. (2011), Saeed and Akhter (2012), Ray (2012) suggest the insignificance of IIP. Aromolaran et al. (2016) exhibited that IIP has positive effect on Nigeria Stock Exchange which signifies that increased industrial production leads to increase in economic activities which translated into higher earnings and in turn higher stock prices.

Money Supply

Money supply is the sum total of monetary assets available in the economy at a particular time. It measures the abundance or scarcity of money. Pilinkus and Boguslauskas (2009), Rad (2011), Vejzagic and Zarafat (2013) and Khan and Khan (2018) discovered that stock price is positively related with money supply and negatively with exchange rate. Raju and Khanapuri (2009) found existence of money supply effect in case of manufacturing sector whereas in case of financial service sector it is found to be insignificant. Sohail and Hussain (2009) found negative influence of money supply on stock prices which supports the keynsian views. Hosseini et al. (2011) failed to show the significant influence of money supply in both Indian and Chinese market. Osamuonyi and Evbayiro-Osagie (2012) and Saeed and Akhter (2012) findings in respect of money supply are in consistence with the findings of Maghayereh (2003), Hosseini et al. (2011) show that money supply cause negative variations in stock market. Mustafa et al. (2013) indicated the short run causal effect of money supply on stock prices whereas in the long run it is suggested that stock market is inefficient with respect to money supply. Prabhu et al. (2019) explored the linkage between monetary policy and sectoral stock indices using identification through heteroscedasticity approach and found significant impact on banking and reality sector while its impact on other sectors is insignificant.

Inflation

Inflation is a rise in general price level of goods and services in an economy and consequently results in decrease in value of currency. Mixed results have been found in case of influence of inflation on stock prices. Ibrahim and Aziz (2003) and Yogaswari et al. (2012) favours Fisher (1930) hypothesis. According to Fisher

(1930) hypothesis, common stock represents contingent claims against real assets of a business which help in beating inflation. In such case stock prices reflect inflation and the relationship between these two variables is positive. However there are some studies which challenged the validity of fisher effect and found negative association between inflation and stock prices. Fama (1981) found inverse relation between equity returns and inflation. This phenomenon has been termed as the Proxy Hypothesis. Maghayereh (2003), Liu and Shrestha (2008), Pal and Mittal (2011), Ray (2012) and Naik (2013) supported the proxy hypothesis.

Oil Price

The prices of crude oil are keenly gauged across the world. The relationship between oil price and stock market varies from country to country depending on its consumption and the fact whether the country is a net importer or exporter. Empirical evidence suggest that there is positive association between crude oil prices and stock prices in oil exporting economies whereas reverse applies for oil importing countries where the research has established negative relationship between the two. Jones and Kaul (1996) investigated the link between oil price and stock price and fond the existence of negative association. Valadhkhani et al. (2009) and Filis (2010) also document negative influence of crude prices on Thailand stock market. Toraman et al. (2011) and Sharma and Khanna (2012) found positive relationship between stock and oil price. Raju and Khanapuri (2009) in Indian market and Hosseini et al. (2011) in both Indian and Chinese market, Saeed and Akhter (2012) in Pakistan and Alqattan and Alhayky (2016) target all GCC countries: Kuwait, Qatar, Oman, KSA and UAE failed to prove the relevance of oil price in determining stock market prices. Chittedi (2012) by applying ARDL and Sahu et al. (2014) by applying Johansen cointegration and vector error correction model (VECM) tested long run association among oil prices and Indian stock market and found that long run causality moves from Indian stock market to oil prices but not the vice versa. Hammami et al. (2019) explored the long run and short run relationship between international oil price and stock price and found significantly long and short run negative influence on stock prices in Jordan.

Gold Price

Gold is considered as an alternative investment opportunity for Indian investors. It is very liquid and can be easily converted into money. It immunises and investors portfolio against inflation and currency depreciation. Ray (2012) examined the association of Indian stock returns with five macroeconomic and results suggest that except IIP all variables impact stock market performance significantly. Kaliyamoorthy and Parithi (2012) documented that Indian stock market is not cointegrated with gold prices. Rao (2015) found negative impact of

gold prices on stock prices in Indian stock market. Yahyazadehfar and Babaie (2012) found that the influence of gold price is negative on stock market which can be attributed to the fact that the gold market is an alternative to stock market. Hemavathy and Guruswamy (2016) and Tripathi (2016) found that there exists change in stock price with the change in gold prices.

Interest Rate

Interest rate is a macroeconomic variable known to influence savings and investments in the country (Tripathi and Kumar 2015). The interest rate is a vital macroeconomic variable, that affects growth and prosperity of an economy. Kurihara and Nezu (2006) document inefficiency of interest rate to predict the Japanese stock prices. Ahmed and Imam (2007) empirically tested the association between macroeconomic factors and Bangladesh stock market and results show no cointegration between the variables. The results of granger causality test demonstrate unidirectional causality from interest rate to stock price. Coleman and Tettey (2008) show that lending rate have negative relationship with stock price supporting the view that higher lending rates increase cost of operation and therefore makes shares of these companies less attractive. Srivastava (2010) and Pal and Mittal (2011) also found the existence of interest rate effect but only for Nifty index. Yahyazadehfar and Babaie (2012), Saeed and Akhtar (2012), Yogaswari et al. (2012) and Khan and Khan (2018), found negative influence of interest rate on stock market. Naik (2013) also tried to investigate whether Indian stock market is inefficient in respect of macroeconomic factors or not and his findings in respect of interest rate shows that interest rate is insignificant determinant of stock prices.

Exchange Rate

With increase in globalisation, economies around the world are getting integrated to each other and thus, exchange rate has become one of the important fundamental factors which can influence stock prices and also can get influenced by the fluctuations in stock market. Muhammad and Rasheed (2002) examined the long run and short run association between exchange rate and stock prices for four south Asian nations, India, Pakistan, Bangladesh and Sri Lanka and found no short run and long run link for India and Pakistan, whereas for Bangladesh and Sri Lanka long run causality is found which suggests that in short run exchange rate and stock prices are unrelated in Asian countries. Yusof and Majid (2007), Pilinkus and Boguslauskas (2009), Pal and Mittal (2011), Rad (2011), Ray (2012), Saeed and Akhtar (2012), Vejzagic and Zarafat (2013) and Khan and Khan (2018) found negative relationship between exchange rate and stock price which supports the view that when a currency depreciates, its exports become cheaper which in turn increase its profitability and therefore the value of

stock. Coleman and Tettey (2008), Raju and Khanapuri (2009), Sohail and Hussain (2009) in respect of exchange rate found positive influence on stock market which indicates the fact that major movers of the market have actually gained from the depreciation of domestic currency. Liu and Shrestha (2008) using heteroscedastic cointegration attempt to explore the relationship between macroeconomic variables and the Chinese stock market and found exchange rate significantly influence stock prices. Richards et al. (2009) explored the asociation between exchange rate and stock prices and found that variables are cointegrated in the long run and supported the portfolio balance model which says that changes in stock prices affect exchange rate while reverse is not true. Megarravali and Sampagnaro (2018) made an effort to explore the impact of exchange rate on stock market of ASIAN 3 economies (India, Japan and China) and found significant positive long run impact of exchange rate on stock prices in all economies. Some studies found insignificance of exchange rate in determining stock prices such as Muhammad and Rasheed (2002), Kurihara and Nezu (2006), Raju and Khanapuri (2009 in financial services sector), Srivastava (2010), Naik (2013) and Aromolaran et al. (2016).

Foreign Exchange Reserves

Foreign exchange reserves are the assets held by a central bank in the form of foreign currency reserves, bonds and also comprises of gold, special drawing rights and International Monetary Fund (IMF) reserve position. It is important to understand the relationship between foreign exchange reserves and stock prices because accumulating international reserves is preferred by developing nations to ensure financial stability. A very few studies explains the influence of foreign reserves on stock prices. Bhattacharya and Mukherjee (2003) and Kurihara (2016) found no evidence of influence of foreign exchange reserves on stock market. Maghayereh (2003), Hussain (2009) and Sulaiman et al. (2009) concluded the stock market index is fundamentally linked with foreign reserves. Similarly Akinlo (2015) and Abakah and Abakah (2016) concluded that enhancing foreign exchange reserves will booster stock market growth.

Foreign Institutional Investments

FII is an investment made by an individual or an institution of one country in the financial market of other country. It is imperative to understand the influence of these foreign institutional investments (FII) on stock market due to its growing importance worldwide. Kumar (2001), Gordon and Gupta (2003), Trivedi and Nair (2003), Pal (2005),Behera (2010), Upadhyay (2006), Ray (2012) found unidirectional positive influence of FII on stock prices which indicates that increase or decrease in FII induce stock prices to move in the same direction. Bekaert, Harvey and Lumsdaine, (2002) found that increase in capital flows increase stock

returns which is in line with a price pressure hypothesis. Badhani (2005) also examined the association among FII and stock prices using granger causality test and found long run relationship between the two but no short run causality could be traced. Bindu (2004), Sundaram (2009), Stigler, Shah and Patnaik (2010) and French (2011) discovered unidirectional causality running from stock returns to FII, however, reverse is not found in their studies. Rai and Bhanumurthy (2004), Ray and Vani (2003), Mazumdar (2004) and Panda (2005) found no effect in stock prices due to change in foreign investments and also show that foreign investors are not relying on the stock market performance of the host country. There are very few studies found outside India like Hasan and Nasir (2008) also found the positive relationship between FII and stock price whereas French (2011) did not find any link between the two. Singhania and Saini (2016) examined the impact of FIIs on Sensex returns and suggested that more liberalised policies are required to gain confidence of foreign investors they it impact Indian market significantly.

Objective

The present study aims to investigate impact of economic variables on stock prices in India

Research Methodology

The study tests the influence of selected nine economic factors on stock prices using ARDL Bound testing approach. Monthly data for eleven years spanning from April 2007 to March 2018 has been used. Descriptive statistics, namely, mean, maximum, minimum, standard deviation, coefficient of variation, skewness, kurtosis and Jarque-Bera test are computed for Nifty 50 index which has been used as the proxy of the stock market and the selected nine economic factors i.e. index of industrial production (IIP), broad money supply (M3), wholesale price index (WPI), crude oil prices (OIL), gold price (GOLD), interest rate as proxied by monthly average of yield on 91days Government of India treasury bills, exchange rate (EXR), foreign exchange reserves (FOREX) and foreign institutional investments (FII). Further, the variables are graphically presented and examined to look for the possibility of trend in the mean and variance.

The present study makes use of time series analysis. Economic time series generally face the problem of non-stationarity and applying ordinary least square regression on such series might provide spurious results. Therefore, instead of applying regression, use of cointegration technique is favoured. The most commonly used cointegration techniques are Engle Granger (1987) cointegration and Johansen and Juselius (1990) and Johansen (1991) cointegration. The ARDL bounds test given by Pesaran et al. (2001) can be applied even if variables are

integrated of order 0 or 1 or both. It also does well with small sample size (Hasan and Nasir, 2008; Oskenbayev et. al, 2011). Before proceeding for ARDL estimation following assumptions have to be satisfied:

i) Data should be stationary at level or first difference
ii) Data must be free from serial correlation
iii) Data must be free from heteroscedasticity
iv) Data must be normally distributed.

Augmented Dickey Fuller test (ADF) and Philips and Perron (PP) unit root tests have been used to test the order of integration of the selected variables. To test the assumptions of no serial correlation, homoscedasticity and normality of data, Breusch-Godfrey Serial Correlation LM test, Breusch-Pagan- Godfrey Heteroscedasticity test and Jarque-Bera normality test have been used respectively.

The equation of ARDL model can be represented as equation 1:

$$LNIFTY = \alpha_1 + \beta_1 LIIP_{t-1} + \beta_2 LM3_{t-1} + \beta_3 LWPI_{t-1} + \beta_4 LOIL_{t-1} + \beta_5 lGOLD_{t-1} + \beta_6 INT_{t-1} + \beta_7 EXR_{t-1} + \beta_8 FOREX_{t-1} + \beta_9 FII_{t-1} + \sum_i^q \beta_{10i} DLNIFTY_{t-i} + \sum_i^q \beta_{11i} DLIIP_{t-i} + \sum_i^q \beta_{12i} DLM3_{t-i} + \sum_i^q \beta_{13i} DLWPI_{t-i} + \sum_i^q \beta_{14i} DLOIL_{t-i} + \sum_i^q \beta_{15i} DLGOLD_{t-i} + \sum_i^q \beta_{16i} DINT_{t-i} + \sum_i^q \beta_{17i} DLEXR_{t-i} + \sum_i^q \beta_{18i} DLFOREX_{t-i} + \sum_i^q \beta_{19i} DFII_{t-i} + \mu_t$$

Where, LNIFTY represents the natural logarithm of Nifty 50, LIIP denotes natural logarithm of the Index of Industrial Production, LM3 denotes natural logarithm of broad money supply, LWPI represents natural logarithm of monthly wholesale price index, LOIL explains the natural logarithm of monthly crude oil prices, LGOLD depicts natural logarithm of gold price, INT depicts interest rate as proxied by monthly average yield on 91days Government of India treasury bills, LEXR represents natural logarithm of month-average exchange rate of the Indian rupee vs. US dollar, LFOREX represents natural logarithm of foreign exchange reserves, FII describes net investments by foreign institutional investors, and ε_t represents error term in the model where LNIFTY is the dependent variable.

General error correction representation of ARDL model is presented in equation 2 as:

$$D(LNIFTY) = \alpha_1 + \sum_i^q \beta_{10i} DLNIFTY_{t-i} + \sum_i^q \beta_{11i} DLIIP_{t-i} + \sum_i^q \beta_{12i} DLM3_{t-i} + \sum_i^q \beta_{13i} DLWPI_{t-i} + \sum_i^q \beta_{14i} DLOIL_{t-i} + \sum_i^q \beta_{15i} DLGOLD_{t-i} + \sum_i^q \beta_{16i} DINT_{t-i} + \sum_i^q \beta_{17i} DLEXR_{t-i} + \sum_i^q \beta_{18i} DLFOREX_{t-i} + \sum_i^q \beta_{19i} DFII_{t-i} + ECM_{t-1} + \mu_t$$

Where, D is the difference operator q is used for the maximum lags selected for the model, $\hat{a}_1$ to $\hat{a}_{19}$ are drift components and μ_t represents error term in the model. Rest of the terms are same as given for equation 1. ECM_{t-1} denotes the

residuals from the cointegrating equation and is expected to be negative. Cumulative Sum of Recursive Residuals (CUSUM) test and Cumulative Sum of Squares of Recursive Residuals (CUSUM of squares) test have also been used to check whether the parameters are stable (desirable) or not.

Results and Discussion

The descriptive statistics of the stock market index Nifty 50 and the selected nine economic variables are presented in Table 1. During the study period, Nifty 50 exhibits the mean value of 6,398.266 and its maximum value is around five times the minimum value. The coefficient of variation indicates that it is relatively volatile. IIP is used as a measure of real economic activity has mean value of 103.402 over the last eleven years and is the least volatile variable. Money supply has considerably increased over the past eleven years from 33064.350 billion rupees in April 2007 to 139625.900 billion rupees in March 2018. Inflation as measured by WPI is second least volatile variable. The standard deviation of crude oil price is 1283.224 while the coefficient of variation is 0.306 suggesting its instability in oil prices. There has been a phenomenal increase in gold prices from as low as Rs. 8707.42 per 10 grams to Rs. 31672.83. During this period interest rates remained at the minimum level of 3.218% and rose to as high as 11.334%. The range of exchange rate during the study period is Rs. 28.863. Foreign exchange reserves have grown substantially. The flow of FII has been highly volatile. The highest FII during the study period is 336.830 billion rupees while its lowest value is -173.550 when the outflows were more than the inflows. The skewness has been estimated to reveal the symmetry of the distribution. All the variables, except WPI, gold prices, interest rate and exchange rate, are positively skewed. The value of kurtosis helps to spot the peakedness of the data. Barring interest rate, all the distributions are platytokurtic resulting in lower peaks than normal distribution. The null hypothesis of normality is rejected for all the distributions except IIP and FII.

The first and the simplest way to determine stationarity of the time series is to present the series graphically and look for the possibility of trend in the mean and variance as shown in Figure 1. The time series of exchange rate, foreign exchange reserves, gold price, IIP, money supply and WPI clearly exhibit signs of non- stationarity. FII is relatively volatility and there is a possibility of FII being stationary. The graphical presentation of Nifty 50, oil price, WPI and interest rate suggests drift around the years 2009 and 2014.

Table 1.Descriptive statistics of Nifty 50 and economic variables for the period from April 2007 to March 2018

	NIFTY 50 (in Rupees)	IIP	Money supply (Rupees Billion)	WPI	Oil Price	Gold Price (in Rupees)	Interest rate (%)	Exchange rate	Foreign exchange reserves (Rupees Billion)	FII (Rupees Billion)
Mean	6398.266	103.402	81317.240	100.047	4186.436	23259.950	7.080	54.566	17313.320	53.882
Maximum	11027.70	140.300	139625.900	117.200	6926.830	31672.830	11.334	68.237	27608.500	336.830
Minimum	2755.100	75.280	33064.350	73.350	2004.000	8707.420	3.218	39.374	8440.010	-173.550
Standard Deviation	1938.745	14.296	30957.220	14.264	1283.224	7221.192	1.626	9.297	5076.003	102.866
Coefficient of Variation	0.303	0.138	0.380	0.143	0.306	0.310	0.229	0.170	0.293	1.909
Skewness	0.413	0.088	0.127	-0.561	0.404	-0.678	-0.690	-0.063	0.385	0.197
Kurtosis	2.347	2.199	1.752	1.782	1.990	1.941	3.249	1.525	1.912	2.660
Jarque-Bera	6.101	3.697	8.915	15.088	9.204	16.303	10.819	12.050	9.770	1.494
Probability	0.047	0.157	0.012	0.001	0.010	0.000	0.004	0.002	0.007	0.473
Observations	132	132	132	132	132	132	132	132	132	132

Source: Result output of E-Views 9

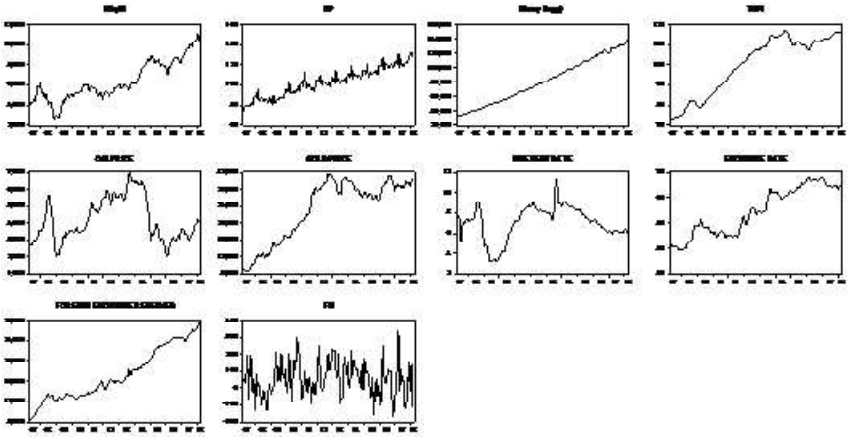

Figure 1: Dataset graphs of Nifty 50 and economic variables

Source: Result output view of Eviews 9

To test the stationarity of the variables and to determine the order of integration of the variables ADF and PP unit root tests have been carried out with and without deterministic trend (Table 2). The results show that at level most of the series are not stationary whereas at first difference they become stationary. The results of the unit root tests confirm each other and reinforce that majority of the observed variables are integrated of order one, whereas there are few variables that are integrated of order zero.

After determining the order of integration, the next step is to run ARDL model as shown in equation 2. Akaike Info Criterion (AIC) is the most commonly used information criterion to determine the optimum number of lags. It is found that ARDL (3, 1, 1, 0, 4, 3, 0, 2, 4, 1) has lowest Akaike Info Criterion value of -3.278, thus, it is considered as the optimal model for further estimation. The software automatically selected three lags for LNIFTY, one for LIIP and LM3 each, zero for WPI, four for LOIL, three for LGOLD, zero for INT, two for LEXR, four for LFOREX and one for FII.

To test if the variables have a long-run relationship, the F-test is performed to examine the joint null hypothesis that the coefficients of lagged level variables are zero. Coefficient of lagged variables in the present study are β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8 and β_9 of LIIP, LM3, LWPI, LOIL, LGOLD, INT, LEXR, LFOREX and FII respectively as presented in equation 1. The computed F-value is evaluated with reference to the critical values tabulated in Pesaran et al. (2001) to accept or reject the following null hypothesis:

H_O: If $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9$, long run relationship does not exist.

H_a: If $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq \beta_9$, long run relationship exists.

Table 2: Results of Augmented Dickey –Fuller and Phillips Perron unit root test

Variables	ADF Unit Root Test				PP Unit Root Test			
	At Level (with intercept)	At Level (with intercept and trend)	At First Difference (with intercept)	At First Difference (with intercept and trend)	At Level (with intercept)	At Level (with intercept and trend)	At First Difference (with intercept)	At First Difference (with intercept and trend)
LNIFTY 50	-1.024	-2.628	-10.819***	-10.786 ***	-1.197	-3.062	-10.857 ***	-10.822 ***
LIIP	0.032	-2.482	-4.383 ***	-4.337 ***	-1.767	-10.151 ***	-37.453 ***	-37.243***
LM3	-4.036 ***	-1.653	-10.999***	-4.340***	-16.122***	-2.308	-11.031***	-26.745***
LWPI	-2.032	-1.214	-6.197 ***	-6.463 ***	-2.138	-0.917	-6.197 ***	-6.476 ***
LOIL	-2.643 *	-2.620	-7.534 ***	-7.524 ***	-2.308	-2.284	-7.610 ***	-7.601***
LGOLD	-2.592 *	-1.293	-10.592 ***	-11.047 ***	-2.572	-1.303	-10.591***	-11.061***
Interest Rate	-1.764	-1.749	-8.545 ***	-8.514 ***	-1.732	-1.721	-9.379***	-9.339 ***
LEXR	-1.335	-2.380	-8.635***	-8.629***	-1.013	-1.688	-8.499***	-8.440 ***
LFOREX	-1.719	-3.251*	-10.175***	-10.223***	-1.651	-3.404*	-10.217 ***	-10.260***
FII	-8.510 ***	-8.476 ***	-11.762 ***	-11.714 ***	-8.477 ***	-8.442 ***	-81.087 ***	-79.914***

Note: *, ** and *** indicate significance at 10, 5 and 1 per cent levels respectively

Source: Result output of E-Views 9.

Table 3: F- statisitcs of cointegration relationship

Dependent Variable	LNIFTY	
F-Statisitcs	6.794***	
Critical Value Bounds		
Significance	L	U
10%	1.880	2.990
5%	2.140	3.300
2.50%	2.370	3.600
1%	2.650	3.970

Note: *, ** and *** indicate significance at 10, 5 and 1 percent levels respectively

Source: Result output of E-Views 9

If the calculated F-statistics derived from Wald test is more than Pesaran et al. (2001)'s upper critical bound value, long run association between the variables is established. If calculated F-statistics is between lower and upper critical bounds, the results are inconclusive implying thereby that some other cointegration tests should be used. The presence of long run relationship between LNifty and maroeconomic variables is confirmed as the calculated F-value 6.794 (Table 3) is more than upper bound critical value at 1% level. The null hypothesis of cointegration is accepted. The robustness of the ARDL model is examined through diagnostic tests in Table 4.

Table 4: Results of diagnostic tests

	Test Applied	Null Hypothesis(H_0)	Test Statistics	P Value	Result
Serial Correlation	Breusch- Godfrey Serial Correlation LM Test	No serial correlation	0.663	0.517	Accepted
Heteroscedasticity	Breusch-Pagan-Godfrey	Homoscedasticity	1.451	0.093	Accepted
Normality	JarqueBera	Normality	0.559	0.755	Accepted

Source: Result output of E-Views 9

The null hypothesis of Breusch- Godfrey Serial correlation LM Test states that there is no serial correlation between the residuals. The calculated LM test value is insignificant which shows that errors are not serially correlated. Breusch-Pagan-Godfrey test results suggest absence of heteroscedasticity and Jarque-Bera statistics suggests that data is normally distributed. As all the assumptions of ARDL model have been met, further the long-run and short-run association between the factors is estimated.

Subsequent to establishment of cointegration relationship, the study continues to determine the long-run coefficients and the error correction model (ECM) using the ARDL approach. The Akaike info criterion (AIC) is used to select the optimal lags for the time series: ARDL (3, 1, 1, 0, 4, 3, 0, 2, 4, 1). Table 5 presents the result of estimated long run coefficients for selected ARDL model.

Analysis reveals that Indian stock market index as proxied by Nifty 50 forms significant long run association with four out of selected nine economic factors. There is positive and significant long run impact of LM3 on LNIFTY. The findings indicate that if money supply increases by 1%, the stock index Nifty 50 would increase by 2.645%. Stock prices react favourably to the changes in money supply. An expansion of money supply in the economy rejuvenates the pace of economic activities (Hosseini et al., 2011). The resultant boost in corporate liquidity and earnings drives up stock prices (Khan and Yousuf, 2013). Increase in money supply makes more money available for purchase of equities and simultaneously makes bond yields less attractive. This positive influence of money supply on stock prices is constant with the prior expectations and is also suggested by Majid and Yusof (2009), Sohail and Hussain (2009), Naik (2013), Ouma and Muriu (2014). This positive relation is attributed to the fact that money supply has positive impact on real economic activity (Mukherjee and Naka, 1995).

Table 5. Estimated long run coefficients for selected ARDL model

Variable	Coefficient	Std. Error	t-Statistic
LNIIP	-1.142	0.974	-1.172
LNM3	2.645	1.386	1.908*
LNWPI	0.181	2.770	0.065
LNOIL	0.021	0.301	0.071
LNGOLD	-0.945	0.275	-3.429***
INT	-0.009	0.022	-0.425
LNEXR	-0.097	0.549	-0.177
LNFOREX	-1.223	0.743	-1.646*
FII	0.001	0.001	2.160**
C	5.067	2.677	1.892*

Note: *, ** and *** indicate significance at 10, 5 and 1 percent levels respectively

Source: Result output of E-Views 9

Gold is an alternative investment opportunity for investors. Thus, negative relationship between the gold and stock prices is expected and same has been found in this study. LGOLD has significant negative impact on LNIFTY and the findings are in consistence with the results of Zhang and Wei (2010), Ray (2012),

Yahyazadehfar and Babaie (2012), Choi et al. (2013), Rao (2015), Hemavathy and Gurusamy (2016) and Tripathy (2016). The estimated long run coefficient indicates that an advance in gold prices by 1% would lead to a fall in the market index by 0.945%. Hence, gold prices may be used to predict the direction of the market due to long-term integration between the two variables. It is considered as a diversification tool due to its negative relation with stock prices (Jaffe 1989, Ameer et al 2018). Gold and equities are two alternative asset classes, of which equity is preferred in bullish market with hope of earning high returns and as the sentiments turn bearish investors shift to safer options like gold.

Another significant variable which influences stock prices in India is FII and the results are in concurrence with findings of Kumar (2001), Gordon and Gupta (2003), Trivedi and Nair (2003), Pal (2005), Behera (2010), Upadhyay (2006), Ray (2012) who also found unidirectional positive influence of FII on stock prices. FIIs are among dominant investment groups, therefore, they play a vital role in determining market direction. "The arrival of FIIs has led to increase in value of Indian securities which is considered to be undervalued because of low capital availability in India" opined Varughese and Mathew (2017) exhibiting the importance of FIIs. Rest of the variables fails to show any significant influence on stock prices in long run. Coefficient of foreign exchange reserves is -1.223 which is significant at 10% although the sign of coefficient is in contrast with major findings of Maghayereh (2003), Hussain (2009) and Sulaiman et al. (2009) and Abakah and Abakah (2016).

Table 6. Error correction representation for the selected ARDL model

Variable	Coefficient	Std. Error	t-Statistic
D(LNIFTY(-1))	-0.194	0.087	-2.212**
D(LNIFTY(-2))	-0.182	0.081	-2.278**
D(LIIP)	-0.106	0.123	-0.866
D(LM3)	-0.582	0.512	-1.135
D(LWPI)	0.040	0.623	0.065
D(LOIL)	0.031	0.063	0.502
D(LOIL(-1))	-0.032	0.083	-0.393
D(LOIL(-2))	-0.019	0.084	-0.234
D(LOIL(-3))	-0.102	0.055	-1.833*
D(LGOLD)	-0.287	0.123	-2.332**
D(LGOLD(-1))	-0.318	0.173	-1.851*
D(LGOLD(-2))	-0.297	0.135	-2.198**
D(INT)	-0.002	0.005	-0.425

Contd...

Contd...

D(LEXR)	-0.958	0.349	-2.744***
D(LEXR(-1))	-1.266	0.348	-3.637***
D(LFOREX)	0.035	0.243	0.146
D(LFOREX(-1))	0.682	0.292	2.331**
D(LFOREX(-2))	0.123	0.280	0.438
D(LFOREX(-3))	0.243	0.193	1.252
D(FII)	0.001	0.001	5.156***
ECM(-1)	-0.224	0.059	-3.786***

Note: *, ** and *** indicates significance at 10, 5 and 1 percent levels respectively
Source: Result output of E-Views 9

The outcomes of short-run dynamics of macroeconomic variables and stock prices are presented in Table 6. The error correction term ECM (-1) exhibits the pace of adjustment to re-establish equilibrium in the model. The coefficient of ECM (-1) should be significant with negative sign. It is found that estimated error coefficient (-0.224) is negative and statistically significant at 1 % level which implies that equilibrium in the long run will adjust by approximately 22.4 % after a short run shock. It is illustrated from the outcomes of error correction representation that LNIFTY is found to be influenced by its own lags in the short run but negatively. The coefficient of D(LNIFTY (-1)) and D(LNIFTY(-2)) are -0.194 and -0.182 respectively which is significant at 5% level. Gold prices negatively and significantly influence stock prices in short run also. According to the results, short term elasticity of D(LGOLD), D(LGOLD(-1)), D(LGOLD(-2)) are -0.287, -0.318 and -0.297 which are much lower than long run elasticity i.e. -0.945. It is also observed that oil prices and exchange rate do not exhibit long run relationship with stock prices but their relation become statistically significant in short run. Oil prices exert significant negative influence on D(LNIFTY). The findings are in consistence with the findings of Jones and Kaul (1996), Valadkhani et al. (2009) and Filis (2010). The lagged variables of exchange rate D(LEXR) and D(LEXR(-1)) have significant negative influence on stock prices. The results confirm the findings of Muhammad and Rasheed (2002), Yusof and Majid (2007), Liu and Shrestha (2008),Pilinkus and Boguslauskas (2009), Rad (2011), Saeed and Akhter (2012), Vejzagic and Zarafat (2013). FII is found to be positively significant in short run also.

The direction of relationship of long term coefficients of gold and FII is maintained even in short run. However, money supply which has significant positive relationship with stock prices in long run fails to explain the relation in short run which may be attributed to the fact that money supply causes hike in stock prices in long term only.

The cumulative sum (CUSUM) and the cumulative sum of square (CUSUMSQ) tests have been used to investigate the stability of long and short run parameters as suggested by Giri and Joshi (2015).The (CUSUM) and the CUSUMSQ plots (Figure 2) are between the critical boundaries at 5% level and confirm the stability of the parameters having an impact in India. The model seems to be stable and appropriate.

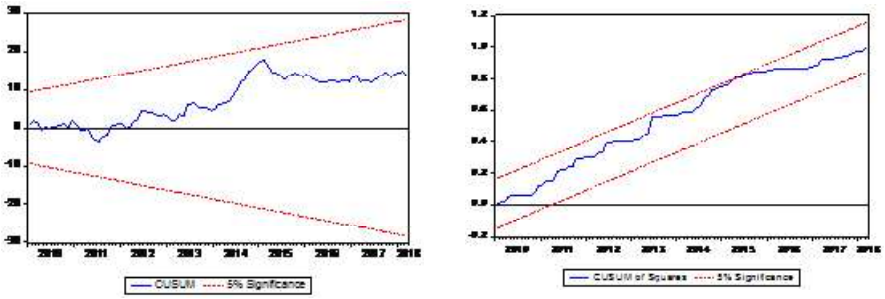

Figure 2: Plots of stability tests

Source: Result output of E-Views 9

Variance Decomposition Analysis

In the variance decomposition analysis, variance of the anticipated error of a variable is separated into fraction accountable to shocks in each variable in the system, including its own. Table 7 presents the results of variance decomposition. The results show that mostly all variance in LNIFTY is explained by itself which is followed byLEXR, INT, LOIL, and LGOLD.

At the first period (month) stock prices i.e. LNIFTY are determined by itself and LWPI, LOIL and INT explains 0.400%, 1.331% and 2.402% of the variance of LNIFTY. In the subsequent periods the impact of other macroeconomic variables starts explaining the variance of LNIFTY. In second period, as can be depicted from Table 7 that all the macroeconomic variables explain variance of LNIFTY of which LOIL explains the most after LNIFTY i.e. 2.989%. In 12th period LNIFTY explains itself about 70% while exchange rate explains about 8.5%, INT by 7.5% and LIIP explains the least of variance of LNIFTY. In following periods also, apart from itself LNIFTY is explained by LEXR and INT the most.

Conclusion

Stock markets are considered as an indicator of economic prosperity. Therefore, any variation in security prices is keenly gauged by economists, policymakers, government, researchers and investors. Macroeconomic determinants of stock prices may be used to predict future direction of the market, hence may provide

Table 7. Variance decomposition of LNIFTY

Period	S.E.	LNIFTY	LIIP	LM3	LWPI	LOIL	LGOLD	INT	LEXR	LFOREX	FII
1	0.475	95.868	0.000	0.000	0.400	1.331	0.000	2.402	0.000	0.000	0.000
2	0.669	93.212	0.728	0.375	0.224	2.989	0.140	1.387	0.402	0.323	0.221
3	0.792	91.195	0.618	0.649	0.339	3.832	0.227	0.999	0.293	0.813	1.034
4	0.889	89.476	0.551	0.804	0.311	4.446	0.238	0.884	0.457	1.140	1.693
5	0.973	87.590	0.571	0.996	0.277	4.395	0.214	1.093	0.964	1.417	2.481
6	1.045	85.472	0.555	1.155	0.284	4.168	0.206	1.682	1.792	1.730	2.955
7	1.106	83.001	0.529	1.306	0.347	3.943	0.243	2.554	2.865	1.999	3.214
8	1.157	80.239	0.507	1.441	0.446	3.846	0.350	3.631	4.080	2.187	3.272
9	1.201	77.327	0.500	1.556	0.559	3.912	0.547	4.767	5.345	2.275	3.211
10	1.238	74.454	0.511	1.651	0.660	4.117	0.844	5.840	6.555	2.268	3.099
11	1.269	71.806	0.540	1.728	0.734	4.399	1.237	6.741	7.628	2.200	2.986
12	1.295	69.519	0.583	1.792	0.774	4.691	1.710	7.406	8.509	2.116	2.900
24	1.492	60.148	0.872	2.681	1.029	4.787	5.934	7.541	9.334	4.735	2.938
36	1.599	57.653	1.010	3.585	1.376	5.358	5.769	8.401	8.841	5.046	2.962
48	1.658	57.057	1.125	4.136	1.359	5.339	5.715	8.457	8.828	5.020	2.966

Source: Result output of Eviews 9.

valuable inputs for econometric modelling, policy making, theory building, framing laws or investment decision. The paper empirically examines the influence of selected economic variables on stock prices in India using ARDL Bounds testing approach to understand the evolving pattern of dynamic interactions between economic factors and stock prices under changing financial conditions in India for a time span of eleven years commencing from April 2007 to March 2018. The assumptions of stationarity, absence of serial correlation, homoscedasticity and normality of data have been tested and satisfied using ADF and PP unit root tests; Breusch-Godfrey Serial Correlation LM test; Breusch-Pagan- Godfrey Heteroscedasticity test and Jarque-Bera normality test respectively.

The results confirm the existence of co-integration between economic factors and stock prices. ECM reveals significant positive impact of money supply and foreign institutional investments on stock prices. Gold prices negatively and significantly influence stock prices in short run. The direction of relationship of long term coefficients of gold and FII is maintained even in short run whereas money supply is unable to maintain its relation. Stock prices do get influenced by their own lags, oil prices and lagged values of exchange rate in short run. The results of variance decomposition analysis illustrate that mostly all variance in LNIFTY is explicated by itselfwhich isfollowed byLEXR, INT, LOIL, and LGOLD.

The findings of the present study provide a better understanding of investment environment and how macroeconomic indicators affect stock prices which would help investors and portfolio managers to understand the association between economic factors and stock prices. Similarly, the study is expected to assist the government agencies to design economic policies that encourage inflows in form of FII into the financial markets. Monetary policy may be made liberal to influence real economic activities. Gold, an effective portfolio diversifier, is strongly recommended to be part of investor's portfolio due to its inverse relation with stock prices. Further studies may span across countries and focus on a comparative study of relationship between macroeconomic variables and stock prices in developing and developed stock markets.

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Testing Fama and French Six Factor Model in Indian Equity Market

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Abstract: This Research Paper evident that the new Fama French Six factor(FFSF) model is a weak factor model to fully explain the variances in Indian Equity Market portfolios. The data of 402 companies, which excludes the 99 financial service companies from the S&P NSE Nifty 500, is used for portfolio construction that covers a period of 17 years ranging from July 2002 to June 2019. The monthly (1-12) Momentum profits portfolios along with other five Fama and French proxies are regressed on the 6 factor and 5 factor model of Fama and French (FnF) using LHS and RHS methodology. The study provides evidences about the incapacitated presence of size factor when combined with other risk factors in Indian equity market portfolios. The study also raises doubt on the use of operating profitability as factor premium. The factor spanning test performed and the pattern of monthly averages of portfolios depicts the redundancy of size factor in presence of other FFSF model. In addition to this, operating profitability is comparatively a weaker factor premium throughout the analysis. The GRS test out rightly rejects the null hypothesis claiming the six-factor model fails to capture factor variance in Indian equity market portfolios from July 2002 to June 2019. The other metric tests on alpha also confirm the presence of large factor variables unexplained by FFSF Model.

Keywords: Fama and French Model, Asset Valuation and Pricing, Factor Model, Size, GRS Test.

Introduction

The Fama and French Three Factor (FFTF) asset valuation and pricing model has captivated considerably both practitioners and academicians with the aim to test and accept the most efficient asset pricing model globally. Researchers have also found that there are many other significant anomalies of asset pricing model which are overlooked by (Fama & French, 1993). For example, (Novy Marx. Robert, 2013) had found that there is a direct relation between profitability proxy

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and average returns while (Titman.et al. 2004)and (Anderson.et al. 2006) had found thatinvestment growth has a strong inverse relation to average returns. In defense to all these criticism FnF(Fama & French, 2015) addended proxy - profit and investment growth to their three factor model. (Fama & French, 2017) tested their five-factor model on markets of developed countries that were classified into four regions – North-America, Europe-Union, Japan and Asia-Pacific to prove their model's universal applicability and likelihood to become the new standard in asset valuation & pricing model. But, no sooner the five-factor model could be largely accepted, than it was crowded with concerns and criticism. For example, Blitz et.al (2018) pointed out that- a) the model ignored momentum factor which is too pervasive and important to be ignored b) the FFFF model is not significant enough to explain many other anomalies that are closely related to profitability and investment. (Blit.David; Hanauer.Matthias X. ; Vidojevic.Milan; Vliet.Pim van , 2018). Another study proved that short-term momentum effects are present and strong in almost all the asset classes.(Zaremba, Long, & Karathanasopoulos, 2019). In view of these criticism and proofs FnF recently constructed a FFSF model with momentum premium as addition.

This research paper examines the new FFSF model in Indian equity market portfolios which is an addendum of FFFF model. Numerous researches are done globally on FFTF and FFFF model and many academicians have found that FFTF and FFFF model do lag behind to explain the other prominent factor anomalies as the researchers results fails to prove the robustness of FFTF and FFFF models. Thus, in the light of such developments in asset pricing literature this research Paper aims to identify whether Fama and French six-factor model is significant and sufficient enough to describe the changes in the portfolio returns of equity stock market in India than its five-factor version.

Literature Review

The need for an asset pricing model was marked by Harry Markowitz in his research Paper titled Portfolio Selection, who identified the efficient frontier that defines the mean-variance relationship (Markowitz, 1952). Based on this remarkable finding (William F. 1964)and(Lintner 1965)gave (CAPM) Capital Asset Pricing Model, using Stock beta to market as the only factor responsible for changes in the expected return of a stock (William F. 64), (Lintner 1965). CAPM model achieved many acclaims but was also pray to criticism in form of anomalies. Many researchers identified numerous factor anomalies which are proved relevant for determining the expected return of a stock. Some of such prominent anomalies are: Size (Banz, 1981), Value or distress premium(Rosenberg, et al. 1985) , profitability (ROE)(Haugen & Baker, 1996.) and, investment (NOA)(Hirshleifer,et al. 2004)and (Investment/Assets) (Cooper et al. 2008) and factor momentum (Jagadeesh & Titman 1993).

Out of these prominent anomalies FnF gave new and more robust model than CAPM after dissecting various given factor anomalies, the FFTF model. This model adopted Market cap as size and inverse of P/B ratio as Value or Distress factor in addition to stock beta to market to define the expected return of a stock or portfolio. This Fama and French model achieved high acclaims and was tested by numerous researchers in almost every countries index and it proved to be more realistic and explanatory model than CAPM globally. Despite of such global response there were few factor anomalies which were left unaddressed by Fama and French i.e. profitability and investment and momentum. Such anomalies were prominent and have high explanatory power therefore; Fama and French came up with another five factor model, adding profitability (ROE) and Investments (Net operating Assets) to its three-factor model. But yet again Fama and French ignored momentum factor which was given high importance for the first time as an explanatory factor in a model by Carhart four factor model (Carhart, 1997). Fama and French laid more emphasis on distress premium and defended the criticism by countering that the presence of value or distress factor makes the momentum factor redundant. But later Frazzini gave monthly value factor that better explains the expected return of a stock or portfolio than the FnF much hyped distressed factor (Asness & Frazzini, 2013). Therefore, FnF recently gave a new FFSF model that includes factor monthly momentum to their FFFF model and has replaced value factor with Frazzini's monthly value factor (Fama & French, 2018).

Based on research gap found in Indian finance literature this research paper aims to identify the effects of FFSF model on asset returns in Indian Equity market. As other factor of FFTF and FFFF are"size, value factor, profitability and investment"(Fama & French, 2015) have been tested a number of times in Indian equity stock market. This will help to prove or identify the robustness of FFSF model in India.

Model

This section outlines the models taken under study.

The FFFF Model supplements its own FFTF with profit and investment growth premiums:

$$R_{it} = Rf_t + \beta_i (Rm_t - Rf_t) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + \varepsilon_{it} \quad (1)$$

where R_{it} is the return of tested portfolios i for time period t, Rf is risk-free return, β_i is beta- coefficient for market premium, Rm is the return of benchmark market index, SMB_t(small minus Big) proxy used for size risk premium, HML_t

(High minus Low) is used for distress-value risk premium, RMW_t (Robust minus Weak) is used for Operating profitability risk premium and CMA_t (Conservative minus aggressive) is the investment growth risk premiumin addition to this, h, r, c are the respective co-efficient of the factors.

The FFSF Model that is an addendum to its FFFF model with momentum premium:

$$R_{it} = Rf_t + \beta_i (Rm_t - Rf_t) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + u_i UMD_t + \varepsilon_{it} \quad (2)$$

Where UMD (ups minus downs) is the momentum factor and u is the co-efficient of momentum factor.

Research Design and Methodology

Data and Variables

The sample consists of 500 companies from equity index NSE-500 and uses average closing share price to the stock at the end of each month after adjusting the prices for bonus, rights and stock splits,constrained due to data availability, from year Jan 2003 to Dec 2018. The accounting information is sourced from Bloomberg, The proxy for risk free rate used is the 91-day monthlyT- bills extracted from RBI archived database and NSE-500 equity index, which is used as a proxy for market return is extracted from NSE historical database.

This research Paper attempts to use LHS portfolios with RHS factors in the regression.The month end share prices are converted into return percentages series for further estimation. The new set of portfolios are formed every time at the end of June in each t year, sorted on Distress factor (BE/ME), profitability and investment every year, except sorted on momentum (MOM) every month. Only those stocks are included for which complete data was available. Stocks with negative BE/ME values are excluded. Following the previous researches (like; Norvy-Marx, (2013) the financial service stocks are excluded. The data is further cleaned by excluding stocks with missing value, size, profit, investment and momentum factors.25 portfolios are formed each year, after cleaning and sorting the stock returns. In each portfolio stocks ranges from minimum 7 to maximum 16 in a given year (t). The Table 1 below explains the measurement of independent variables used to form portfolios.

Table 1: Measurement of independent variables

Variables	Measurement
Market Capitalisation[size]	Current market price multiplied by equity shares outstanding $_{Dec(t-1)}$
Book Equity to Market Equity[BE/ME]	$BE_{June(t)}$ = [(TA)Total Assets$_{(t-1)}$ – (TL)Total Liabilities$_{(t-1)}$]/ Market Capitalisation
Operating Profitability [OP]	$OP_{June(t)}$ = [Profit before Tax$_{(t-1)}$]*/ Book Equity$_{June(t)}$
Investment[INV]	$I_{June(t)}$ = [$TA_{March(t-1)}$ – $TA_{March(t-2)}$] / $TA_{March(t-2)}$
Momentum[MoM]	$MOM_{June(t)}$ = Monthly Average return (t-12) till (t-2)
Market Premium[Rm-Rf]	Mkt = Monthly Market Return(VW) – Rf (91days Indian T-bills)

** FF six and five factor model used profit after tax but due to data constrains Profit before tax is used. This does not impact the robustness of the model.*

RHS Factor Construction Methodology

The RHS factor are identified from the portfolios created using 2X3 sorting on size and BE/ME, OP, INV and MOM.The portfolios are sorted on market capitalisation risk premium, at the end of June for each t year.The data on each independent variables measured are taken for the fiscal year ending for each t-1 calendar year except the market capitalisation in BE/ME ratio is taken from theDecember end for each t-1 calendar year (Fama & French, 1993). The portfolio construction to arrive at RHS factors is same as defined and used by FF(2018). The stocks so sorted are formed into portfolios at 30-40-30 break points. This means:

"the intersection of independent 2x3 sort on Size and BE/ME will give six portfolios – SG, SN, SV, BG, BN, BV where S and B denotes small and big and G, N, V denotes growth, neutral and value.""We compute monthly VW returns for each portfolio from July of year t to June of t+1. The Size factor, SMB B/M, is the equal-weight (EW) average of the returns on the three small stock portfolios from the 2×3 Size-B/M sorts for the region minus the average of the returns on the three big stock portfolios. For each region, we construct value minus growth returns for small and big stocks, HMLS =SV – SG and HMLB =BV – BG, and HML is the average of HMLS and HMLB. The profitability and investment factors, RMW and CMA, are constructed in the same way as HML except the second sort is on either profitability (robust minus weak) or investment (conservative minus aggressive)"(Fama & French, 2017).

The MOM 2x3 sorts are framed exactly like risk premium HML was constructed except that the portfolios are formed and sorted monthly based on the monthly average of t-2 to t-12 returns for arriving at period t portfolios. As the stocks are sorted each time on different factor other than size, this produces 5 size factor –

SMB, $SMB_{BE/ME,}$ SMBOP, SMB_{INV}, and SMB_{MoM}. Therefore, The average of aforesaid 5 factors gives SMB- the size risk premium. Similarly, it can be the average returns on 12 small size portfolios minus 12 big size portfolios.

Hypothesis

As mentioned above the main objective of the research is to assess the performance of FFSF model in Indian equity market, which can be assessed by comparing the intercepts of FFSF model. This is done by analysing the alphas obtained from 100 regression of LHS portfolio return. It is widely known that a model is robust and valid when the alpha or (intercept)of the regression is approximately zero. And to obtain more absolute results to confirm this hypothesis GRS Test is conducted.

H_0 = The alpha of multiple regression is not significantly discrete to zero ($\alpha = 0$)

H_1 = The alpha multiple regression is significantly discrete to zero ($\alpha \neq 0$)

Analysis

The Table 2 and 3 below summarises the descriptive statistics for the monthly factor return. The monthly average for CMA followed by RMW factor (2.36% and 1.93%, respectively) is highest. Similarly, the mean for Market premium is also large (1.11%). While the mean for UMD factor is least (0.06% per month).

Table 2: Descriptive statistics for the monthly factor return

Mkt		SMB		HML	
Mean	1.11%	Mean	-0.19%	Mean	-1.15%
Standard Error	0.47%	Standard Error	0.45%	Standard Error	0.70%
Median	0.93%	Median	-0.28%	Median	-0.80%
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	6.78%	Standard Deviation	6.38%	StandardDeviation	10.07%
Sample Variance	0.46%	Sample Variance	0.41%	SampleVariance	1.01%
Kurtosis	3.86	Kurtosis	35.11	Kurtosis	44.51
Skewness	0.02	Skewness	-3.57	Skewness	1.00
Range	60.72%	Range	83.85%	Range	154.98%
Minimum	-26.55%	Minimum	-57.08%	Minimum	-67.14%
Maximum	34.16%	Maximum	26.77%	Maximum	87.84%
Sum	2.27	Sum	-0.38512	Sum	-2.34
Count	204	Count	204	Count	204

This shows that investors gain better monthly returns when portfolios are sorted based on investment and profitability. But on the flip side, the monthly deviations from mean is also largest for CMA and RMW factor (11.87%, 10.88%) followed closely by HML factor (10.07%). These results would shock risk averse and moderate risk investors to invest in a highly risky market for a month's time horizon.The standard deviation for UMD factor is least (5.10%) but relative to its mean portfolio return this deviation is quite large. In summary, descriptive statistics clears the fact that investing in portfolios based on ff six factor model factor premiums for a month's time horizon is not a very lucrative for a risk averse investor in Indian equity market.

Table 3: Descriptive statistics for the monthly factor returns

CMA		RMW		UMD	
Mean	2.36%	Mean	1.93%	Mean	-0.06%
Standard Error	0.83%	Standard Error	0.76%	Standard Error	0.36%
Median	1.06%	Median	1.11%	Median	-0.07%
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	11.87%	Standard Deviation	10.88%	Standard Deviation	5.10%
Sample Variance	1.41%	Sample Variance	1.18%	Sample Variance	0.26%
Kurtosis	73.17	Kurtosis	36.44	Kurtosis	48.72
Skewness	7.98	Skewness	4.77	Skewness	-4.60
Range	151.77%	Range	121.95%	Range	71.75%
Minimum	-25.46%	Minimum	-25.05%	Minimum	-50.72%
Maximum	126.31%	Maximum	96.90%	Maximum	21.04%
Sum	4.81	Sum	3.94	Sum	-0.12
Count	204	Count	204	Count	204

Table 4: Covariance -matrix of monthly factor returns

	RM-RF	SMB	HML	CMA	RMW	UMD
RM-RF	1					
SMB	0.23	1.00				
HML	0.31	-0.28	1.00			
CMA	-0.05	-0.48	0.28	1.00		
RMW	-0.21	-0.48	-0.11	0.63	1.00	
UMD	-0.04	-0.34	0.35	0.09	-0.27	1

The Table 4 below shows the correlation matrix across the risk factor. The CMA and RMW factors are most correlated (0.63) followed by SMB with CMA and RMW are moderately correlated (0.48). UMD, CMA and Mkt factor are least correlated. While by large the factors are only on an average correlated. Therefore, regression performed in this research Paperstill holds the validity.

Table 5: Monthly percent average returns of portfolios from year 2003 to 2019

	Low	2	3	4	High
FFSF – $SMB_{(t)}$,$HML_{(t)}$,$CMA_{(t)}$,$RMW_{(t)}$ and $UMD_{(t)}$					
Panel A: Size – BE/ME Portfolio					
Small	3.09	2.52	2.52	1.76	2.20
2	6.15	2.54	5.07	1.88	1.65
3	3.73	3.10	2.51	2.24	2.82
4	2.48	5.61	3.55	2.22	1.84
Big	2.30	2.62	2.10	4.96	1.38
Panel B: Size – OP Portfolio					
Small	1.18	1.34	2.90	3.39	3.33
2	1.14	5.04	2.46	4.78	4.00
3	1.82	2.67	2.53	2.80	4.75
4	1.93	3.13	2.49	5.64	3.28
Big	1.65	1.99	1.88	2.43	6.39
Panel C: Size – INV Portfolio					
Small	1.74	1.95	2.07	2.58	3.03
2	1.67	2.87	2.38	5.32	3.44
3	2.85	2.47	2.85	3.17	2.84
4	2.22	1.50	2.42	3.83	5.28
Big	1.62	1.98	1.99	2.10	6.07
Panel D: Size – MOM Portfolio					
Small	3.05	1.72	2.65	1.93	1.99
2	4.98	1.84	1.95	2.80	2.52
3	3.03	2.51	2.32	2.20	2.65
4	2.23	2.75	2.40	2.59	3.57
Big	2.04	2.31	1.88	2.19	2.76

The Table 5 below details the variation in spread in BE/ME, OP, INV and MOM returns with Size returns. For SIZE-BE/ME portfolios, there is a positive relationship between average returns and BE/ME but it is incrementally weaker in higher BE/ME fifth quantiles. Similarly, for Size-MOM portfolios average returns and MOM are positively related and the strength weakens with higher MOM quintiles. The results are all the way opposite for Size-OP and Size INV portfolio average returns. The Size and OP , Size and INV portfolios average returns are positively related to respective OP and INV quintiles but it progressively strengthens with higher OP and INV quintiles.

It is also seen that Size-BE/ME, Size-OP, Size-INV and Size-MOM for mega-cap portfolio monthly returns are more or less similarly related. In addition to this the portfolio returns in each panel on Size quintiles are loosely related,this raises the question on relevance and importance of size risk factor in presence of other combination of factors.

Factor Spanning Test and GRS Test

The factor spanning test is the test of any one factor premiums on the other factor premiums. This test helps in finding, which given factor is more relevant and redundant for an asset pricing model. The factor spanning results for Fama and French six factors model in panel A and five factors in panel Bare shown in Table 6. R-square is least (0.22 and 0.21) when tested on market premium and highest (0.67, 0.55) when tested on profit premium in six-factor and five-factor model respectively. On the other hand, the intercept is highest for HML premium followed by market and Investment premium (-1.82, 1.55, 1.24 respectively). While the intercept for profit premium is only 0.41 and 0.14 for six and five factor model respectively. This clarify that market premium is the most relevant factor premium as its absence from the model increases the intercept and low R-square confirms that other factor premiums are not sufficient enough to explain the variance in market premium. Alternatively, profit premium is a significantly weak factor premium. It is surprising that Fama and French (2017) found profit premium important for Asia-Pacific region but it is found that market, size and investment factor premium are more relevant for Indian equity market. The size risk factor is found to be a redundant factor in factor spanning test for both six and five factor model. The intercept is approaching zero (0.08 and -0.14) when tested on size premium for both six and five factor model respectively. Again, size proves to be the weakest factor premium as already evident from results in Table 2 and Table 5.

The intercept in a time series regression should be identical to zero for an asset pricing model to be stated as the best fit model amongst other prevalent models. This study uses GRS statistic, average alpha and other summary metrics to test

Table 6: Using five-factors in regression that explains the average return on sixth from period July 2003 to June 2019

	Coefficient							t-statistics							
Part A: FFSF– $(Rm-Rf)_{(t)}$, $SMB_{(t)}$, $HML_{(t)}$, $CMA_{(t)}$, $RMW_{(t)}$ and $UMD_{(t)}$															
	Int	Mkt	SMB	HML	CMA	RMW	UMD	Int	Mkt	SMB	HML	CMA	RMW	UMD	R^2
Mkt	1.55		0.16	0.49	0.02	-0.05	-0.06	3.50		0.16	0.49	0.02	-0.05	-0.06	0.22
SMB	0.08	0.30		-0.52	0.01	-0.71	-0.41	0.23	0.30		-0.52	0.01	-0.71	-0.41	0.53
HML	-1.82	0.28	-0.16		0.34	-0.24	0.05	-3.11	0.28	-0.16		0.34	-0.24	0.05	0.38
CMA	1.24	0.01	0.00	0.33		0.48	0.10	2.06	0.01	0.00	0.33		0.48	0.10	0.54
RMW	0.41	-0.05	-0.34	-0.38	0.78		-0.32	0.85	-0.05	-0.34	-0.38	0.78		-0.32	0.67
UMD	0.36	-0.15	-0.51	0.20	0.43	-0.83		1.24	-0.15	-0.51	0.20	0.43	-0.83		0.42
Part B: FFFF – $(Rm-Rf)_{(t)}$, $SMB_{(t)}$, $HML_{(t)}$, $CMA_{(t)}$ and $RMW_{(t)}$															
	Int	Mkt	SMB	HML	CMA	RMW	Int	Mkt	SMB	HML	CMA	RMW	R^2		
Mkt	1.51		0.24	0.48	0.00	-0.05	3.42		4.42	5.52	-0.02	-0.05	0.21		
SMB	-0.14	0.37		-0.61	-0.17	-5.14	-0.38	4.42		-5.76	-1.44	-5.14	0.41		
HML	-1.77	0.28	-0.23		0.38	-6.38	-3.02	5.52	-5.76		5.53	-6.38	0.38		
CMA	1.46	0.00	-0.06	0.35		10.58	2.39	-0.02	-1.44	5.53		10.58	0.52		
RMW	0.14	0.00	-0.23	-0.45	0.67		0.26	-0.05	-5.14	-6.38	10.58		0.55		

the hypothesis how better FFSF model explains the portfolio returns. The GRS test have a pre-assumed null hypothesis that alpha is zero, the smaller is GRS statistics the better are the chances not to reject the null hypothesis for a given model. The results in Table 7 clearly shows that GRS p-value test outrightly rejects the null hypothesis for all types of factor sorted portfolios for the six-factor and five-factor model. The FFSF and FFFF model clearly fails the GRS test and the null hypothesis is rejected.

Table 7: Asset pricing test summary for six-factor and five-factor model from period July 2002 to June 2019

	GRS stats	GRS pval#	Aa_i^2/Ar_i^2	$A\|a_i\|$	$As^2(a_i)/Aa_i^2$	AR^2
Panel A: 6-factor model						
Size-BE/ME	2.67	0.00	0.58	0.01	0.02	0.56
Size-INV	2.55	0.00	0.75	0.01	0.02	0.55
Size- OP	3.92	0.00	0.66	0.01	0.02	0.56
Size-MOM	2.49	0.00	1.01	0.01	0.00	0.61
Panel B: 5-factor Model						
Size-BE/ME	2.62	0.00	0.16	0.01	0.02	0.54
Size-INV	2.62	0.00	0.68	0.01	0.02	0.55
Size- OP	3.51	0.00	0.27	0.01	0.02	0.54

#5% significance level

Fama and French (2017) clearly mentions that GRS test failed FF five factor model for all the regions except Japan where the GRS statistics was close to 1(Fama & French, 2017) . According to our results the GRS statistics at 5% significance level is more than 2 for all types of factor sorted portfolios, this means that there is presence of more than twice factor variance in the portfolio returns which is remained unexplained by the FF six factor and five factor model. It is to be noted that GRS test for Size-OP portfolios is close to 4 (3.92) in six-factor model and more than 3 (3.51) in five-factor model this shows that profitability factor of Fama and French model is significantly weak in comparison to other factors, reinforcing the R-square and intercept results from Table 6 of factor spanning test where the R-square is maximum and intercept is low for both the models when tested on profit factor. The other summary tests- Aa_i^2/Ar_i^2, describes the unexplained dispersion relative to total dispersion in the portfolio returns, are significantly high for six-factor model for all types of factor sorted portfolios. This means that higher the ratio, greater the presence of unexplained variable factor premiums. The FFFF model intercept dispersion is still better for size-be/

me (0.16) and size-op (0.27) factor sorted portfolios than six-factor model. The average absolute interceptA $|a_i|$ of different portfolios is almost same for both the factor models. The results show both six-factor and five-factor model in Indian equity market have high intercept 0.01 (close to 1%) on an average during the given time period from 2002 to 2019. $As^2(a_i)/ Aa_i^2$ metric tests the dispersion of intercept in relation to dispersion of LHS average portfolio returns. Thus, lower this metric the better is the model. The estimates of Aa_i^2/Ar_i^2 for FF six-factor model size-be/me portfolios is 0.58 states the FFSF model has failed to explain nearly 60% of the spread in average portfolio returns. The $As^2(a_i)/ Aa_i^2$ estimate for the same is only 0.02 which states that there is merely 2% of the unexplained disturbance in average portfolio returns that accounts to sampling error. It is a negligible value. In addition to this the average of R-squares for each type of factor sorted portfolio is almost same, except for a little improvement in size-mom factor portfolios. These results suggest and conclude that the FFSF model is not preferable or stronger than the FFFF for Indian equity market for the time period from July 2002 to June 2019.

Asset Pricing

This is the most important section of the study that details the results of regression for each type of factor sorted portfolios. Table 8,9,10 and 11 summarises the intercept and coefficient values of LHS portfolio returns for six and five factor model sorted on size-be/me, size-op, size-inv and size-mom factor premiums respectively.

Size-Be/Me Portfolio

The intercept for five-factor model is very high that progressively reduces on BE/ME and size quintiles. There is a large difference in intercept range where -2.22% is minimum and 2.61% is maximum. The intercept for six-factor model widens even more ranging from minimum -2.36% to maximum 2.61%. The market and size coefficient are very strong and progressively gains strength with each higher BE/ME quintiles. The h coefficient has an average strength but the other (c, r, u) coefficient are relatively very low, this means that any change in CMA, RMW and UMD factor will not have any significant effect on the portfolio returns.

Table 8: Six-factor Intercepts and coefficient for 25 Size-BE/ME portfolios for period July 2003 to June 2019

B/M	Low	2	3	4	High	Low	2	3	4	High
Part A:FFSF coefficients: $(Rm- Rf)_{(t)}$, $SMB_{(t)}$, $HML_{(t)}$, $CMA_{(t)}$, $RMW_{(t)}$ and $UMD_{(t)}$										
			$a_{(i)}$				t(a)			
Small	1.71	1.56	1.23	0.45	1.47	2.82	2.96	2.65	0.83	1.79
2	1.35	1.29	-0.65	0.85	0.61	0.87	3.05	-0.44	1.95	1.13
3	2.22	1.81	1.21	1.18	2.61	0.02	4.40	2.95	2.89	2.51
4	1.26	-2.36	2.54	0.91	0.91	3.19	-1.38	2.77	2.41	2.19
Big	1.18	1.45	0.93	1.11	0.32	2.95	4.80	2.60	0.97	0.88
			$\hat{a}_{(i)}$				t(â)			
Small	0.87	0.75	0.92	1.00	0.75	9.13	9.14	12.71	11.88	5.83
2	1.52	0.81	0.08	0.87	0.94	6.24	12.35	0.36	12.72	11.12
3	0.82	0.73	0.82	0.86	0.68	0.82	11.39	12.69	13.49	4.17
4	0.69	1.43	0.84	0.89	0.93	11.08	5.34	5.82	14.98	14.35
Big	0.63	0.68	0.84	0.80	1.04	10.18	14.44	15.06	4.49	18.04
			$s_{(i)}$				t(s)			
Small	0.72	0.49	0.60	0.59	0.83	5.53	4.33	6.05	5.12	4.75
2	1.06	0.50	4.28	0.38	0.45	3.16	5.55	13.68	4.04	3.85
3	0.30	0.24	0.20	0.27	0.37	0.30	2.74	2.28	3.14	1.67
4	0.09	-2.03	-0.64	0.27	0.10	1.04	-5.54	-3.24	3.33	1.18
Big	0.00	0.08	-0.01	-1.58	-0.07	0.02	1.22	-0.19	-6.49	-0.85
			$h_{(i)}$				t(h)			
Small	0.10	0.21	0.13	0.17	0.44	1.41	3.39	2.42	2.60	4.56
2	-0.76	0.10	-0.42	0.14	0.22	-4.12	1.92	-2.45	2.64	3.41
3	-0.10	0.17	0.05	0.13	0.29	-0.10	3.48	1.10	2.73	2.36
4	-0.11	-2.69	-0.14	0.09	0.16	-2.26	-13.24	-1.28	2.08	3.31
Big	0.00	0.00	0.05	2.85	0.12	0.07	-0.05	1.13	21.06	2.68
			$c_{(i)}$				t(c)			
Small	0.01	-0.03	-0.03	0.00	0.05	0.21	-0.56	-0.53	0.04	0.48
2	-0.08	0.00	3.56	-0.02	0.01	-0.45	0.05	20.85	-0.47	0.08
3	-0.04	0.06	0.02	-0.03	-0.29	-0.04	0.06	0.02	-0.03	-0.29
4	-0.03	1.43	0.16	0.01	-0.01	-0.55	7.16	1.50	0.33	-0.15

Contd...

Contd...

Big	0.00	0.01	-0.05	0.97	-0.03	-0.09	0.15	-1.12	7.29	-0.73
			$r_{(i)}$				t(r)			
Small	0.15	0.10	0.13	0.08	0.05	1.71	1.32	1.91	0.95	0.42
2	1.08	0.11	-1.43	0.00	-0.02	4.64	1.74	-6.55	-0.03	-0.26
3	0.16	0.13	0.04	0.02	0.10	0.16	2.06	0.70	0.36	0.66
4	0.03	-0.41	-0.47	0.05	-0.13	0.57	-1.61	-3.46	0.94	-2.05
Big	0.05	0.04	0.02	1.67	-0.14	0.82	0.79	0.44	9.82	-2.47
$u_{(i)}$	t(u)									
Small	0.34	0.09	0.14	0.12	-0.21	2.34	0.72	1.24	0.94	-1.07
2	-3.16	0.22	0.55	0.11	-0.13	-8.40	2.17	1.57	1.04	-1.02
3	0.42	0.19	0.04	0.13	0.05	0.42	1.93	0.43	1.34	0.22
4	0.17	0.39	0.26	0.08	-0.25	1.75	0.93	1.16	0.90	-2.46
Big	0.19	0.13	0.02	-1.18	-0.22	1.98	1.82	0.20	-4.30	-2.47
	Low	2	3	4	High	Low	2	3	4	High
PartB: FFFF coefficients: Rm- Rf, SMB, HML, CMA and RMW										
			$a_{(i)}$				t(a)			
Small	1.84	1.59	1.28	0.49	1.39	3.00	3.04	2.77	0.91	1.70
2	0.20	1.37	-0.45	0.89	0.56	0.11	0.11	-0.31	2.04	1.04
3	2.37	1.88	1.23	1.23	2.63	3.67	4.56	3.00	3.01	2.55
4	1.32	-2.22	2.64	0.94	0.82	3.33	-1.30	2.88	2.50	1.96
Big	1.25	1.50	0.94	0.68	0.24	3.11	4.95	2.64	0.57	0.65
			$\hat{a}_{(i)}$				t(â)			
Small	0.85	0.74	0.91	1.00	0.76	8.85	9.12	12.63	11.85	5.95
2	1.72	0.80	0.05	0.86	0.95	6.08	6.08	0.21	12.68	11.27
3	0.79	0.72	0.81	0.85	0.67	7.87	11.18	12.73	13.40	4.17
4	0.68	1.41	0.82	0.88	0.94	10.91	5.28	5.74	14.97	14.46
Big	0.62	0.67	0.84	0.87	1.05	9.96	14.25	15.15	4.72	18.13
			$s_{(i)}$				t(s)			
Small	0.58	0.45	0.55	0.54	0.92	4.96	4.51	6.16	5.28	5.89
2	2.34	0.41	4.06	0.33	0.50	6.77	6.77	14.52	4.01	4.86
3	0.13	0.16	0.18	0.22	0.35	1.05	2.08	2.34	2.83	1.77
4	0.02	-2.19	-0.74	0.24	0.20	0.27	-6.71	-4.23	3.28	2.55

Contd...

Contd...

Big	-0.08	0.03	-0.02	-1.10	0.02	-0.99	0.43	-0.32	-4.88	0.31
			$h_{(i)}$				t(h)			
Small	0.12	0.22	0.14	0.17	0.43	1.64	3.48	2.55	2.71	4.48
2	-0.92	0.11	-0.40	0.14	0.21	-4.30	-4.30	-2.29	2.76	3.33
3	-0.08	0.18	0.06	0.14	0.29	-1.08	3.67	1.15	2.87	2.40
4	-0.10	-2.67	-0.13	0.10	0.15	-2.08	-13.21	-1.17	2.19	3.04
Big	0.01	0.00	0.05	2.79	0.11	0.27	0.14	1.16	19.87	2.41
			c				t(c)			
Small	0.05	-0.03	-0.01	0.01	0.02	0.71	-0.42	-0.28	0.24	0.26
2	-0.40	0.02	3.61	-0.01	-0.01	-1.94	-1.94	21.58	-0.25	-0.14
3	0.00	0.08	0.03	-0.02	-0.28	0.01	1.65	0.60	-0.42	-2.40
4	-0.01	1.47	0.19	0.02	-0.03	-0.19	7.52	1.78	0.53	-0.67
Big	0.02	0.02	-0.04	0.85	-0.05	0.33	0.54	-1.10	6.27	-1.26
			r				t(r)			
Small	0.05	0.07	0.09	0.04	0.12	0.59	1.11	1.49	0.55	1.13
2	2.08	0.04	-1.60	-0.04	0.02	8.94	8.94	-8.52	-0.65	0.31
3	0.02	0.07	0.03	-0.02	0.09	0.29	1.24	0.56	-0.37	0.64
4	-0.02	-0.53	-0.55	0.03	-0.05	-0.37	-2.43	-4.72	0.56	-0.91
Big	-0.01	-0.01	0.02	2.04	-0.07	-0.22	-0.16	0.39	13.40	-1.39

#5% significance level

Table 9:Six-factor intercepts and coefficient for 25 Size-OP portfolios for period July 2003 to June 2019

OP	Low	2	3	4	High	Low	2	3	4	High
Part A: FFSF coefficients: $(Rm- Rf)_{(t)}$, $SMB_{(t)}$, $RMW_{(t)}$, $CMA_{(t)}$ and $UMD_{(t)}$										
			$a_{(i)}$				t(a)			
Small	-0.20	0.08	1.39	2.64	1.96	-0.36	0.18	2.45	3.42	3.75
2	0.09	-0.57	1.29	0.16	2.54	0.15	-0.39	3.12	0.09	3.14
3	0.72	1.24	1.27	1.59	4.25	1.42	2.61	3.14	4.39	4.01
4	0.87	2.19	1.32	-2.52	2.04	2.12	2.08	3.72	-1.46	5.48
Big	0.49	0.96	0.83	1.13	2.08	1.38	2.84	2.56	3.89	1.57
			$\hat{a}_{(i)}$				t(â)			
Small	1.05	0.93	1.11	0.61	0.86	11.86	12.44	12.48	5.07	10.61

Contd...

Contd...

2	0.92	0.11	0.79	1.55	0.91	9.38	0.47	12.24	5.86	7.19
3	0.99	0.88	0.79	0.79	0.54	12.52	11.89	12.56	14.02	3.26
4	0.91	0.92	0.78	1.52	0.75	14.20	5.57	14.15	5.67	12.83
Big	1.02	0.76	0.71	0.84	0.71	18.22	14.33	14.18	18.50	3.43
			$s_{(i)}$				t(s)			
Small	0.61	0.66	0.60	0.75	0.59	4.99	6.44	4.94	4.57	5.25
2	0.48	4.27	0.42	1.00	0.54	3.60	13.62	4.78	2.78	3.13
3	0.27	0.17	0.23	0.27	0.44	2.49	1.64	2.63	3.52	1.93
4	0.04	-0.72	0.19	-2.10	0.22	0.41	-3.17	2.54	-5.71	2.80
Big	-0.16	-0.04	0.06	0.04	-1.74	-2.08	-0.53	0.86	0.72	-6.13
			$h_{(i)}$				t(h)			
Small	0.16	0.18	0.14	0.32	0.14	2.33	3.13	2.13	3.46	2.30
2	0.19	-0.37	0.08	-0.69	0.02	2.57	-2.16	1.71	-3.45	0.20
3	0.16	0.16	0.05	0.08	0.14	2.65	2.86	1.11	1.76	1.09
4	0.12	-0.10	0.03	-2.70	-0.03	2.43	-0.80	0.79	-13.23	-0.68
Big	0.12	0.05	0.04	0.01	3.09	2.89	1.27	1.06	0.28	19.71
			$c_{(i)}$				t(c)			
Small	0.06	0.01	-0.08	-0.01	0.03	0.96	0.25	-1.18	-0.07	0.56
2	0.00	3.52	0.01	-0.10	-0.06	0.03	20.59	0.31	-0.51	-0.68
3	0.00	0.05	0.04	0.02	-0.36	-0.07	0.89	0.83	0.51	-2.89
4	0.03	0.16	0.00	1.44	-0.02	0.66	1.29	0.04	7.16	-0.41
Big	0.05	-0.02	-0.02	-0.01	1.05	1.12	-0.57	-0.46	-0.39	6.80
			$r_{(i)}$				t(r)			
Small	0.00	0.09	0.20	0.13	0.14	0.03	1.25	2.40	1.11	1.81
2	-0.01	-1.42	0.05	1.05	0.19	-0.07	-6.52	0.83	4.17	1.60
3	-0.06	0.11	0.02	0.04	0.34	-0.78	1.59	0.38	0.83	2.15
4	-0.13	-0.54	0.01	-0.39	0.06	-2.08	-3.45	0.28	-1.51	1.16
Big	-0.17	-0.04	0.01	0.04	1.99	-3.25	-0.70	0.13	0.95	10.12
			$u_{(i)}$				t(u)			
Small	-0.05	0.06	0.21	0.06	0.30	-0.38	0.49	1.51	0.34	2.35
2	0.12	0.53	0.16	-2.87	0.03	0.82	1.49	1.61	-7.07	0.18
3	-0.12	0.17	0.05	0.22	0.49	-1.02	1.48	0.53	2.58	1.93
4	-0.27	0.22	0.11	0.34	0.28	-2.78	0.87	1.30	0.83	3.14
Big	-0.19	-0.14	0.02	0.21	-1.24	-2.16	-1.66	0.23	3.07	-3.91

#5% significance level

Size-Op, Size-Inv And Size-Mom Portfolio

The intercept range widens (-2.52 to 2.54) but in comparison to Size-BE/ME portfolios the intercepts are relatively low. The intercept increases with the BE/ ME quintile. Similar pattern is found for results of Size-INV portfolios where the intercept range is even wider (-2.77 to 2.73). Just like Size-BE/ME portfolios the â and s coefficient are very strong with an average strength h coefficient and least from c, r, and u coefficient. The Size-MOM portfolio also show the similar pattern except that the intercept are stronger at low BE/ME quintile and becomes progressively weakens at high BE/ME quintiles. The strength of for all the coefficient is similar as described above except for u coefficient show average strength on all the BE/ME quintile.

Table 10:Six-factor Intercepts and coefficient for 25 Size-INV portfolios for period July 2003 till June 2019

INV	Low	2	3	4	High	Low	2	3	4	High
Part A: FFSF coefficients: $(Rm- Rf)_{(t)}$, $SMB_{(t)}$, $RMW_{(t)}$, $CMA_{(t)}$ and $UMD_{(t)}$										
			$a_{(i)}$					t(a)#		
Small	1.55	0.82	0.68	1.17	1.79	1.71	1.56	1.35	2.38	3.38
2	0.66	1.44	1.12	-0.79	2.12	1.39	1.93	2.54	-0.49	4.63
3	2.72	1.36	1.50	1.82	1.47	2.63	3.43	2.33	4.72	3.64
4	0.91	0.89	1.39	2.73	-2.77	2.67	2.17	3.72	3.03	-1.59
Big	0.48	0.93	0.99	0.82	2.06	1.33	2.98	3.35	2.55	1.72
			$â_{(i)}$					t(â)#		
Small	0.33	0.91	0.99	0.91	0.83	2.36	11.06	12.61	11.91	10.08
2	0.86	0.98	0.96	-0.11	0.85	11.61	8.41	13.97	-0.44	11.88
3	0.53	0.80	0.86	0.84	0.86	3.29	12.93	8.54	13.97	13.60
4	0.88	0.53	0.72	0.83	1.62	16.55	8.25	12.43	5.86	5.94
Big	0.82	0.77	0.76	0.83	0.86	14.39	15.75	16.53	16.55	4.58
			$s_{(i)}$					t(s)#		
Small	0.78	0.58	0.58	0.53	0.64	4.02	5.15	5.45	5.03	5.61
2	0.48	0.50	0.32	4.84	0.41	4.71	3.12	3.41	13.81	4.16
3	0.47	0.21	0.31	0.15	0.32	2.11	2.49	2.28	1.86	3.66
4	0.18	-0.02	0.08	-0.65	-2.09	2.46	-0.26	1.01	-3.35	-5.59
Big	0.02	-0.07	-0.06	0.02	-1.53	0.21	-1.11	-0.97	0.26	-5.95
			$h_{(i)}$					t(h)#		
Small	0.48	0.22	0.07	0.14	0.17	4.45	3.48	1.16	2.39	2.71
2	0.17	0.07	0.05	-0.44	0.08	3.00	0.79	0.89	-2.29	1.42

Contd...

Contd...

3	0.30	0.09	-0.03	0.17	0.03	2.43	1.89	-0.34	3.62	0.68
4	0.02	0.12	0.05	-0.13	-2.60	0.43	2.39	1.11	-1.26	-12.59
Big	0.06	0.06	0.02	0.00	2.82	1.35	1.59	0.44	0.01	19.90
			$c_{(i)}$					t(c) #		
Small	0.07	-0.05	0.00	-0.01	0.10	0.62	-0.85	-0.02	-0.12	1.64
2	-0.03	-0.05	-0.03	3.94	0.07	-0.47	-0.62	-0.59	20.65	1.35
3	-0.36	-0.01	-0.03	0.07	0.04	-2.96	-0.16	-0.41	1.62	0.84
4	0.02	0.04	0.02	0.14	1.47	0.42	0.78	0.56	1.34	7.24
Big	0.00	-0.01	-0.06	0.02	0.99	-0.10	-0.38	-1.66	0.41	7.08
			$r_{(i)}$					t(r) #		
Small	0.00	0.13	0.08	0.17	0.02	0.01	1.68	1.08	2.35	0.31
2	0.03	0.15	0.02	-1.53	0.01	0.38	1.33	0.31	-6.30	0.21
3	0.25	0.02	0.09	0.06	0.04	1.60	0.31	0.89	0.98	0.70
4	0.00	-0.16	-0.05	-0.39	-0.49	-0.06	-2.62	-0.96	-2.91	-1.87
Big	-0.03	-0.04	-0.03	-0.01	1.69	-0.47	-0.76	-0.74	-0.14	9.46
			$u_{(i)}$					t(u) #		
Small	-0.23	0.01	0.20	0.15	0.16	-1.05	0.11	1.65	1.30	1.22
2	0.17	-0.10	0.11	0.72	0.13	1.45	-0.56	1.09	1.83	1.21
3	0.19	0.11	0.24	0.14	0.18	0.78	1.11	1.58	1.47	1.86
4	-0.06	-0.31	0.01	0.42	0.15	-0.70	-3.12	0.12	1.93	0.35
Big	-0.03	-0.04	-0.06	0.01	-1.09	-0.38	-0.57	-0.88	0.18	-3.80

#5% significance level

Table 11: Six-factor Intercepts and coefficient for 25 Size-MOM portfolios for period July 2003 to June 2019

MOM	Low	2	3	4	High	Low	2	3	4	High
Panel A: FFSF coefficients: $(Rm- Rf)_{(t)}$, $SMB_{(t)}$, $RMW_{(t)}$, $CMA_{(t)}$ and $UMD_{(t)}$										
			$a_{(i)}$					t(a) #		
Small	1.70	0.69	1.20	0.62	0.54	3.38	1.39	2.45	1.35	1.01
2	1.16	0.65	0.78	1.63	1.17	0.94	1.54	1.70	3.98	2.60
3	1.89	1.30	0.98	0.80	1.18	4.37	3.33	2.41	2.30	2.95
4	1.24	1.76	1.08	1.28	2.17	3.53	4.61	3.15	3.56	3.03
Big	1.12	1.42	0.83	0.95	1.32	3.08	3.99	2.51	2.94	3.35

Contd...

Contd...

			$\hat{a}_{(i)}$					t(â)#		
Small	1.05	0.86	1.00	1.00	1.02	13.39	11.04	13.09	13.94	12.23
2	1.50	0.83	0.88	0.81	0.94	7.77	12.58	12.25	12.61	13.30
3	0.78	0.81	0.91	0.91	0.96	11.53	13.27	14.31	16.74	15.35
4	0.86	0.72	0.84	0.84	1.04	15.68	12.13	15.63	15.03	9.28
Big	0.82	0.69	0.72	0.81	0.97	14.34	12.41	13.93	15.99	15.81
			$s_{(i)}$					t(s)#		
Small	0.52	0.58	0.62	0.63	0.66	4.87	5.46	5.87	6.42	5.80
2	0.86	0.40	0.49	0.51	0.38	3.25	4.48	4.93	5.77	3.93
3	0.13	0.29	0.23	0.29	0.41	1.35	3.50	2.68	3.89	4.75
4	-0.06	0.22	0.15	0.13	-0.44	-0.74	2.68	2.08	1.63	-2.85
Big	-0.18	0.09	0.07	0.09	0.08	-2.26	1.15	1.00	1.25	0.98
			$h_{(i)}$				t(h)#			
Small	0.18	0.18	0.13	0.16	0.12	3.08	3.09	2.24	3.03	1.97
2	-0.41	0.11	0.08	0.11	0.10	-2.77	2.25	1.42	2.24	1.90
3	0.20	0.08	0.02	0.07	0.08	3.83	1.83	0.47	1.76	1.79
4	0.09	0.09	-0.02	0.02	-0.15	2.26	2.07	-0.40	0.47	-1.80
Big	0.09	0.09	0.06	0.03	0.03	2.03	2.10	1.44	0.90	0.65
			$c_{(i)}$				t(c)#			
Small	-0.01	-0.03	0.02	-0.06	-0.03	-0.18	-0.57	0.38	-1.11	-0.52
2	-0.11	0.02	-0.01	0.02	0.01	-0.79	0.43	-0.23	0.36	0.15
3	0.08	0.02	-0.01	0.00	-0.02	1.67	0.48	-0.22	0.11	-0.49
4	0.04	0.00	0.04	0.00	0.09	0.88	0.00	1.00	0.05	1.07
Big	0.02	-0.08	-0.04	-0.01	-0.01	0.38	-1.88	-1.15	-0.28	-0.14
			$r_{(i)}$				t(r)#			
Small	0.08	0.06	0.11	0.17	0.18	1.09	0.81	1.44	2.44	2.21
2	0.83	0.04	0.03	0.06	0.07	4.53	0.60	0.44	1.05	1.08
3	-0.02	0.03	0.04	0.09	0.16	-0.37	0.55	0.72	1.84	2.61
4	-0.16	-0.01	-0.02	0.04	-0.28	-3.15	-0.13	-0.38	0.79	-2.64
Big	-0.18	0.04	0.05	0.04	0.05	-3.29	0.73	0.99	0.87	0.91
			$u_{(i)}$				t(u)#			
Small	-0.04	0.00	0.10	0.43	0.43	-0.31	0.04	0.83	3.88	3.39
2	-2.70	-0.01	0.21	0.33	0.24	-9.10	-0.14	1.93	3.39	2.21
3	-0.26	0.14	0.16	0.27	0.31	-2.54	1.43	1.60	3.24	3.24
4	-0.41	0.00	0.03	0.24	0.54	-4.90	0.02	0.38	2.75	3.13
Big	-0.51	0.02	0.07	0.26	0.37	-5.85	0.28	0.90	3.28	3.91

5% Significance Level

Conclusion

The descriptive statistics summary clearly depicted debilitated role of ff six factor model risk premiums with very high coefficient of variation for a month's time horizon. This leaves scope for further investigation on FFSF model on weekly constructed portfolios and/or on futures and options contract portfolios for various time horizons. The study uses factor spanning test to identify how important or redundant are the FF six and five factor model for Indian Equity Market. The study also applied GRS test, and other metrics to test the presence of unexplained alpha in the total LHS portfolio returns. As detailed earlier in results, the range of intercept widens with six factor model than five factor model although the average absolute alpha is nearly same for both the models. GRS p-value test clearly rejects the null hypothesis that alpha for FF six-factor model is zero. And also, the GRS statistics results are more than 2 that clearly show presence of other important unexplained factor variable in the risk factor model. The Aa_i^2/ Ar_i^2 also shows that the unexplained variance in alpha out of the total variance in portfolio return is more than 60% unexplained. The $As^2(a_i)$/ Aa_i^2 confirms the robustness of the study with merely 2% of sampling error. As stated in the results, operating profitability premiumis comparatively weaker from other factor premium and raises doubt on its measurement. It is found that there is further scope of investigation on other measures of profitability than to use operating profitability for asset pricing model in Indian equity market portfolios. During the analysis results also shows that size risk factor is a weak factor in the ff six and five factor model for Indian equity market. It is suggested to test the importance and relevance of size factor in combination with other factor as individually -size has significant relevance and found to be strong by Sehgal and Tripathi (Sehgal & Tripathi, 2005) for Indian equity market. Therefore, this research Paper is insightful for academicians and researcher, who gets directed to find a more consistent and strong factor premium model, most appropriately suitable for Indian equity market. It also has significant implication for portfolio managers, investors, mutual fund managers who can better form and sort the portfolios with different combinations of factor premium than following ff six factor model universally.

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Measuring Dispersion and Volatility for Diversification Benefit: Evidence from the NSE Nifty50 Portfolio

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Abstract: *Diversification is used by portfolio managers to reduce diversifiable risk. Dispersion measures the spread of a stock's price around a reference benchmark such as a broad-based stock index, like NSE Nifty50, or another asset. Portfolio managers require quantitative metrics for estimation of risk and correlation for active and objective management in line with evolving market dynamics. Unlike the other measures of risk, like volatility, variance, and correlation, Dispersion does not require a long historical time series to provide an estimate of future volatility of a stock. Therefore, it captures market evolution well and qualifies as a handy, quantitative metric for decisions related to options pricing and portfolio diversification. The study examines the utility of dispersion as a portfolio diversification tool for the NSE Nifty50 portfolio during recent market action, i.e., from the year 2014 to 2020. The study examines the dispersion of monthly returns of heavyweight Nifty50 portfolio stocks around the index, their contemporaneous volatility, and demonstrates how can dispersion be used for identifying potential portfolio diversification benefit opportunities without the need for long-term historical estimators.*

Keywords: Stock Market, NSE, Return, Volatility, Correlation, Dispersion, Portfolio Diversification.

Introduction

In portfolio management, Volatility (of component stock returns), Correlation (among component stock returns), and Dispersion (of component stocks returns around a reference) are the three major considerations in building the portfolio and actively managing the portfolio for meeting the return and risk targets. As demonstrated by Edwards (2014, 2013) for the S&P Dow Jones Industrial Average (DJIA) index, recent period dispersion captures the volatility effect well, without

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needing a long time series of stock returns. Combined with the correlation among the component stocks, dispersion can be used for portfolio diversification and active portfolio management. This study empirically validates the application of dispersion, as proposed by Edwards (2014) for S&P DJIA index, to Nifty50 portfolio diversification for the period from January 2014 to September 2020.

Volatility, Correlation and Dispersion

Volatility of an asset – such as a stock, stock index, option, future, interest rate, exchange rate and diversified portfolio, etc. – indicates the variability of its returns over a *historical* period of time, ranging from a minute to a day to decades. Volatility is defined in terms of statistical measures of the variability of percentage price changes or rates of return. The most commonly used statistical measure of volatility is the standard deviation (commonly denoted as 'ó') of historical returns, in part because it is used as a standard measure of risk in theories of portfolio selection and asset pricing. The standard deviation measures the dispersion of returns or the degree to which they vary from period to period, the period being a month, day and even hour or minute. Thus, volatility can be calculated for month-to-month returns, day-to-day returns and even minute-to-minute returns. For instance, if the standard deviation based on daily close-to-close percentage price change for a month is 10%, it is very unlikely (that is, there is about a 5% chance) that an investor will experience returns outside a range of ± 20% (two standard deviations) over that month.

Volatility of a stock depends upon the market-wide risk (systematic risk) and stock-specific risk (idiosyncratic risk). While the idiosyncratic risk can be mitigated by diversification, systematic risk is undiversifiable.

Different factors affect long-term and short-term volatility. Long-term volatility is related to factors whose impact persists in time. Schwert (1989) has shown that aggregate financial leverage is correlated with stock return volatility, a finding that is in conformity with the Financial Leverage theory. Schwert(1989b) has shown that the Great Depression was a period of extremely high volatility. This relationship may in part reflect operating leverage, as recessions are typically associated with excess capacity and unemployment.

Short-term bursts of volatility are hard to relate to longer-term phenomena such as recessions or leverage. Instead, most researchers have tried to relate them to the structure of securities trading, e.g. trading volume (Karpoff, 1987), trading halts (Roll, 1988), mergers and acquisitions, international market linkages (Contagion), or simply the "noise" trading around a news/event that is hard to figure coherently, e.g. the Covid 2019 virus pandemic. Kaur (2002, 2003, 2004) has extensively studied volatility patterns and behaviour of the Indian stock

market and confirmed its characteristics of persistence (GARCH process) and mean reversion.

Correlation is a metric for the amount of variance shared between asset pairs. A high and positive coefficient of correlation between two Nifty portfolio stocks means that their prices will move up or down instep and in the same direction. Conversely, a high but negative correlation means strong co-movement but in opposite directions, i.e. positive return on one asset is offset by negative return on the other.

Volatility and Correlation are key to portfolio diversification decision. However, Correlation as a portfolio diversification tools though suffers from some problems. According to Edwards and Lazzara (2013), Correlation, in this context, has the deficiencies as: Correlation does not fully and truly capture interrelationships among more than two assets; It captures the extent of (un)sympathetic movement of asset pairs but not the magnitude of their movements; Even uncorrelated assets may have some relationship with each other; Like Volatility, Correlation requires a sizable historical time series for robust estimation.

Dispersion of a portfoliois the extent of spread of component stock returns around a reference benchmark, e.g. the Nifty50 index. Dispersion is a single-period measure that measures the cross-sectional correlation of portfolio component returns. Weaker the correlation, wider the spread and higher the dispersion. While correlation is about the *direction* of a stock's price relative to another, dispersion is about the *magnitude* of returns on the two (or more) stocks.

As shown in Figure 1a and 1b a sample Nifty sub-portfolio had higher daily return dispersion in March 2020 than in March 2014, and, exhibited episodes of high and low dispersion within a month. The thick red line represents daily return on Nifty. Figure 2 depicts the differences in component stock returns, and

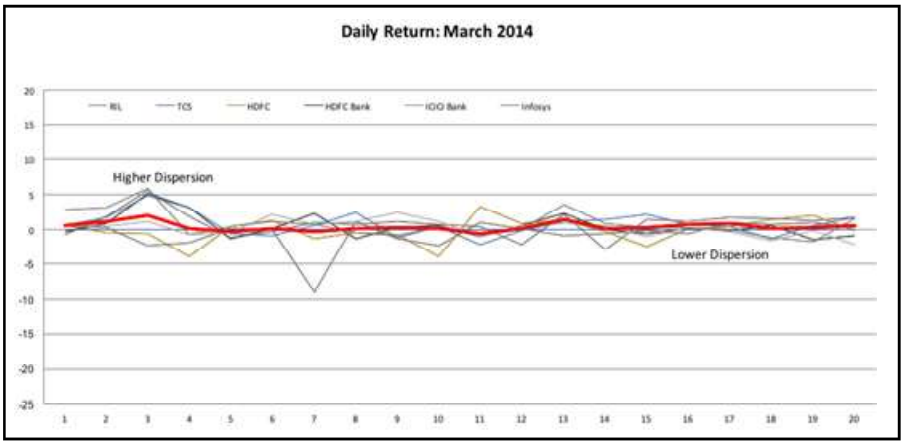

Figure 1a: Nifty & components: dispersion snapshots

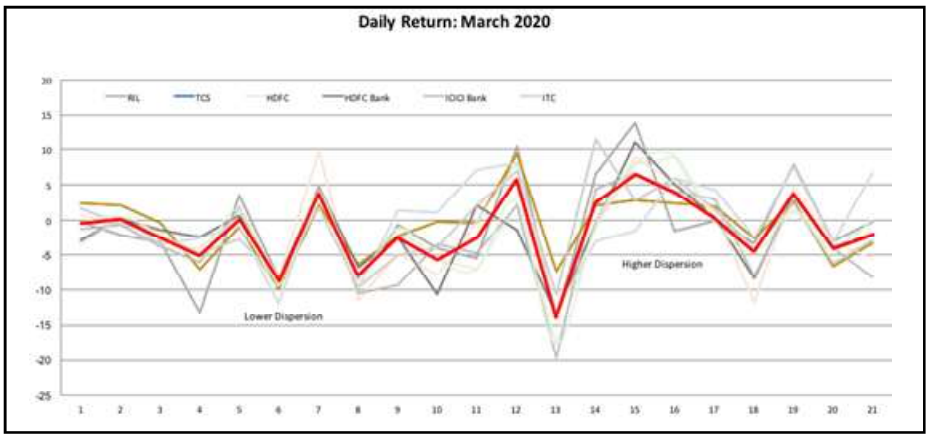

Figure 1b: Nifty & components: dispersion snapshots

the difference of component stocks returns from Nifty returns during these two months. While March 2014 had a mix of positive and negative return, all stocks gave negative returns in March 2020. March 2020 also exhibited higher dispersion of returns from the Nifty index as compared to March 2014.

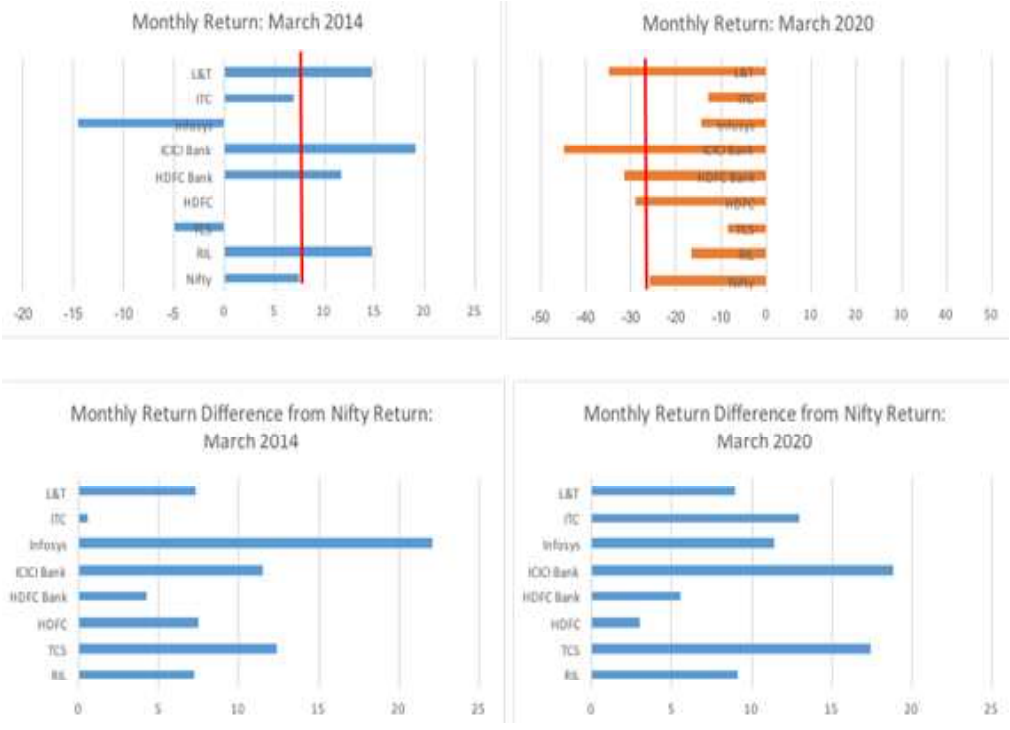

Figure 2: Dispersion of monthly returns on Nifty component stocks

Unlike volatility and correlation, dispersion is a single-period measure and does not require long-term historical data for meaningful computation, especially for the purpose of option pricing and active portfolio management. Volatility exhibits persistence over time (stickiness) and mean reversion. Dispersion has both these characteristics and, additionally, accounts for the correlation among the component stocks. This make dispersion an excellent parameter from the point of view of *active* portfolio management.Dispersion's volatility-like method of computation (Table 1) and properties(mean reversion, persistence) coupled with the need for a smaller data set make it very suitable for portfolio diversification decisions. Since dispersion is a metric of the *magnitude (and not the direction, as is the case with Correlation)* of a stock's return relative to return on a benchmark (index), it is a better tool – for a simple stock picker as well as for a portfolio manager wanting to rebalance a portfolio for gaining the diversification benefit.

Table 1: Computations of volatility and dispersion

Volatility	$s =$	$\sigma = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(r_t - \bar{r})^2}$	n = number of observations r_i = return on day i $\bar{r}$ = average return during the period
Dispersion		$\delta = \sqrt{\sum_{i=1}^{n} w}$	w_i = Weight of the i_{th} portfolio component tr_{it} = Return on i_{th} portfolio component stock on period tm_t = Market (or Portfolio) return on period t

Portfolio Diversification & Dispersion

Portfolio diversification refers to the science (and art) of choosing a basket of assets to meet the goal of earning a return equal to or higher than a specified minimum while capping the risks – market risk and asset-specific or company-specific risk – to within a certain maximum. Diversification endeavours to mitigate the "diversifiable" risk, i.e. risk specific to a portfolio component. Diversification can be done by using a single type of asset, e.g. equity shares of different companies, or across many asset classes, e.g. equity, debt, exchange rate, assets traded on foreign markets, etc.

Diversification is primarily done for exploiting the "Diversification Benefit" – defined as the difference between the average component volatility and market volatility – to reduce portfolio risk. The difference between the average component volatility and market volatility may exist because of varying degree (magnitude) and nature (positive or negative) of correlation among portfolio components. For instance, a "balanced" portfolio could have a mix of debt and equity because return on debt and equity have a negative correlation. Similarly, stocks across

industry segments and products across asset classes may have a negative correlation, e.g. Oil & Gas and automotive, and equity and gold.

Over time, dispersion measures the diversification benefit of the market portfolio. For an unequal-weighted portfolio, the return and dispersion of a portfolio is computed as follows (Table 2):

Table 2: Computations of portfolio return & dispersion

Portfolio Return	$P_t = M_t + \sum_{i=1}^{n} w_i r_{it}$	P_t = Portfolio Return M_t = Market Return w_i = Weight of the i_{th} portfolio component r_{it} = Return on the i_{th} portfolio component
Dispersion (Diversification Benefit)	$\delta = \sqrt{\sum_{i=1}^{n} w_i (r_{it} - M_t)^2}$	

The weight of a component is the proportion of total portfolio investment allocated to that component. Higher its weight, more the impact of a component's return/ volatility on portfolio return/volatility.Dispersion measures the cross-sectional idiosyncratic variance over a time period. In other words, the amount of variance that is lost when considering market portfolio as a single investment (Edwards and Lazzara, 2014).

The "Diversification Benefit", i.e. dispersion, then is the net outcome of interplay of volatility and correlation among portfolio components, Intuitively, a low market volatility and low correlation regime should yield higher diversification benefit.

Research Methodology

Sample

Since the market indices are fairly representative of the various industry sectors, and trading activity mostly revolves around the stocks comprising the indices. the study sample comprises two NSE indices, viz. Nifty50 and India VIX (NVIX), and eight component stocks from the Nifty50 portfolio. While Nifty50 represents the market portfolio, NVIX has been used to represent the expected market volatility. Eight "heavyweight" stocks that accounted for around 50% of Nifty50 market capitalization during the period of study (January 2014 to September 2020), have been chosen for component analysis (Table 3).

We restrict our analysis to these stocks in order to limit the number of computations required but without compromising on the validity of outcomes. Some of these stocks are also part of the 'Nifty Low Volatility 30' list, and, therefore, it is reasonable to assume that this portfolio consists of low as well as higher volatility stocks.

Table 3: Component stocks

Company	Stock Symbol (Yahoo! Finance)	Industry
Reliance Industries	RELIANCE.NS	Energy
Tata Consultancy Services	TCS.NS	IT
HDFC	HDFC.NS	Financial Services
HDFC Bank	HDFCBANK.NS	Financial Services
ICICI Bank	ICICIBANK.NS	Financial Services
Infosys	INFY.NS	IT
ITC	ITC.NS	Consumer Goods
Larsen & Toubro	LTI.NS	Construction

Table 4: Methods of computation of return, volatility, correlation & dispersion

Volatility (Standard Deviation)	$\sigma = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(r_t - \bar{r})^2}$	n = number of observations r_i = return on day i $\bar{r}$ = average return during the period

Monthly volatility is calculated as the standard deviation of daily returns in a month multiplied by the square root of number of trading days in a month. Further, monthly volatility is annualised by multiplying by square root of number of months in a year.

Daily Return	$r_t = log_n(\frac{p_t}{p_{t-1}})$	p_t = price on day t p_{t-1} = price on the day t-1

Monthly return is calculated by considering p_t as the last day of the month and p_{t-1} as the first day of the month. Further, monthly return is annualised by multiplying by square root of number of months in a year.

Correlation *(Pearson)*	$r = \rho_{xy} = \frac{\sigma_x \sigma_y}{Cov\ (x,y)}$	Cov(x,y) = covariance of variables x and y, e.g. daily returns on RIL and HDFC ó$_x$ = standard deviation of variable x, i.e. of daily return on RIL ó$_y$ = standard deviation of y, i.e. of daily return on HDFC
Dispersion	$\delta = \sqrt{\sum_{i=1}^{n} w_i (r_{it} - m_t)^2}$	w_i = Weight of the i_{th}portfolio component, e.g. weight of RIL in the Nifty50 portfolio r_{it} = Return on i_{th} portfolio component stock on period tm_t = Market (or Portfolio) return on period t, e.g. return on Nifty50 in a day/month/…

Data Sources

Daily closing prices (adjusted) of the NSE Nifty50 index, NSE India VIX index – NVIX, and the eight Nifty heavyweight stocks(listed above) for the period January 2014 to September 2020 have been taken from Yahoo! Finance(*finance@yahoo.com)*. Summary statistics on Nifty component stocks and their respective weights have

been taken from monthly reports published by the NSE (www.*nseindia.com).*

Measures of Daily Return, Volatility, Correlation and Dispersion

Table 4 summarises the methods used for computation of return, volatility, correlation and dispersion.

Method of Analysis

The following methodology has been used in the study.

First, the various time series used in the study, viz. Nifty50, RIL, TCS, HDFC, HDFC Bank, ICICI Bank, Infosys, ITC, L&T and NVIX, are synchronised by removing extra values and/or estimating missing values. Next, daily return is computed for Nifty and the eight component stocks as log normal difference of consecutive day prices. Monthly return is computed as log normal difference of prices on the first and last day of the month. Returns are represented as percentages. Volatility of daily returns in a month is then computed as the sample standard deviation of daily returns. Monthly volatility considers the number of trading days in a particular month. For annualizing monthly volatility, it is multiplied it by $\sqrt{12}$. Dispersion of portfolio returns in a month is computed similar to volatility but the component stock average return is replaced with the return on the reference benchmark (Nifty), and multiplying the variance with the weight of the component stock. Correlation among asset-pairs, e.g. Nifty-RIL, TCS-Infosys, etc., is computed as Pearson's product moments. Next step is to compute some useful descriptive statistics on annualized Monthly Returns, Volatility and Dispersion. This is done in order to study the nature of the distributions. Also, months are ranked and grouped on the basis of high/low returns, volatility and dispersion to examine the contemporaneous values of these metrics on the timeline. For instance, was dispersion high or low during a month in which volatility was high, or, was monthly return high when dispersion was high, etc.

Where required, charts are plotted to visually present the information generated and see the evidence of interrelationships among the various metrics.

Results

Computation & Analysis of Monthly Return

Table 5 summarises the descriptive statistics on the monthly returns on Nifty50 index and component stocks from January 2014 to September 2020. From Table 5, on the average, RIL (2.15%) and Infosys (1.79%) were the best performing

stocks (bold text), and ITC (-0.14%) and HDFC (0.38%) the worst performing (*italicised* text). ICICI Bank (64.71%) and L&T (54.93%) exhibited the largest range of monthly returns.

Table 5: Monthly return (%) on Nifty and components: Descriptive statistics (January 2014 – September 2020)

Metric	Nifty	RIL	TCS	HDFC	HDFC Bank	ICICI Bank	Infosys	ITC	L&T
Mean	0.74	2.15	1.30	*0.38*	1.76	1.56	1.79	*-0.14*	0.47
Min.	-25.84	-16.70	-14.96	-28.87	-31.38	*-44.68*	-14.58	-18.29	*-34.79*
Max	*17.78*	29.57	19.39	19.06	18.85	20.03	27.75	*12.56*	20.14
Range	43.62	46.27	*34.34*	47.93	50.23	64.71	42.34	*30.85*	54.93
Q1	-1.88	*-3.75*	-3.35	-2.08	-1.28	-3.19	-2.20	-3.23	*-5.47*
Q2 (Median)	0.99	1.62	*0.57*	0.00	1.77	1.30	2.37	*-0.70*	0.68
Q3	4.44	6.81	5.06	*2.24*	6.02	7.60	6.04	*3.43*	5.31
Q4	*17.78*	29.57	19.39	19.06	18.85	20.03	27.75	*12.56*	20.14

Table 6 lists the top 5 and bottom 5 months for monthly returns on all the assets, i.e. Nifty and each component stock. From Table 6, it is observed that April 2020 (18.07%) was the top month for all Nifty and all components, excepting ITC, and, March 20 (-24.22%) among the bottom performers for Nifty as well as all component stocks.

Across all assets, April 2020, January 2018 (9.92%), July 2018 (7.795), March 2016 (7.63%) and May 2014 (7.285) gave the highest returns, and November 2016 (-4.91%), March 2015 (-5.07%), August 2015 (-5.37%), February 2016 (-8.70%) and March 2020 gave the lowest returns. February 2016 was poor month for Nifty (-7.83%), TCS (-9.87%), HDFC (-10.70%), ICICI Bank (-13.35%), and ITC (-9.39%).

Each stock also had its own unique good and bad months, such as October 2017 for RIL (16.42%), April 2018 for TCS (19.39%), November 2018 for the HDFC twins (10.71% for HDFC Bank & 12.12% for HDFC), July 2014 for ITC (-13.86%), etc. This indicates the existence of a market wide pattern as well as stock-specific behaviour. This is expected since at any given time the performance of an asset will be affected by broad market phenomena and company specific factors.

Computation & Analysis of Volatility

Table 7 summarises the descriptive statistics of the annualised volatility of monthly returns on Nifty50 index and component stocks from January 2014 to September 2020. From Table 7, on the average, ICICI Bank (31.86%) and RIL (26.23%) were the most volatile stocks (bold text), and HDFC (17.98%) and HDFC Bank (18.95%)

the least volatile (*italicised* text). ICICI Bank was the most volatile stock even on quartile basis.

Table 6: Monthly return (%) onNifty and components: Top 5 & bottom 5 months (January 2014 – September 2020)

Top 5 Months	Return (%)	Bottom 5 Months	Return (%)	Top 5 Months	Return (%)	Bottom 5 Months	Return (%)
All				*HDFC Bank*			
Apr-20	18.07	Nov-16	-4.91	Apr-20	18.85	Oct-18	-6.27
Jan-18	9.92	Mar-15	-5.07	Mar-14	11.69	Aug-15	-6.40
Jul-18	7.97	Aug-15	-5.37	Jan-15	10.98	Feb-16	-8.66
Mar-16	7.63	Feb-16	-8.70	Aug-20	10.76	Jul-19	-9.88
May-14	7.28	Mar-20	-24.22	Nov-18	10.71	Mar-20	-31.38
Nifty				ICICI Bank			
Apr-20	17.78	Oct-18	-5.81	Apr-20	20.03	Jan-16	-10.47
May-14	7.69	Jul-19	-6.51	Mar-14	18.98	Sep-14	-10.88
Mar-14	7.47	Aug-15	-6.93	Oct-19	18.56	Aug-15	-11.86
Mar-16	6.90	Feb-16	-7.83	May-17	16.93	Feb-16	-13.35
Jul-18	6.35	Mar-20	-25.84	Jun-14	14.88	Mar-20	-44.68
RIL				Infosys			
Apr-20	29.57	Jun-19	-2.51	Jul-20	27.75	Aug-17	-9.44
Jul-18	21.08	Jul-19	-6.51	Apr-20	17.14	Dec-14	-9.77
Jul-20	17.74	Oct-18	-5.81	Jan-19	11.91	Apr-15	-11.27
Feb-17	16.51	Aug-15	-6.93	Oct-14	11.49	Mar-20	-14.43
Oct-17	16.42	Mar-20	-25.84	Jan-18	11.07	Mar-14	-14.58
TCS				ITC			
Apr-18	19.39	Sep-19	-7.00	May-20	12.56	Feb-16	-9.39
Jan-18	17.03	Aug-16	-7.55	Jul-18	12.37	Sep-20	-10.23
Apr-20	16.46	Mar-20	-8.43	May-16	11.65	Mar-20	-12.88
Jun-14	14.91	Feb-16	-9.87	May-17	11.04	Oct-19	-13.95
Feb-17	12.89	Oct-18	-14.96	Jul-14	9.06	Jul-17	-18.29
HDFC				L&T			
Apr-20	19.06	Feb-18	-8.42	May-14	20.14	Feb-18	-9.92
Jan-18	13.85	Sep-18	-10.30	May-16	16.39	Jul-19	-10.23

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May-16	12.53	Feb-16	-10.70	Apr-20	14.76	Jan-16	-13.11
Nov-18	12.12	Nov-16	-11.51	Mar-14	14.74	Jul-14	-13.86
Jan-17	11.53	Mar-20	-28.87	May-19	13.65	Mar-20	-34.79

Two interesting observations can be made from Table 7.

Nifty (14.49%) volatility was lower than even the least volatile component stock (HDFC, 17.98%). *Weighted* average of component volatilities (computed by multiplying a component's volatility by its weightage in that month) is around 11 to 12% higher than Nifty volatility.

These two observations point to the phenomenon where, in a portfolio like Nifty, volatilities across components cancel each other out due to negative correlation between index/stock pairs. This phenomenon is key to our understanding of the utility of dispersion as a portfolio diversification tool. We further confirm this behaviour in the section on correlation.

Table 7: Annualised volatility of monthly return (%): Descriptive statistics
(January 2014 – September 2020)

Metric	Nifty	Weighted	RIL	TCS	HDFC	HDFC	ICICI Bank	Infosys	ITC	L&T
Mean	*14.49*	25.74	26.23	23.62	*17.98*	*18.95*	31.86	25.51	24.42	25.58
Min.	*5.41*	16.05	12.56	10.79	0.00	*8.04*	15.99	12.87	*10.36*	11.44
Max	79.74	95.20	110.65	68.41	105.68	89.16	102.74	85.48	91.93	93.43
Range	74.33	79.15	98.09	57.62	105.68	81.12	86.75	72.61	81.57	81.99
Q1	*10.04*	20.60	20.45	18.79	0.00	*13.64*	23.78	19.74	*18.01*	18.67
Q2 (Median)	*12.54*	23.50	23.72	22.60	*18.04*	*16.11*	28.86	22.08	21.42	22.82
Q3	*15.41*	27.07	27.85	25.82	*24.61*	*20.11*	34.87	27.74	26.53	28.00
Q4	*79.74*	95.20	110.65	*68.41*	105.68	89.16	102.74	*85.48*	91.93	93.43

Table 8 lists the five most volatile and five least volatile months for Nifty, Weighted Components,and individual components. From Table 8, it is observed that the March 2020 – May 2020 period was the most volatile for the market and the components. March had the highest volatility (around 80% for Nifty and 95% for weighted components). February 2020 was also highly volatile but only for HDFC (38.22%) and ITC (48.78%).

Similar to the case of monthly returns, each stock/index/portfolio had its own unique high and low volatility months. For instance, February 2017 was a highly volatile month only for RIL (42.20%) and October 2017 only for ICICI Bank

(53.61%). December 2017 a very low volatility month for only RIL(12.56%) and weighted components (16.05%).

June 2017 was the least volatile for Nifty (5.41 %) and December 2017 (16.05%) for weighted components. This again confirms that the volatility of Nifty is below the components by at least by around 11%. This behaviour points to the fact that in an index like Nifty50, the volatility of components gets cancelled out due to correlations among them. Their individual idiosyncrasies come into play, especially during periods of low or medium volatility. This, though,is not true during regimes when some high impact macro event, like the crash of March 2020, overwhelms investor sentiment and drives most stocks in the same direction.

This observation is confirmed by Figure 3, where annualised volatility of Nifty index and component stocks is plotted for various months from January 2014 to September 2020. The chart shows that the weighted volatility of component stocks stays above the Nifty volatility by around 11%-12%. The two horizontal lines represent the average volatility of Nifty and the average (weighted) volatility of component stocks.

Table 8: Annualised volatility of monthly return (%) on Nifty and components: Top 5 & bottom 5 months (January 2014 – September 2020)

Top 5 Months	Volatility (%)	Bottom 5 Months	Volatility (%)	Top 5 Months	Volatility (%)	Bottom 5 Months	Volatility (%)
Nifty					*HDFC Bank*		
Mar-20	79.74	Oct-17	7.56	Mar-20	89.16	Jun-19	11.76
Apr-20	45.78	Jul-18	7.22	Apr-20	55.73	Jul-17	11.16
May-20	32.93	Jul-17	7.16	May-20	55.10	Aug-18	9.85
Sep-19	25.81	Nov-14	7.09	Sep-19	37.41	Jun-17	9.74
Aug-15	25.18	Jun-17	5.41	Jun-20	35.79	Nov-17	8.04
Component Weighted					ICICI Bank		
Mar-20	95.20	Jun-17	18.13	Mar-20	102.74	Dec-17	18.23
Apr-20	61.99	Dec-19	18.02	Apr-20	92.48	Dec-19	17.02
May-20	51.87	Sep-17	17.07	May-20	71.72	Jun-17	16.95
Oct-18	38.08	Jun-19	16.77	Oct-17	53.61	Sep-17	16.24
Sep-19	36.62	Dec-17	16.05	Sep-19	51.01	Aug-17	15.99
RIL					Infosys		
Mar-20	110.65	Jun-16	14.94	Mar-20	85.48	Dec-19	15.67
Apr-20	61.03	Aug-14	14.79	Oct-19	67.67	Sep-16	15.17
Oct-18	50.80	Jul-16	14.72	Apr-20	57.74	Sep-17	13.99
Feb-17	42.20	Nov-14	14.42	Aug-17	46.73	Oct-17	13.94
Aug-19	41.88	Dec-17	12.56	Jul-20	42.16	Jun-19	12.87

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TCS					ITC		
Mar-20	68.41	Oct-17	12.33	Mar-20	91.93	Oct-17	13.72
Apr-20	61.99	Nov-14	12.01	Jul-17	55.73	Aug-18	13.62
Oct-14	40.93	Aug-17	11.72	Mar-15	50.78	Jan-14	13.41
Oct-18	38.37	Aug-20	11.32	Feb-20	48.78	Jun-19	12.15
Jan-14	36.32	Aug-18	10.79	May-20	48.37	Jul-14	10.36
HDFC					L&T		
Mar-20	105.68	Apr-18	14.89	Mar-20	93.43	Dec-16	15.57
Apr-20	67.81	Mar-19	14.84	May-20	51.55	Feb-17	15.39
May-20	64.61	Dec-17	14.57	May-16	50.53	Nov-19	15.35
Oct-18	40.87	Oct-17	13.26	Sep-19	48.14	Dec-15	12.63
Feb-20	38.22	Sep-17	13.05	Feb-16	44.17	Aug-17	11.44

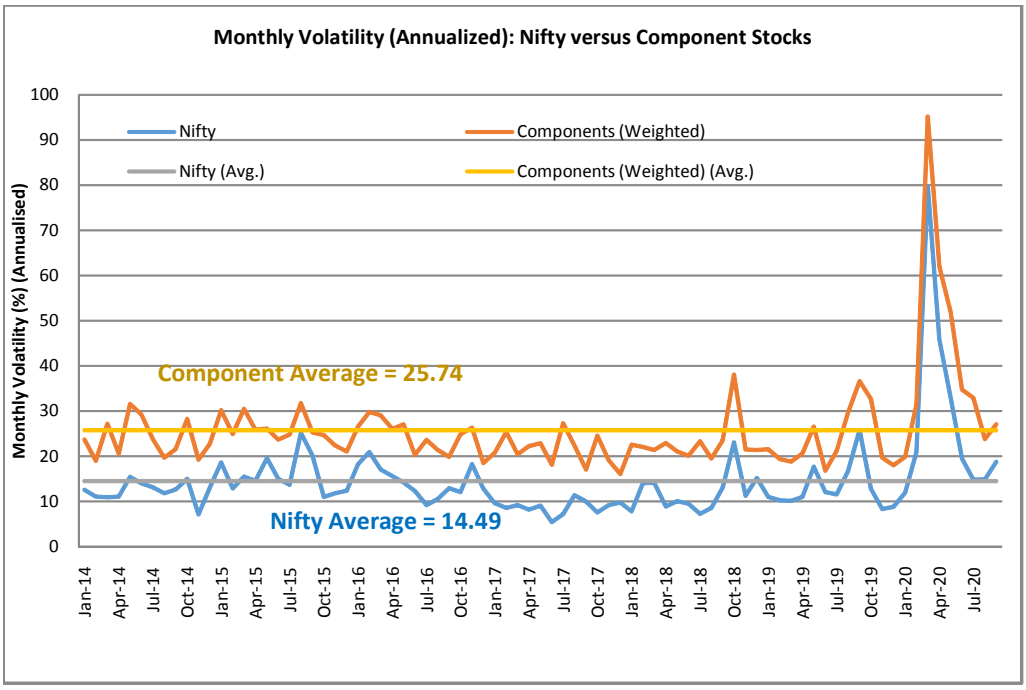

Figure 3: Monthly volatility of daily return (%): Nifty and weighted components (January 2014 – September 2020)

These observations indicate the existence of a market-wide pattern volatility as well as stock-specific behaviour. This is expected since a macro event that induces high volatility (e.g. a market crash, oil shock, global pandemic, war, etc.) is bound to have a sweeping impact across the broad market. A company or sector specific news or event will however have a localised impact on volatility. However, it

may be noted that there is no watertight separation between the macro and micro events. For instance, a good news about a specific company or industry sector may be drowned out by a macro event.

Computation & Analysis of Correlation

Table 9 shows the extent and nature of correlation among Nifty and component stocks.

As expected, Nifty has high degree of correlation with all component stocks, ranging from 42% for TCS to 75% for HDFC Bank. Between the component pairs, correlation of daily returns is much lower, ranging from 14% for Infosys-ITC to 54% for L&T-ICICI Bank.RIL has high correlation with Banking Stocks and low correlation with IT stocks. Banking stocks have low correlation with other sectors but for construction. IT stocks have low correlation with all other sectors. ITC has the lowest correlation with other stocks.

These insights can then be exploited by an active portfolio manager for effective portfolio diversification, that is keeping overall volatility (risk) low while achieving targeted return.

Table 9: Pearson's correlation coefficient of daily return (%) onNifty and components (January 2014 – September 2020)

	RIL	TCS	HDFC	HDFC Bank	ICICI Bank	Infosys	ITC	L&T
Nifty	0.66	0.42	0.57	0.75	0.73	0.45	0.48	0.70
RIL	1.00	0.23	0.28	0.44	0.40	0.22	0.22	0.39
TCS	0.23	1.00	0.20	0.22	0.19	0.50	0.19	0.18
HDFC	0.28	0.20	1.00	0.52	0.40	0.21	0.29	0.36
HDFC Bank	0.44	0.22	0.52	1.00	0.52	0.24	0.31	0.52
ICICI Bank	0.40	0.19	0.40	0.52	1.00	0.21	0.28	0.54
Infosys	0.22	0.50	0.21	0.24	0.21	1.00	0.14	0.20
ITC	0.22	0.19	0.29	0.31	0.28	0.14	1.00	0.28
L&T	0.39	0.18	0.36	0.52	0.54	0.20	0.28	1.00

Computation & Analysis of Dispersion

Finally, we examine the dispersion metric for various months. Table 10 presents the descriptive statistics on the dispersion of component stock return around the Nifty50 benchmark.

Table 10: Dispersion of component returns (annualised) (%): Descriptive statistics (January 2014 – September 2020)

Mean	12.24	Q1	8.81
Min.	4.41	Q2 (Median)	11.37
Max	28.54	Q3	15.00
Range	24.14	Q4	28.54

Figure 3 plots the annualised dispersion of Nifty component returns around Nifty. The orange line represents mean dispersion (12.24%).

Table 11 lists the months of relatively higher/lower portfolio dispersion and and low market volatility. Higher portfolio dispersion means that returns on component stocks are spread wider and stock selection and portfolio rebalancing opportunity exists provided market volatility is low. This is further discussed in the next section.

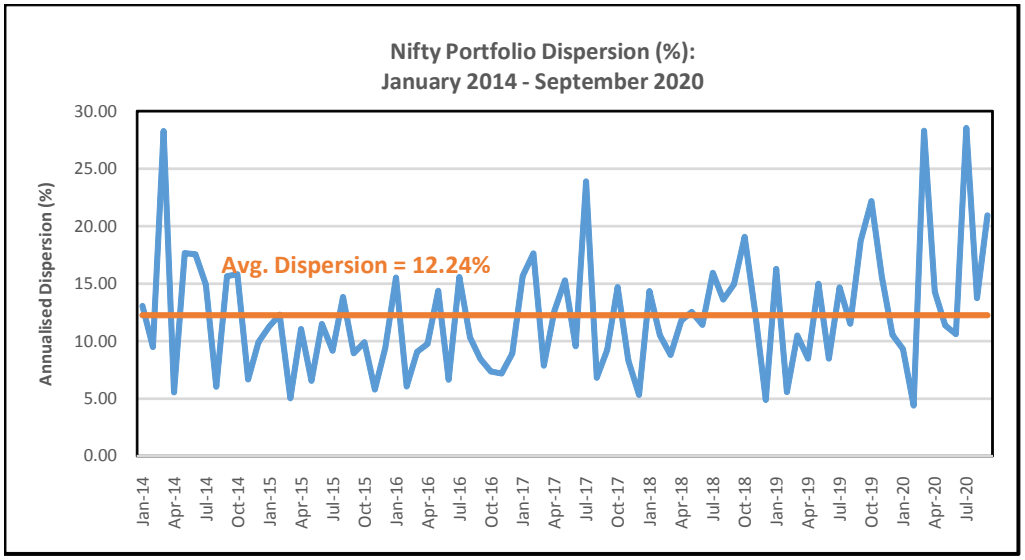

Figure 4: Nifty portfolio dispersion (%) (annualised) (January 2014 – September 2020)

Table 11 shows that there were 32 months out of the total sample of 81 months during which portfolio dispersion was high. Also shown alongside is market (Nifty) volatility during each month. These months, to a varying degree, offered stock selection opportunity to active portfolio managers, that is, they had the opportunity to shuffle stocks in the portfolio to achieve targeted return at a lower risk, or to get higher returns at the same level of risk.

Table 11: Nifty portfolio: diversification benefit opportunities (January 2014 – September 2020)

#	Month	Dispersion (%)	Market Volatility (%)	#	Month	Dispersion (%)	Market Volatility (%)
1	Jul-17	23.90	7.16	17	Apr-18	11.78	8.86
2	Mar-14	28.28	10.90	18	Jul-19	14.69	11.55
3	Jul-18	15.95	7.22	19	Jun-14	17.56	13.95
4	Feb-17	17.65	8.51	20	May-18	12.55	10.04
5	Oct-17	14.71	7.56	21	Sep-14	15.65	12.60
6	Jul-20	28.54	14.81	22	Jun-18	11.42	9.48
7	Nov-19	15.59	8.29	23	Dec-19	10.55	8.77
8	Jan-18	14.37	7.81	24	May-14	17.65	15.41
9	Jun-17	9.56	5.41	25	Sep-18	14.95	13.06
10	Oct-19	22.19	12.79	26	Jul-14	14.93	13.10
11	Jul-16	15.57	9.17	27	Nov-18	12.58	11.21
12	May-17	15.30	9.05	28	Sep-20	20.93	18.73
13	Jan-17	15.69	9.60	29	Oct-14	15.82	14.96
14	Aug-18	13.63	8.51	30	Jan-14	13.06	12.54
15	Apr-17	12.60	8.14	31	Mar-19	10.50	10.11
16	Jan-19	16.28	10.98	32	May-16	14.38	14.19

Opportunities for Exploiting the Diversification Benefit

It is also notable that from Table 11 that none of the high market volatility months are present. This means that high market volatility regimes do not offer opportunity for gaining the diversification benefit. The best bet for an active manager is a lowmarket volatility – high dispersion regime.

Dispersion and Expected Market Volatility

Near-term expected market volatility, say, over next few weeks or months, is used as an input for options pricing. NSE's India VIX index – NVIX – is a robust and popular volatility index. Figure 5 plots daily values of Nifty50 and NVIX, and dispersion of monthly returns on the Nifty component stocks.The green markers (low NVIX – high dispersion) are opportunities for diversification benefit, while the red markers (high VIX – low dispersion) are not.

The pattern observed in Figure 5 is consistent with our earlier analysis done by using monthly volatility (instead of expected volatility) of realized returns on

Nifty and component stocks. This further established the robustness of dispersion as a metric for identifying opportunities for getting the diversification benefit.

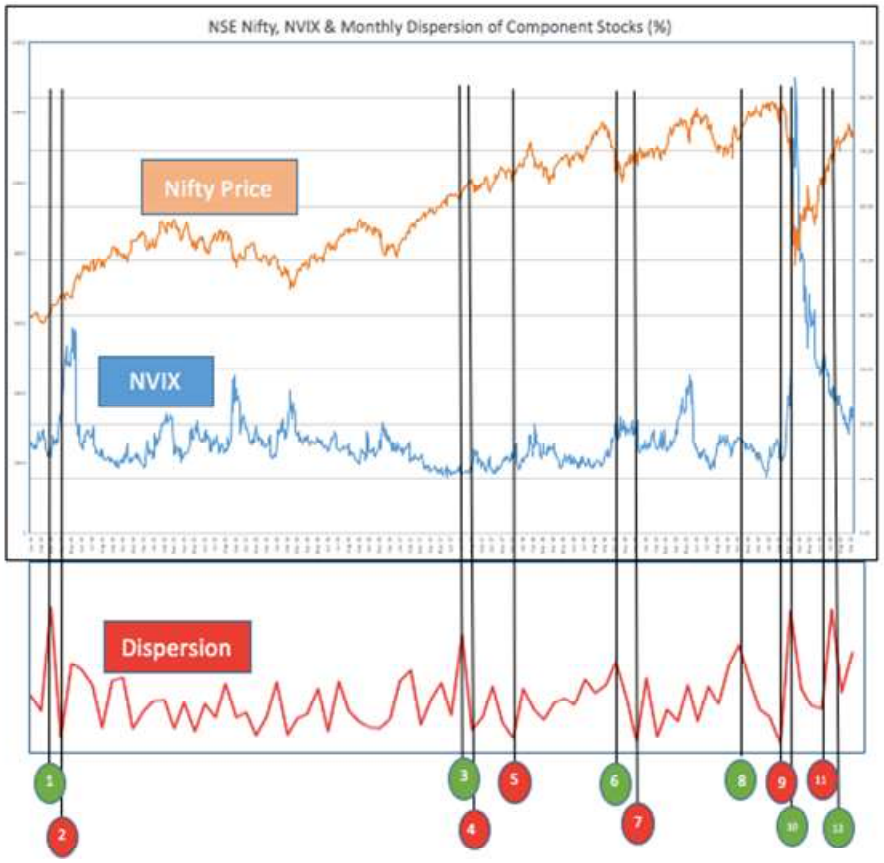

Figure 5: Nifty price, expected volatility (NVIX) & dispersion: Opportunities for diversification benefit (January 2014 – September 2020)

Conlusion

The study examines the monthly return, volatility and dispersion behaviour of NSE Nifty50 index and a portfolio of eight, heavyweight, mixed-volatility level stocks from the Nifty50 portfolio. Dispersion of component stocks around a reference benchmark like a stock index, e.g. Nifty 50, is a single-period measure that complements volatility and correlation in providing inputs to active portfolio managers for exploiting the diversification benefit. The study confirms the findings of Edwards (2014) and Edwards and Lazzara (2013) for the Nifty portfolio, and the usefulness of Dispersion as a metric for active portfolio management.

Specifically, the study finds that Low Volatility – High Dispersion regimes are most suitable for getting the diversification benefit. On the other hand, high general market volatility regimes are not suitable for application of diversification as an active portfolio management metric. Opportunities for exploiting the diversification benefit existed in 32 of the 81 months, that is, roughly 40% of the sample months.

Further studies can be done considering more diversified portfolios in respect of asset classes and global linkages, e.g. debt, bonds, exchange rates, global market indices, sectoral indices, and commodities, etc.

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Ownership Structure and Firm Value: A Panel Data Analysis of BSE Listed Companies

BHARGAV PANDYA

Abstract: The main purpose of this study is to examine the relationship between ownership structure and firm value in the context of Indian listed companies. A sample of 159 firms included in the BSE 200 Index was chosen as a sample for the study. Panel data models were run to examine the relationship between independent and dependent variables. The study covered a period of 11 years ranging from 2009 to 2019. The results of the study suggest that non-promoter institutional holding is positively related to Tobin's Q and price-to-book value ratio. On the contrary, non-promoter non-institutional holding is negatively related to Tobin's Q and price-to-book value ratio. The results of the study imply that increase in institutional holding increases firm value, whereas, the increase in non-promoter non-institutional holding decreases the firm value.

Keywords: Tobin's Q, price-to-book value ratio, ownership structure, firm value.

Introduction

The relationship between ownership structure and firm value has always been a matter of great academic interest and discussions. Promoters being the dominant holders of equity capital of the company usually take away a significant portion of profit with them albeit, at higher business risk. This has led to the accumulation of wealth in the hands of promoters holding a significant stake in equity ownership of the company. Wider diffusion of equity ownership ensures distribution of profits among varied shareholders and brings in greater transparency in the managerial decision making.

Berle and Means (1932) argued that the wider the diffusion of ownership, the poorer the firm performance. They considered ownership structure as an exogenous variable in their study and suggested that the relationship between ownership structure and firm performance should be analyzed adversely. Demsetz (1983) contradicted to the observation of Berle and Means (1932) and suggested that ownership structure should be studied as an endogenous variable

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while analyzing firm performance. Jensen and Meckling (1976) investigated the nature of agency cost and its relationship with separation and control. Demsetz and Villalonga (2001) examined the relationship between ownership structure and firm performance treating ownership as an endogenous variable and found no statistically significant relationship between them. The study further indicated that diffused ownership generated advantages nullifying the agency problem. Clay (2002) found that institutional ownership increases firm value measured in terms of Tobin's Q.Lins and Lemmon (2003) documented that ownership structure is of critical importance in determining the role of insiders in expropriating minority shareholders. Deb and Chatruvedula (2003) investigated the relationship between ownership structure and firm value in Indian firms. They found that an increase in institutional holdings increases the value of the firms. On the contrary, the individual investor holding is negatively related to firm value.

Literature Review

Chen et al. (1993) measured the relationship between management ownership and firm value in the context of Fortune 500 –sized firms. They found that corporate value, measured as Tobin's Q was a function of management ownership. Miguel, et al. (2004) showed that ownership structure mattersin enhancing the value of the firm. Chen, et al. (2008) investigated the relationship between institutional ownership and firm performance of non-financial companies in NewZealand. They found that total institutional ownership had a positive impact on firm value as measured by Tobin's Q and return on equity. Vintilã and Gherghina (2015) analyzed the influence of ownership structure on firm value by using a panel data regression model. The results of their study indicated that insider shareholding and employees' organization ownership had a negative influence on firm value. Marimuthu (2017) attempted to investigate the impact of insider ownership on firm value. Using the pooled OLS method, the study found that managerial ownership and firm values are negatively correlated.

Kumar (2004) analyzed the impact of ownership structure on firm value in the context of Indian companies. His study revealed that shareholding by institutional investors and managers had a significant impact on firm value. Selarka (2005) found a curvilinear relationship between firm value and the fraction of voting rights held by insiders. She also reported that the coordinated behavior of the largest two minority block holders increased firm value when collective control is located in the lower range. Pant and Pattanayak (2007) examined the effect of insider ownership on firm value taking a sample of 1833 firms listed on the Bombay Stock Exchange. The study revealed that there was a non-linear relationship between insider shareholding and firm value. It also confirmed that there was a positive impact of foreign promoter/collaborator shareholding on firm value. Mishra and Kapil (2017) investigated the relationship between

promoter ownership and firm performance taking a sample of 391 companies included in the NSE 500 index. Using panel data analysis, they found a significant positive relationship between promoter ownership and firm performance. This relationship also varied across different levels of promoter ownership. Nazir and Malhotra (2017) attempted to measure the effect of ownership structure on the market value of firms included in the BSE 100 index over the period 2000 to 2014. Using panel data analysis, they found that there was a significant impact of non-promoters holding and non-promoter institutional holding on the market capitalization of the firms. Moreover, the study also found that non-promoters institutional holding and non-promoters non-institutional holding had a significant impact on the price-to-book value of the firms.

Objectives

The following are the objectives of the study.

- To examine the relationship between ownership structure and firm value measured as Tobin's Q
- To investigate the relationship between ownership structure and price-to-book value ratio

Research Methodology

Sample

159 companies included in the BSE 200 index were considered as a sample for the study. These companies were chosen based on the availability of the data for the study period 2009 through 2019.

The data relating to the sample companies for the period 2009 to 2019 were sourced from the Centre for Monitoring Indian Economy's Prowess software.

Independent Variables: Nonpromoters holding, non-promoters institutional holding, non-promoters non-institutional holding represented ownership structure. Total assets were used as a control variable.

Dependent Variable is Tobin's Q

Following clay (2002),Chen et al. (2008), Marimuthu (2017) Tobin's Q ratio was used to capture the firm value. It was calculated as below:

Tobin' Q = (Market value of Equity + Debt)/ Total Assets

Price-to-book value ratio

It is simply the ratio of market price per share divided by the book value per share.

Hypotheses

H_1: There is no significant relationship between measures of ownership structure and Tobin's Q.

H_2: There is no significant relationship between measures of ownership structure and price-to-book-value ratio.

Results and Discussion

Test of Normality

To apply the regression model, all variables were normalized using the two-step method suggested by Templeton (2011). Table 1 presents the results of the normality test. As can be seen, all variables were found to be normally distributed ($p>0.05$).

Table 1: One-sample kolmogorov-smirnov test

		NRNPH	NRNPINH	NRNPNIH	NRTA	NRPB	NRTBQ
N		1717	1712	1716	1747	1706	1748
Normal Parameters[a,,b]	Mean	44.2894	28.1125	16.0626	703094.7633	5.1796	2.8390
	Std. Deviation	17.36108	14.04931	9.71386	2.14455E+06	5.43677	2.99269
Most Extreme Differences	Absolute	.018	.002	.002	.001	.003	.001
	Positive	.018	.002	.002	.001	.003	.001
	Negative	-.017	-.002	-.002	-.001	-.002	-.001
Kolmogorov-Smirnov Z		.762	.076	.087	.039	.112	.039
Asymp. Sig. (2-tailed)		.607	1.000	1.000	1.000	1.000	1.000

a. Test distribution is Normal.

b. Calculated from data.

NRNPH = normalized non-promoter holding

NRNPINH = normalized non-promoter institutional holding

NRNPNIH = normalized non-promoter non- institutional holding

NRTA = normalized totals assets

NRPB = normalized price-to-book-value ratio

NRTBQ = normalized Tobin's Q

Panel Data Models

Model #1:

$$NRTBQ_{it} = \beta_0 + \beta_1 NRNPH_{it} + \beta_2 NRNPH_{it} + \beta_3 NRNPINH_{it} + \beta_4 NRNPNIH_{it} + \beta_5 NRTA_{it} + u_{it}$$

Model # 2:

$NRPB_{it} = \beta_0 + \beta_1 NRNPH_{it} + \beta_2 NRNPH_{it} + \beta_3 NRNPINH_{it} + \beta_4 NRNPNIH_{it} + \beta_5 NRTA_{it} + u_{it}$

In the above models, β_0 represents intercept. $\beta 1$, β_2, β_3, β_4, β_5 are coefficients of independent variables, and u_{it} indicates error term. The subscript i stands for an individual company and t for a specific year.

Model Specifications Tests

Table 2 presents the results of model specification tests for all panel data models.

The results of table 3 suggest that to test the relationship between ownership structure and Tobin's Q, the fixed-effect model is the most suitable model ($F = 26.2174$, $p<0.05$).Breusch-Pagan test statistic indicates that random effect model is preferable to pooled OLS model (LM = 2247.37,

p-value = prob(chi-square(1)>2247.37) = 0). Finally, the Hausman test (H = 393.171, $p<0.05$) suggests that the fixed effect model is preferable to the random effect model.

In case of testing the relationship between ownership structure and price-to-book-value ratio, again the fixed effect model is preferred to pooled OLS model ($F = 22.4367$, $p<0.05$). Random effect model is preferred to pooled OLS model (LM = 2472.84, p-value = prob(chi-square(1) > 2472.84) = 0). Further, Hausman test indicates that fixed effect model is most suitable as compared to random effect model (H= 219.996, $p<0.05$).

Relationship between Ownership structure and Tobin's Q

Table 3 presents the results of the fixed-effect model to test the relationship between ownership structure and Tobin's Q.

Table 2: Results of the fixed effect model

	Coefficient	Std. Error	t-ratio	p-value	
Constant	3.59297	0.255524	14.06	<0.0001	***
NRNPH	"0.0609267	0.0127437	"4.781	<0.0001	***
NRNPINH	0.0668868	0.0121852	5.489	<0.0001	***
NRNPNIH	"0.0176133	0.0151487	"1.163	0.2451	
NRTA	6.11604e-07	5.50236e-08	11.12	<0.0001	***

Mean dependent var	2.948977	S.D. dependent var	2.921528
Sum squared resid	2492.642	S.E. of regression	1.269770
LSDV R-squared	0.829017	Within R-squared	0.212738
LSDV F(162, 1546)	46.27073	P-value(F)	0.000000
F(4, 1546) = 104.442			

with p-value = P(F(4, 1546) > 104.442) = 8.29492e-079

Table 2: Tests for comparing pooled OLS, fixed effect model, and random effect models

	Relationship between ownership structure and Tobin's Q			Relationship between ownership structure and price-to-book value		
Hypothesis	Test	Result	Decision	Test	Result	Decision
H_0: Pooled OLS is consistent.H_1: Fixed Effect Model is consistent. H_0: Pooled OLS is consistent.H_1: Random Effect Model is consistent. H_0: Random Effect Model is consistent.H_1: Fixed Effect Model is consistent.	F Test Breusch-Pagan test statistic Hausman test statistic:	F(158, 1546) = 26.2174, p-value = 0 LM = 2247.37, p-value = prob(chi square(1)>2247.37) = 0 H = 393.171 p-value = prob(chi-square(4) > 393.171) = 8.3136e-084	The fixed effect model is preferable. The random effect is preferable. The fixed effect model is preferable.	F Test Breusch-Pagan test statistic Hausman test statistic:	F(158, 1540) = 22.4367 p-value =1.31709e-300 LM = 2472.84, p-value = prob(chi-square(1) > 2472.84) = 0 H = 219.996 with p-value = prob(chi-square(4) > 219.996) = 1.87837e-046	The fixed effect model is preferable. A random effect is preferable The fixed effect model is preferable.

As can be seen, the model was found to be statistically significant (F = 104.442, p<0.05). All independent variables jointly explained 82.90% variation in Tobin's Q (LSDV R-squared = 0.8290). Results of the t-test indicate the significance of each independent variable in explaining variation in Tobin's Q. All independent variables, except non-promoter non-institutional holding, were found to be statistically significant. Non-promoter holding (t= -4.781, p<0.01) and total assets demonstrated a negative relationship with Tobin's Q. Non-promoter institutional holding was positively related to Tobin's Q (t= 5.489, p<0.01). Non-promoter non-institutional holding was a statistically insignificant predictor of Tobin's Q (t= -1.163, p>0.05).

Relationship between ownership structure and price-to-book value ratio

Table 3: Results of the fixed effect model

	Coefficient	Std. Error	t-ratio	p-value	
const	6.93438	0.537861	12.89	<0.0001	***
NRNPH	"0.122492	0.0267535	"4.579	<0.0001	***
NRNPINH	0.142228	0.0255855	5.559	<0.0001	***
NRNPNIH	"0.0585190	0.0317893	"1.841	0.0658	
NRTA	8.08285e-07	1.16724e-07	6.925	<0.0001	***
Mean dependent var	5.187981		S.D. dependent var	5.437884	
Sum squared resid	10925.85		S.E. of regression	2.663590	
LSDV R-squared	0.782912		Within R-squared	0.165901	
LSDV F(162, 1540)	34.28330		P-value(F)	0.000000	
F(4, 1540) = 76.5761 with p-value = P(F(4, 1540) > 76.5761) = 2.7998e-059					

The results of the fixed effect model are presented in Table 3. The model was found to be statistically significant (F = 76.5761, p<0.05). All independent variables jointly explained 78.29% variation in the price-to-book value ratio (LSDV R Squared = 0.7892). Non-promoter holding (t = -4.579, p<0.01) and total assets (t = 6.925, p<0.01) were negatively associated with price-to-book value ratio. Non-promoter institutional holding was positively significant predictor of price-to-book value ratio (t = 5.559, p<0.01). Non-promoter non-institutional holding was found statistically insignificant (t = -1.841, p>0.05).

Conclusion

The results of the study indicate that institutional ownership is positively related to firm value. This is consistent with the findings of Clay (2002); Deb and Chaturvedula (2003); Kumar (2004); Chen, et al. (2008); and Nazir and Malhotra

(2017). The results show a negative relationship between non-promoter non-institutional ownership and firm value. This corroborates the findings of Vintilã and Gherghina (2015) and Marimuthu (2017).

The study demonstrates that non-promoter holding, in general, is negatively associated with firm value. This supports the finding of Vintilã and Gherghina (2015) and Marimuthu (2017). The study also finds that non-promoter institutional holding is positively related to the price-to-book value ratio. This is consistent with the results of Nazir and Malhotra (2017). Non-promoter non-institutional holding demonstrates no association with the price-to-book value ratio. This contradicts the findings of Nazir and Malhotra (2017).

Broadly speaking, results suggest a significant relationship between ownership structure and firm value. This is consistent with Chen et al. (1993) and Miguel et al. (2004). On the other hand, the results contradict the findings of Demsetz and Villalonga (2001). The results of the study suggest that institutional holding plays a crucial role in maximizing value for shareholders. This implies firms with significant institutional holding tend to take such decisions which are value-enhancing. Non-promoter non-institutional holding is adversely related to a firm value indicating that an increase in it destroys firm value.

This study focused on analyzing the relationship between ownership structure and firm value across BSE listed companies using Tobin' Q as a measure of firm value. Future studies should use other measures of firm value viz, Economic Value Added, Economic Profit, Shareholder Value added to investigate the relationship between ownership structure and firm value. In addition to this, a sector-specific study could also be attempted to get greater insights into the relationship between ownership structure and firm value confined to the chosen sector.

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An Analysis of Initial Performance of SME IPOs in India

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Abstract: This paper attempts to study the initial performance of SME IPOs in India listed on NSE SME EMERGE platform. 203 IPOs from 2012 to 2019 were considered for analysis. Initial raw returns of the IPOs were calculated as a measure of initial performance for five time periods i.e. listing day, 1-week, 1-month, 2-months and 3-months end. The average initial returns came out to be 5.92% on listing day. There was a rising trend of average initial returns in short run. Industry wise the platform seems fairly diversified with Infrastructure and Construction sector having highest number of IPOs (22). Multiple regression analysis was used to identify the factors explaining underpricing. The result shows significant positive relation of underpricing with offer size and age of the firm.

Keywords: Micro, Small and Medium Enterprises, Initial Public Offering, SME Exchange, Underpricing.

Introduction

Micro, Small and Medium Enterprises (MSMEs) are the backbone of the world economies, mainly developing economies. They constitute around 90% of businesses and 70% of the employment worldwide (ICSB report, 2018). For countries like India they are the pillars of strength in promoting industrialisation, employment generation, reducing regional disparity and encouraging start-ups and innovation. In 2018-19 the sector contributed around 29% to GDP, 48% of exports and created 110 million jobs in India (MSME Annual report, 2018-19). Overall, they play a very crucial role in strengthening the economy at its core. To support the development of MSMEs the government of India enacted Micro, Small and Medium Enterprises Development Act, 2006. The Act addresses the issues related to MSMEs and work on their competitiveness, growth and development.

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Despite much importance the sector is highly underfinanced. Though government keep providing credit flow from time to time, but it is not enough to bridge the finance gap. Moreover, debt have deteriorating impact on the financial strength of the firms. Thus, to bridge this gap Prime Minister Task Force on MSME (2010) recommended to set up dedicated stock exchanges/platforms for SMEs listing. Following the advice Bombay Stock Exchange (BSE) launched its SME platform named BSE SME in March 2012. In the same year National Stock Exchange (NSE) also launched its SME platform named NSE SME EMERGE in September 2012. The concept of SME exchange is not new to the world. Before India, many countries have fully functioning successful SME exchanges/platforms. These are structured in 3 ways i.e. as a separate board/market under the main market (ex: Alternate Investment Market [AIM] in UK, BSE SME and NSE SME EMERGE in India, Growth Enterprise Market [GEM] in Hong Kong, Market for High Growth and Emerging Stocks [MOTHERS] in Japan, etc.), part of the main board with more regulatory flexibility (ex: Australian Stock Exchange) and as a separate exchange (ex: GreTai in Taiwan). Apart from catering to finance needs, it provides various other benefits like market visibility and prestige, better firm valuation, employee incentives via ESOPs, migration to main board and many more.

Table 1. Difference between SME and mainline IPO

Basis	Mainline IPO	SME IPO
Post Issue Paid Up Capital	Minimum ₹ 10Cr	Maximum ₹ 25Cr
Scrutiny of Offer document and DRHP	SEBI	Exchange
Underwriting	Not mandatory	100% Underwriting mandatory, minimum 15% by merchant banker
Market Making	Not mandatory	Minimum 3 years of market making is mandatory
Application Size	₹ 10000-₹ 15000	Minimum ₹ 1Lakh
No. of Allottees	Minimum 1000	Minimum 50
Migration	Can migrate to SME board if post issue paid up capital fall below 25Cr	Compulsory migration to main board if post issue paid up capital exceeds 25Cr
Reporting	Quarterly	Half Yearly

Source: SEBI guidelines

When a Small and Medium Enterprise (SME) decides to change its status from private to Public Ltd. by raising money from the public for the first time, it is known as SME Initial Public Offering (IPO). It is a great mode of raising funds as the risk of financing gets diversified among the large investor base. SME IPOs are attributed with lesser stringent disclosure requirements than mainline IPOs.

The leniency in the disclosure norms make them risky bets. Moreover, big application and lot size can result in investors being stuck with highly illiquid stocks because they cannot buy or sell in fraction of lot size. SME IPOs regulatory requirements are different from that of Mainline IPOs because of difference in the support they demand. Table-1 shows the difference between SME and Mainline IPOs.

Literature Review

Equity capital market is a massively researched area throughout the world, be it primary market or secondary market. These researches have led to the development of various theories. These theories help us to explain why issuers and investors act in a certain manner. Among many the most common occurring phenomenon is Underpricing. When the listing price of an IPO (preferably the closing price on listing day) is greater than the offer price, an IPO is said to be underpriced. Ljungqvist (2004) classified causes of IPO underpricing into four main categories i.e. Asymmetric Information, Institutional reasons, Control considerations and Behavioural approach. Among them, Information Asymmetry is considered as the root cause of IPO underpricing. Baron (1982), Rock (1986), Welch (1989) and Benveniste and Spindt (1989) are credited for conceptualizing and structuring Information Asymmetry theory of IPO Underpricing.

While Baron (1982) said that investment banks deliberately underprice the issue to induce optimal selling effort, on the other hand Welch (1989) reasoned underpricing as a signalling device of good firms. According to Rock (1986), there are two types if investors, informed and uninformed. In case of a good IPO, the informed investors will crowd out the uninformed investors. What is left for uninformed investors are overvalued IPOs (Winners Curse). To motivate the uninformed investors to keep investing and to compensate them for losses an IPO is deliberately underpriced. Benveniste and Spindt (1989) proposed that issue is underpriced to induce investors to truthfully reveal information before offer price is determined. Various empirical studies have been done to test the occurrence of underpricing and how long it prevails. Beatty and Ritter (1986), Gounopoulos (2003), Cassi,et al. (2004), Chang, et al. (2008), Elston and Yang (2010), Tian (2012), Heerden and Alagidede (2012), Malhotra and Nair (2015), Handa and Singh (2017), Dhamija and Arora (2017), Li, Liu, Liu, & Tsai (2018), Hawaldar, et al. (2018), Singh and Kumar (2019), Singh, et al. (2020) and Manu and Saini (2020) in their studies have found the evidences of underpricing on first trading day and short run.

Though ample amount of research has taken place on mainline IPOs, very few are found on SME IPOs. It is still an emerging market with huge scope of research. Jain, et al. (2013), Harwood and Konidaris (2015), Nassr and Wehinger (2015)

and Inamdar (2016) provide the theoretical view of SME exchanges and their contribution, opportunities and limitations. Chorruk and Worthington (2013) conducted a study on Thai Market for Alternate Investment to investigate the pricing and performance of the IPOs listed from 2001 to 2008.Four underpricing measures were considered namely headline underpricing i.e. initial excess return, Underpricing issuer loss (loss to issuer per share due to shares retained by the company), Underpricing loss by market value (underpricing loss standardized by market value because of the presence of pre- IPO shareholders) and Underpricing loss by issue price (loss to the issuer standardized by the value of the firm on the issue price).The underpricing came out to be 12,69%, 5.01%, 4.74% and 11.40% respectively. For evaluating post IPO performance monthly cumulative average return, buy and hold return and wealth relative was calculated.

Anderson, et al. (2015) attempted to study the performance of ChiNext. Market Adjusted Abnormal Return (MAAR) came out to be 33.55%, higher than the mainline IPOs. Results showed deterioration in the post IPO performances with negative 12 months buy and hold abnormal return (BHAR) i.e. -45.7%. Regression analysis results suggest that age, listing delay, underwriter and P/R ration have significant impact on underpricing. Alhadab (2016) conducted an empirical study to identify the relationship between audit quality and underpricing on the IPOs listed on AIM in UK. His study revealed that higher the audit quality, lower is the level of underpricing. The study also reveals that age and liquidity ratio has significant impact on the IPO underpricing. Dhamija and Arora (2017) studied the Initial and after market performance of SME IPOs in India. The sample consisted of 93 BSE IPOs and 7 NSE IPOs. The average underpricing came out to be 11%. Agriculture and Biotech industry yielding highest underpricing (51.5%). The regression analysis results showed that issue size, oversubscription, offer for sale, lead manager prestige and stock exchange have significant impact on underpricing. For post IPO performance one year Holding Period Abnormal Return (HPAR) was calculated which came out to be 99.74%.

Arora and Singh (2019) attempted to study the signalling role of auditors and underwriter's reputation on IPO underpricing of SMEs. Underwriters market share and auditors market share was used as a proxy for underwriters and auditor's reputation. The average underpricing came out to be 6.21%. Regression results showed that underwriters reputation have significant impact on IPO underpricing. As for auditor's reputation, it is insignificant. Among the controlled variables issue price, listing delay, oversubscription, firm age has significant impact on underpricing.

SME IPO market is still at a nascent stage and there is huge potential for research. Moreover, limited studies have been done in India to see short run performance

of SME IPO market, especially NSE SME platform. This study attempts to fill this gap.

Objectives of the Study

The objectives of the study are as follows:

- To evaluate the level of underpricing of SME IPOs listed on NSE SME.
- To analyze the impact of offer size, age of the firm and turnover on SME IPO underpricing.
- To identify the differences between SME IPO and Mainline IPO.

Based on the objectives and detailed literature review, following hypotheses are tested.

Ho_1: SME IPOs are underpriced in short run.

Ho_2: There is no significant difference between average initial raw returns of SME IPOs on listing day,

Ho_3: There is no significant relationship between offer size and SME IPO underpricing.

Ho_4: There is no significant relationship between age of the firm and SME IPO underpricing.

Ho_5: There is no significant relationship between turnover and SME IPO underpricing.

Rationale of the Study

SMEs though small but have a very crucial role in the developmental process of an economy. But the sector is highly underfinanced which acts as a hindrance in their growth process. To bridge this finance gap and to help the firms which fail to fulfil the listing requirements of main boards, dedicated SME platforms were created. To ensure that these platforms are able to fulfil their mission towards the firms as well as investors, regular performance review is necessary. Moreover, it also helps to identify any regulatory changes required with time. Thus, the current study is necessary as it helps in understanding the performance of the SME IPO market.

Methodology

Sample

The study period ranges from September 2012 i.e. since inception of NSE SME EMERGE platform to December 2019. The reason behind the selection of the study period is to assess the performance of the platform from the beginning.

During the sample period total 205 SMEs got listed on the platform of which 2 were removed from the study because of the non-availability of data. Thus, the final sample used in the study consists of 203 SME IPOs. The data related to SME IPOs has been collected from NSE, Money Control, Economic Times and Chittorgarh website. These data sources are reliable and have been widely used in past studies.

Statistical Models

For measuring initial performance of the IPO, Initial Raw Returns were calculated (Chorruk and Worthington, 2013). These returns were calculated for listing day, 1 week end, 1 month end, 2 months end and 3 months end.

$$\text{Initial Raw Returns} = \frac{^{\#}\text{Closing} / {}^{\$}\text{End price} - \text{Offer Price} * 100}{\text{Offer Price}}$$

Closing price: Listing day

$ End price: 1 week, 1 month, 2 months and 3 months

If the initial raw return came out to be positive, it means that the IPO is underpriced i.e. the offer price of the IPO failed to present the fair value of the company and investors value the firm more than the firm have charged. If the initial raw return came out to be negative, it means that the IPO is overpriced i.e. the merchant bank has overestimated the firm's value.

Descriptive Statistics was applied for preliminary analysis of the data. It summarizes the large set of data into manageable form and provides information about the basic nature of the data like central value, spread of data, presence of outliers, etc. For this mean, median, standard deviation, range i.e. maximum and minimum value, skewness, and kurtosis is calculated for the variables used in the study.

Analysis of Variance (ANOVA) was applied to determine if there is any statistically significant difference between the mean initial raw returns in short run i.e. listing day, 1 week, 1 month, 2 months and 3 months end.

Multiple Regression Analysis was applied to identify the relation between dependent and independent variables. It is the widely used technique to identify the factors explaining a certain phenomenon. Corresponding to 5 returns, we have 5 regression models.

$$\text{Returns (Listing Day)}_i = \beta + \beta_1 (\text{turnover})_i + \beta_2 (\text{offer size})_i + \beta_3 (\text{age})_i + \beta_i$$

$$\text{Returns (1 week end)}_i = \beta + \beta_1 (\text{turnover})_i + \beta_2 (\text{offer size})_i + \beta_3 (\text{age})_i + \beta_i$$

$$\text{Return (1 month end)}_i = \beta + \beta_1 (\text{turnover})_i + \beta_2 (\text{offer size})_i + \beta_3 (\text{age})_i + \beta_i$$

Returns (2 months end) $_i = \beta + \beta_1$ (turnover) $_i + \beta_2$ (offer size) $_i + \beta_3$ (age) $_i + \beta_i$

Return (3 months end) $_i = \beta + \beta_1$ (turnover) $_i + \beta_2$ (offer size) $_i + \beta_3$ (age) $_i + \beta_i$

As all the variables have different unit of measurement, natural log values have been used to ensure uniformity.

Variables

The data variables used in the study are divided into dependent and independent variables. Under dependent variables we have Raw Returns from listing day to 3 months end. Under independent variables we have age of the firm on the date of listing, offer size and turnover i.e. trade value on listing day. These variables are identified from review of literature. Table 2 gives the details of the variables used in the study.

Table 2. Details of variables

Variables	Description
Dependent Variables	
Initial Raw Returns (Underpricing)	Calculated for listing day, 1 week end, 1 month end, 2 months end and 3 months end.Closing price or end price minus offer price, whole divided by offer price
Independent Variables	
Age of the firm (ln)	Age of the firm on the date of listing (completed years)Year of IPO minus year of incorporation
Offer Size (ln)	Total value of shares offered for sale to the public.Number of shares offered for sale to the public multiplied by offer price
Turnover (ln)	Total value of shares traded on listing day.

Analysis and Interpretation

IPOActivity

The table 3 gives us a brief view of the IPO activity in the NSE SME EMERGE platform. Since inception i.e. September 2012 till December 2019, total 203 IPOs listed on EMERGE were able to raise INR 3113.45cr. The platform had a slow beginning, but it gained its momentum from 2016. 2018 marked the highest no. of IPOs with total 81 deals and proceeds equal to INR1418.85cr. SME IPO market dipped for the first time in 2019 since its launch. This sharp plunge in the IPO activity can be due to fall in interest rate, political uncertainty, liquidity crisis in the NBFCs, etc.

Table 3: IPO activity

Year	No. of IPOs	Amount raised (Cr)
2012	1	19.00
2013	2	38.01
2014	2	34.32
2015	5	38.50
2016	22	157.78
2017	77	1216.53
2018	81	1418.85
2019	13	195.46
TOTAL	203	3113.45

Source:Authors calculation

Figure 1 shows the yearly growth in the IPO activity of NSE SME platform. The trend analysis of the IPO data shows that the number of IPOs has been growing at an Average Annual Growth Rate of 108.75% whereas the size of the IPO has grown at an AAGR of 144.83%. This means that more and more SMEs are opting for equity financing through primary market rather than going for conventional debt financing. One drawback of AAGR is, being simple average of the yearly growth rates results get manipulated by the volatility in the data. Thus, Compounded Annual Growth Rate (CAGR) were also calculated because it smooths out the volatility in the data. For number of IPOs and amount raised CAGR came out to be 44.26% and 39.51% respectively.

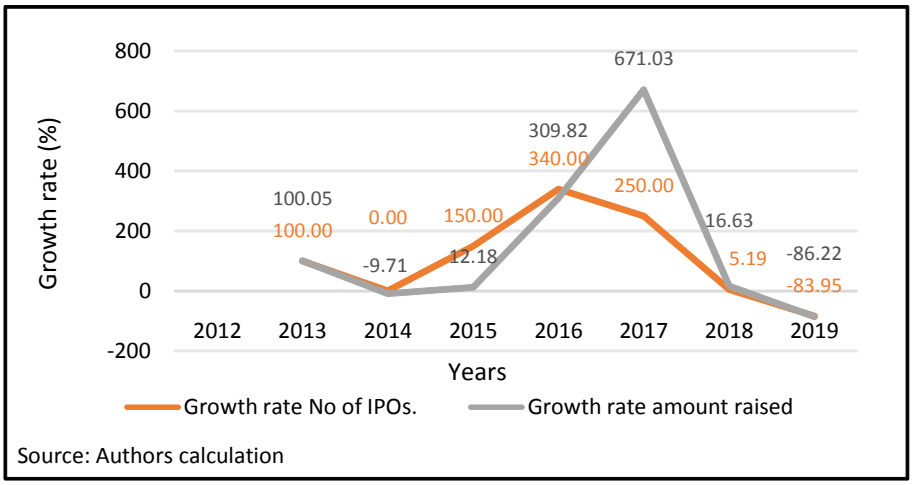

Fig. 1: Yearly growth in SME IPO activity

Since the beginning, SMEs from different industries are getting themselves listed in the platform. The Figure 2 shows the industry wise exposure of the SMEs that got listed on NSE SME EMERGE platform. The distribution of 203 companies in the platform shows that Construction, fabrics and apparels, information technology and transportation and logistics are the top 4 industries with the highest number of listing i.e. 22, 19, 12 and 12 listings, respectively. The composition looks fairly diversified. Sectoral diversification of the listed firms is crucial for the risk management perspective of SME platform as well as for investors. Investors benefit by expanding their portfolio across different sectors, thereby minimizing the negative impact of a certain sector on their portfolio's overall performance. Similarly, sectoral diversification helps in maintaining the overall performance of the index.

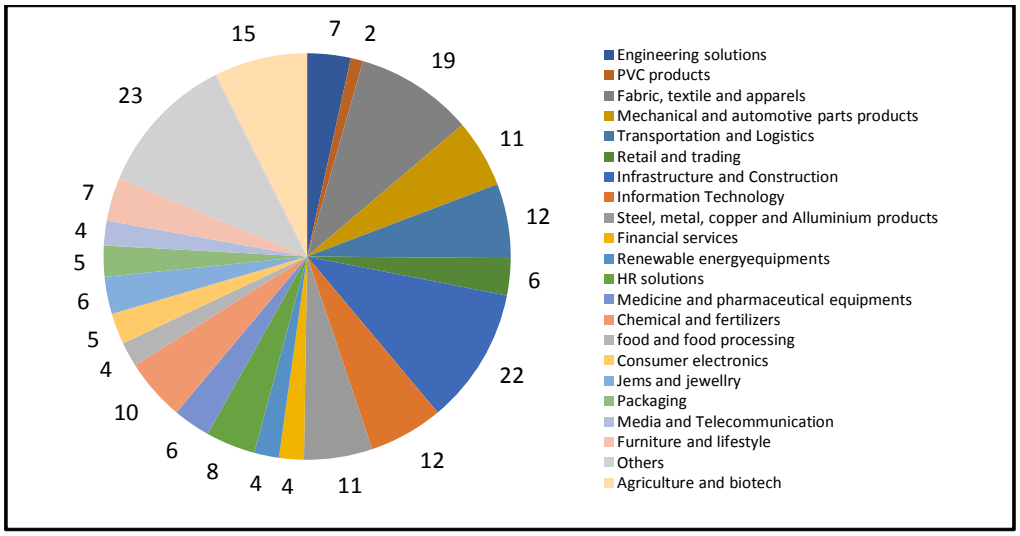

Fig. 2: Industrial composition

Extent of Underpricing

The Figure 3 shows the average raw returns (underpricing) earned during the sample period at different intervals. The returns have shown a positive and rising trend. Out of total 203 IPOs 153 earned positive returns(underpricing) on listing day which reduced to 134 after 1 week, to 114 after 1 month, increased to 115 after 2 months and again reduced to 113 after 3 months. Despite the plunge in the number of profit-making IPOs, the average returns have increased in short run. This was possible because the returns earned by profit making IPOs after each interval were large enough to compensate for the rise in loss making IPOs. The analysis shows increase in number of IPOs with returns between 50 to 100% and more than 100% with increase in time.

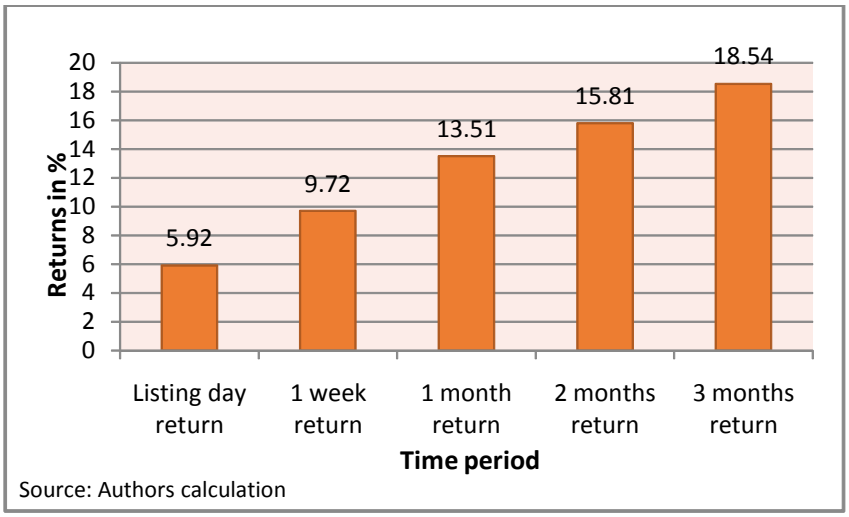

Fig. 3: Average raw return

The Figure 4 shows the distribution of returns earned by NSE SME IPOs in short run. The analysis shows within 2-3 months some IPOs were able to raise more than 50 or 100% returns. These IPOs mainly belong to Information technology, Fabric and apparels and Chemical industries.

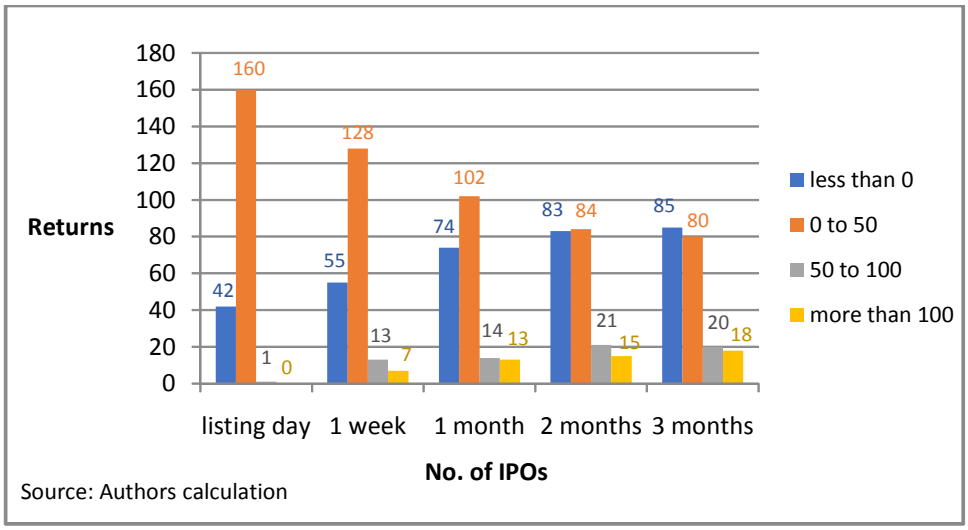

Fig. 4: Return composition of SME IPOs

The Table 4 shows the yearly initial performance of the platform at different intervals. The data yields mixed results. The analysis shows that till 2015 only 10 SME got listed on the NSE platform and they were not able to perform well in

the market as the yearly average returns are very low and most of them are negative. A possible reason could be that the platform was new in the market and both issuers and investors were finding it difficult to exert confidence. Moreover, majority were not much aware of the platform. From 2016 with rise in IPOs, their performance too improved. More and more firms are looking up to the platform for meeting their finance needs. 2019 marked the global slump in the IPO market performance all around the world and its effects can be seen in the NSE SME IPOs performance as well.

To summarize, 2016 and 2017 were the years of good IPOs for investors.

Table 4: Yearly IPOs Initial returns

Year	IPOs	Listing day	1 week	1 month	2 months	3 months
2012	1	0.25	-6.72	-2.49	-3.73	-6.72
2013	2	-8.88	-14.71	-14.29	-17.81	-25.41
2014	2	-0.99	6.76	1.92	0.32	6.84
2015	5	3.34	0.97	0.68	0.48	-1.40
2016	22	7.97	18.04	20.30	24.79	28.00
2017	77	7.68	14.27	23.36	29.35	37.58
2018	81	4.96	6.25	6.97	5.20	3.91
2019	13	2.72	-0.88	-3.29	1.50	-2.38
Average return	203	5.92	9.72	13.51	15.81	18.54

Source:Authorscalculation

Descriptive Statistics

The Table 5 provides a summary of the dependent and independent variables which are considered for study. Though the average listing day return for the SME IPOs is 5.92%, still there are significant differences in the sample data. While the worst first day performer had a negative return of -52.23%, the best performing IPO earned a return of 56.27%. These differences indicate the extent of information asymmetry related to SME IPOs and the inability of the firms to correctly value themselves. Such kind of differences can be seen in 1 week, 1 month, 2 months and 3 months return.

Turnover shows the volume of trade on the listing day. The mean and median turnover is Rs4.18cr and Rs1.99cr, respectively. The mean offer size is Rs4.18cr. The range varies from Rs0.01cr to 39.05cr. This shows the differences in the finance needs by different industries within the SME sector. While some firms are much more experienced (maximum age 44 years), other are new in the

business (minimum age 0 years). The average age of the SMEs on listing day is 12.67 years. The overall data is positively skewed.

Table 5. Descriptive statistics

Variable	N	Mean	Median	Std. Dev.	Min.	Max.	Skewness	Kurtosis
Listing day return (%)	203	5.92	2.74	11.29	-52.23	56.14	0.12	4.46
1-week return (%)	203	9.72	1.39	31.7	-87.59	129.89	1.57	4.03
1-month return (%)	203	13.51	1.25	42.89	-87.19	194.89	1.91	4.87
2-months return (%)	203	15.81	1.56	51.1	-85.49	260	1.83	4.39
3-months return (%)	203	18.45	2.14	61.94	-99.42	389.38	2.33	8.29
Turnover (in Cr)	203	4.18	1.99	5.98	0.01	39.05	2.78	9.44
Offer size (in Cr)	203	15.34	11.46	12.85	1.54	84.6	2.16	6.62
Age (years)	203	12.67	11	8.7	0	44	1	0.86

Source:Authors calculation

Analysis of Variance

One-way ANOVA is used to find out if there is statistically significant difference in the mean raw returns in short run i.e. listing day, 1 week, 1 month, 2 months and 3 months end. Table 6 presents the result of ANOVA testing. The p value of the initial raw returns came out to be significant. This means that raw returns on listing day, 1 week, 1 month, 2 months and 3 months end are significantly different.

Table 6: ANOVA test

Source of Variation	SS	df	MS	F	P-value
Between Groups	19942.557	4	4985.639	2.645	0.032*
Within Groups	1903502.404	1010	1884.656		
Total	1923444.961	1014			

Note: * represents significant at 0.05

Regression Analysis

Multiple regression analysis is used to study the relationship between certain IPO characteristics (offer size, age of the firm and turnover i.e. volume on listing day) which are independent variables and initial raw returns which is dependent variable. Regression analysis is performed for short run i.e. listing day, 1 week, 1 month, 2 months and 3 months end. Table 7 presents the result of regression analysis.

Table 7. Regression analysis

	Dependent Variable: Initial Raw Returns				
	Listing Day	1 Week	1 Month	2 Months	3 Months
Constant	1.373351	1.278451	1.332851	2.436113	3.505201*
Log Offer Size	0.041484**	0.162778**	0.418003**	0.200497**	0.075110
Log Age of the firm	0.020405**	0.040592**	0.034519	-0.151006	-0.380297
Log Turnover	-0.045166	-0.012559	-0.026480	0.140987	0.104373
Observations	203	203	203	203	203
R-Square	0.652398	0.603870	0.630444	0.508475	0.588326
Adjusted R-Square	0.618386	0.550230	0.553004	0.451516	0.540850
F-Statistic	0.115358**	0.160563**	1.10946**	1.427189**	1.394869**

Note:* and ** represents significance at 0.01 and 0.05 respectively

Offer size has significant positive relation with initial returns at all time intervals except 3 months end return. The relation became insignificant after 3 months. It means that larger the offer size, larger the initial returns. As the offer size increases, IPO is deliberately underpriced to ensure the success of the IPO.

Age shows significant positive relation with underpricing for listing day and 1 week. Positive relation between age and underpricing is opposite to expectation. A possible explanation is that investors in SME platform prefer young firms with high potential for growth, thus less need to underprice the issue. After 2-3 months the relation became negative indicating that higher the age of the firm, lesser the underpricing.

Turnover has insignificant negative relation with underpricing for listing day, 1 week and 1 month returns. The relation became positive for 2 and 3 months returns. Insignificance implies that turnover have no effect on the initial returns.

Adjusted R^2 value indicated the explanatory power of the regression model. The fall in the value at each time interval, as shown in the regression output implies the fall in explanatory power independent variables on dependent variable. While some of the regression coefficients are insignificant, the coefficients are jointly significant as indicated by F statistic. For all time intervals the overall regression model is statistically significant.

Conclusion

Given the importance of SMEs in the world, regular and adequate flow of financial resources is priority for governments across the world. The launch of SME platform by stock exchanges is a great initiative. More and more SMEs are opting

for initial public offering to cater their financing needs rather than going for conventional debt financing. The growing interest of firms for equity financing can be attributed to less stringent regulatory and disclosure requirements, compulsory 100% underwriting and secondary market support via compulsory market making. Analysis of the NSE SME platform shows that, though the platform had slow beginning in past 2 -3 years it has shown exemplary growth. The diverse industrial exposure not only provide various options to the investors but also helps in risk management of the platform. Initial raw returns were used as a measure of underpricing. The underpricing on listing day came out to be 5.92%. With the passage of time the underpricing increases shown by 1 week, 1 month, 2 months and 3 months returns. The regression analysis indicates significant positive relation between offer size and age of the firm on listing day with IPO underpricing.

To summarize we can say that though the platform has been able to attract reasonable number of IPOs till now, the performance is still far away from international standards. The regulators and exchanges need to work on developing a robust environment of SME exchange and spread awareness among the investors and firms about the platform. With the current Covid-19 pandemic putting global businesses to halt especially SME sector there is urgent need to boost the sector and uplift sectors confidence. The long-term success of the platform depends on the experience of the issuers and investors.

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Efficiency Assessment of Life Insurers of India A Non-parametric Approach

MAHESH CHAND GARG AND SWATI GARG

Abstract : The present paper has evaluated the operating efficiency of thirteen Indian life insurance companies for the period 2005-06 to 2016-17by employing Data Envelopment Analysis. Life insurers'assessment is based on technical efficiency, pure technical efficiency, scale efficiency, returns to scale and super efficiency. Further, Indian life insurers are compared on the basis of ownership (Public sector or private sector). Public insurer (LIC) is the top most performer among life insurers. Private insurers are technical inefficient and prime reason for technical inefficiency is pure technical inefficiency. Most of the private players are operating at increasing returns to scale for major part under reference.

Keywords: Indian life insurance companies, Data envelopment analysis, Operating efficiency, Super efficiency, Non-parametric analysis.

Introduction

Efficiency for financial institutions consists of enhancement in profitability, fund mobilization, risk-mitigation capabilities due to increase in pooled resources, and improvement in customers' satisfaction with better service quality (Berger *et al*., 1993, and Saad*et al*., 2006). Insurers' efficiency is its ability to produce given set of outputs from available inputs (Diacon*et al*., 2002). The present paper focuses on the efficiency evaluation of life insurance sector of India. On recommendation of Malhotra Committee, insurance sector reforms were introduced in India in 1999 with the establishment of Insurance Regulatory and Development Authority of India (IRDAI). After a long phase of Nationalization of life insurance (from 1956) and general insurance (from 1972), IRDAI opened the Indian insurance sector to private players in 2000 with the objective of making insurance service more competitive, accessible and penetrated that could lead to growth of the Indian economy. However, even after seventeen years of privatization, the penetration (measured by Insurance Penetration) and accessibility (measured by Insurance Density) of insurance sector is still

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very low. In 2017, Indian life insurance penetration {life insurance premium/ Gross Domestic Product (GDP)} is just 2.76 per cent, and life insurance density (premium/total population) is US$ 55 that is very low as compared to world average (US$ 353). The above figures make imperative to look into the reason for inefficiency of the life insurers in India, so that, improvement can be made at the weak spots. In addition, competition from privatization of insurance sector has obliged the public insurer to implement more professional approach in working. Thus, it is in interest to compare efficiency of public insurer and private insurers that would guide the insurers to formulate proper policies for themselves.

Objective

The objective of the present research paper is to evaluate the efficiency of Indian life insurers.

Literature Review

Some of the authors have evaluated insurers' efficiency across different countries (Delhausse*et al*., 1995, Diacon*et al*., 2002, and Eling and Luhnen, 2008).Impact of changes in regulatory environment is accessed byMahlberg and Url (2000),Mahlberg and Url (2003), Barros *et al.* (2005), and Wende*et al.* (2008).

Studies have also looked into the effect of organisation structure and ownership form on the efficiency of insurance companies. Eling and Luhnen (2008) observed strong association between efficiency and organization and line of business. Shujie *et al.* (2007) concluded that firm size, ownership structure, mode of business and human capital were the important factors affecting firm performance. Wende *et al.* (2008) established that regulation influenced comparative advantages of organizational forms. Luhnen (2009) observed that ownership form (stock and mutual) has an impact on efficiency of insurer. Ismail *et al.* (2011) confirmed that there was significant difference in cost efficiency and investment performance of different organisational form.

Some authors have examined the reasons for technical inefficiency in the insurance companies. Mahlberg and Url (2000), Barros and Obijiaku (2007), Borges *et al.* (2008), Mathur and Paul (2014), Micajkova (2015), and Garg and Garg (2020) reported that scale is the major concern for technical inefficiency in insurance companies. However, Rao *et al*. (2010), Lin *et al.* (2011), and Nandi (2014) observed that the major source of technical inefficiency is pure technical inefficiency in the insurance companies. Barros and Obijiaku (2007), Borges *et al.* (2008), and Garg and Garg (2020) have computed super efficiency scores for providing ranks to the efficient insurers.

Indian general insurance sector's efficiency has been evaluated using different perspectives by researchers. Sinha (2007a) compared the efficiency and productivity of public and private general insurers of India. Bawa and Ruchita (2011) examined the efficiencies of health insurance business of general insurance companies, whereas, Mandal and Dastidar (2014) probed the impact of global slowdown on the efficiency of Indian general insurance sector.Mathur and Paul (2014) analytically examined the impact of financial ratios on TE of the Indian general insurers. Garg and Garg (2020) investigated the reason, for inefficiency of the general insurers by evaluating their super efficiency.

Life insurers of India are examined from various angles by researchers. Sinha (2006), and Sinha (2007b) assessed the operating efficiency and productivity growth of Indian life insurance companies respectively. Sinha and Chatterjee (2009), Shinde (2012), Dash and Muthyala (2018), and Sen (2019) estimated the cost efficiency of Indian life insurers. Nandi (2014) conducted the relative performance analysis of efficiency of life insurers in India. Ashraf and Kumari (2015) estimated the investment efficiency of private life insurance industry of India. Sinha (2015) applied Dynamic DEA model to benchmark the performance of life insurance companies of India.

From the above literature review, it is revealed that only three studies (Barros and Obijiaku, 2007, Borges *et al*., 2008, and Garg and Garg, 2020) have examined super efficiency, out of which only Garg and Garg (2020) is in Indian context that too in general insurance sector. Hence, the present study is conducted that contributes to the existing literature in several ways. First, the study evaluates the operating efficiency of the Indian life insurers for a prolonged period of twelve years (2005-2017) withholding the impact of inflation. Second, study looks into the reasons for technical inefficiency in life insurers by computing PTE, SE, and RTS. Third, super efficiency is calculated for providing proper ranks to the insurance companies. Lastly, public and private insurers are compared based on efficiency scores, which will help the insurers to take guidance from the working and policies of each other to enhance their efficiency.

Methodology

The present paper aims to evaluate the efficiency of the Indian life insurers. A firm is technically efficient when it is not possible to enhance outputs or reduce inputs without altering the other inputs and outputs of the firm (Koopmans, 1951). Data Envelopment Analysis (DEA) has been employed to find out the efficiency scores of the insurers under observation.

DEA: Introduction

Data Envelopment Analysis (DEA) is a non-parametric efficiency measurement technique that develops a best practice frontier from the input-output data of the in-sample Decision Making Units (DMUs) by using linear programming approach. DEA provides relative efficiency scores based on the best practice units as DMUs that reside on frontier are full efficient with an efficiency score of one, and the units that lies inside the frontier are inefficient with an efficiency score of less than one but more than zero. Therefore, best practice units act as benchmark for other units under reference.

Charnes*et al.* (1978) has developed DEA with the assumption of Constant Returns to Scale (CRS) in the industry. There work has been extended by Banker *et al.* (1984), who have relaxed the assumption of CRS. The present paper follows Charnes, Cooper and Rhodes model (DEA-CCR) developed by Charnes*et al.* (1978) to determine TE of the life insurers. In addition, Banker, Charnes and Cooper model (DEA-BCC) that was developed by Banker *et al.* (1984) has been used for calculating PTE scores of the life insurers. Further, super efficiency is ascertained with the help of DEA model developed by Andersen and Petersen (1993) (DEA-Super Efficiency). DEA-Super Efficiency model allows efficiency scores to attain a value more than one, which helps in distinguishing between the full technical efficient firms. The present study adopts the output maximization approach for the life insurers as Indian insurance sector is still in the initial stage of growth and output cannot be restricted for minimizing inputs. The mathematical formulation of DEA-CCR model used to compute TE is presented as follows:

Max E_o

Subject to

$\sum_{j=1}^{n} w_j y_{rj} \geq E_o y_{ro}$ r= 1, 2, …, s

$\sum_{j=1}^{n} w_j x_{ij} \leq x_{io}$ i= 1, 2, …, m

$w_j \geq 0$ j =1, 2, …, n

Where, represents expansion factor of the o^{th} DMU. and are number of outputs generated and inputs used by firms respectively, where, = 1, 2, …, s and = 1, 2, …, m. Number of DMUs is represented by ranging from 1, 2, …, n. are the weights applied across n DMUs. shows i^{th} input of j^{th} DMU. isr^{th} output of j^{th} DMU. representsi^{th} input of o^{th} DMU, and isr^{th} output of o^{th} DMU.o^{th} DMU is the Reference DMU for which the efficiency is maximised. Efficiency score is the inverse of for o^{th} DMU.

To calculate PTE as per DEA-BCC model, constraint for convexity ($\sum_{j=1}^{n} w_j = 1$) is added to (1). For determining SE of o^{th} DMU, TE score of o^{th} DMU is divided by PTE score of o^{th} DMU.

RTS of the projected DMUs is computed by comparing the scores of DEA-CCR and DEA-BCC models. If TE and PTE scores are equal than DMU is operating at CRS, however, if scores are different than DMU operates at Variable Returns to Scale (VRS).DEA model with the assumption of Non Increasing Returns to Scale (DEA-NIRS) is used to determine whether DMU are operating at Increasing Returns to Scale(IRS) or Decreasing Returns to Scale (DRS). $\sum_{j=1}^{n} w_j \leq 1$ is added as a constraint in (1) for DEA-NIRS model. DEA-NIRS score is inverse of the expansion factor. When DEA-BCC scores are equal to DEA-NIRS scores than DMU operates at DRS, and if the scores are different than unit operates at IRS (Coelli*et al*., 1998).

Super efficiency is computed by DEA-Super Efficiency model that is very much similar to (1), with a slight difference in constraints as j does not take the value o (reference DMU) in the constraints, means, =1, 2, …, n except o ($j \neq o$). This shows that inputs and outputs of reference DMU are excluded from the weighted sum of inputs and outputs in respective constraints. Super efficiency score is inverse of expansion factor.

Table 1: Sample of the study

No.	Name of insurance company	Abbreviated as
Private insurance company		
1	Aviva Life Insurance Company India Limited	Aviva
2	Bajaj Allianz Life Insurance Company Limited	Bajaj Life
3	Birla Sun Life Insurance Company Limited	Birla
4	Exide Life Insurance Company Limited	Exide
5	HDFC Standard Life Insurance Company Limited	HDFC Life
6	ICICI Prudential Life Insurance Company Limited	ICICI Life
7	Kotak Mahindra Old Mutual Life Insurance Limited	Kotak
8	Max Life Insurance Company Limited	Max
9	PNB MetLife India Insurance Company Limited	PNB Metlife
10	Reliance Nippon Life Insurance Company Limited	Reliance Life
11	SBI Life Insurance Company Limited	SBI Life
12	Tata AIA Life Insurance Company Limited	Tata AIA Life
Public insurance company		
13	Life Insurance Corporation of India	LIC

Sample selection and Data Sources

Sample consists of the Indian life insurers that have begun their operations before April 1, 2004 and has remained in business all through the referred period of twelve years from 2005-06 to 2016-17.Thus, thirteen life insurance companies of India (one public insurer and twelve private insurers) has been considered for the present study. Table 1 displays in-sample insurers.

Secondary data has been used in the study that has been collected from the annual reports of IRDAI and in-sample insurance companies. To curb the impact of inflation, data is appropriately adjusted to the level of 2011-12 with the help of GDP Deflator (Mahlberg and Url, 2003, Barros *et al.*, 2005, and Garg and Garg, 2020). GDP Deflator (Nominal GDP/ Real GDP) is calculated using GDP figures assembled from the website of Ministry of Statistics and Programme Implementation.

Variable Selection

DEA works on input and output variables. In this sub-section, input-output variables of the study are determined. Inputs of insurers mainly include labor and capital. Labor contains agents and home-office labor. Capital includes physical capital, debt capital and equity capital (Cummins *et al.*, 1999, and Cummins and Weiss, 2000). Operating expenses are taken as a substitute for home-office labor because employees' salaries form a major part of operating expenses (Sinha and Chatterjee, 2009, and Micajkova, 2015). Further, commission expenses represents agents. Operating expenses including commission is taken as a single input (Kumar, 2010, Sinha, 2015, and Garg and Garg, 2020). In addition, equity capital is an important input (Borges *et al.*, 2008). Hence, capital is considered as other input, which comprises of shareholder's capital along with reserves and surplus.

Berger and Humphrey (1992) have provided three approaches (Intermediation Approach, User Cost Approach, and Value Added Approach) for the selection of outputs in the service sector. The present research paper has adopted Value Added Approach, as this approach is the most appropriate for measuring outputs of financial service firms (Eling and Luhnen, 2008, and Sinha and Chatterjee, 2009). As per this approach, there are three main services of insurers, that are, risk-pooling and risk-bearing, real financial services, and intermediation services (Eling and Luhnen, 2010). Premium and benefits paid are good proxies for these three main services. Sinha (2006), Sinha (2007a), Sinha (2007b), Bawa and Ruchita (2011), Mandal and Dastidar (2014), and Mathur and Paul (2014) have considered premium as one of the output. Further, benefits paid is taken as an output by Eling and Luhnen (2008), Sinha and Chatterjee (2009), Shinde (2012), and Nandi (2014). Hence, the study considers two outputs namely net premium earned and net benefits paid.

It is necessary to check the correlation between the inputs and outputs variables as DEA model is reliable only when statistically significant positive correlation exist between inputs and outputs (Avkiran, 1999, Mostafa, 2009, and Garg and Garg, 2020).

Table 2: Pearson correlation scores of variables

Input/Output	Operating expenses including commission	Capital
Net Premium Earned	0.993*	-0.279*
Net Benefits Paid	0.984*	-0.251*

Note: * significant at the 0.01 level of significance.

As per Table 2, operating expenses including commission has a significant positive correlation with both the referred outputs, however, capital has a significant negative relation with both the outputs of the study, which makes the model undependable. It is also checked that some of the studies do not include any category of capital as input (Delhausse*et al*., 1995, Mahlberg and Url 2000, Sinha and Chatterjee, 2009, and Shinde, 2012). Hence, input 'capital' is dropped from the study to make the model statistically sound.

The present research paper takes up two outputs (net premium earned, and net benefits paid) and one input (operating expenses including commission) to examine the efficiency of the life insurers of India. Discriminatory power of DEA is affected by the number of input-output variables and number of DMUs under consideration (Boussofiane *et al*., 1991). Hence, the following rules are provided:

- Number of DMUs $\geq$ 3(number of inputs + number of outputs) (Vassiloglou and Giokas, 1990)
- Number of DMUs $\geq$ number of inputs x number of outputs (Boussofiane*et al*., 1991)
- Number of DMUs $\geq$ number of inputs + number of outputs + 1 (Blbl and Akhisar, 2005)

The present study has thirteen DMUs with two outputs and one input, hence, these rules are appropriately followed.

Results

Table 3 shows the TE scores of Indian life insurers with the assumption of CRS. Public insurer namely LIC has achieved 100 per cent TE throughout the study period except for two years (2014-15, and 2016-17). LIC is the topmost performer with an average TE of 99.1 per cent (Sinha, 2006, Sinha, 2007b, Shinde, 2012,Nandi, 2014, Sinha, 2015, Dash and Muthyala, 2018, andSen, 2019). However, private

life insurers are technical inefficient in maximizing the referred outputs with an average TE of just 56 per cent. Eight out of twelve private life insurance companies (Aviva, Birla, Exide, HDFC Life, Kotak, Max, PNB Metlife, and Reliance Life) have not hit the mark of full TE even for once during the observed period of twelve years. In addition, not even a single private insurer is 100 per cent TE up to 2009-10. This clearly shows that the private life insurers in India are technically inefficient in generating net premium earned and net benefits paid. Among private players, SBI Life is the best operator with an average TE of 90 per cent. ICICI Life (79.1 per cent) is just one-step below SBI Life (90 per cent) in terms of average TE, however, a huge difference of 10.9 per cent can be noticed in the TE scores of these two insurers.This variation points out the dispersion in TE scores of life insurers. Exide (35.6 per cent) is the weakest player whose efficiency scores have ranged from 21.9 per cent (year 2005-06) to 49.9 per cent (year 2014-15). However, during the initial years of the study (2005-06 to 2007-08), PNB Metlife (37.1 per cent) is the most fragile one with its TE ranging from just 14.6 per cent to 19.8 per cent. The overall average TE of life insurers is only 59.3 per cent, which depicts that Indian life insurers can enhance their average TE in maximizing the referred outputs by 40.7 per cent without varying their inputs. Further, year-wise average scores have revealed a continuous improvement in the average TE from 2006-07 (40.1 per cent) to 2014-15 (77 per cent). The reason for the expansion in TE scores is the improvement in the TE of private life insurers, which clearly shows that private players are constantly working towards improving their TE.

TE scores are segregated into PTE scores and SE scores. PTE represents managerial efficiency (Barros and Obijiaku, 2007). Table 4 provides PTE scores of the Indian life insurance companies. Public life insurer (LIC) is full pure technical efficient insurer all through the referred period. SBI Life (99.6 per cent) has remained behind LIC by achieving full PTE from 2006-07 to 2016-17. ICICI Life (82.6 per cent) has shown an improvement in PTE from 45.2 per cent (2007-08) to 100 per cent (2010-11) and has attained full PTE in five years under observation. Exide (75.4 per cent) and Aviva (74.3 per cent) has achieved 100 per cent PTE in six years under reference, even though these insurers are less efficient than ICICI Life in terms of average PTE. As per average PTE, Max (43.5 per cent) is the most inefficient DMU, which shows that Max is weak at managerial front. Reliance Life (54.3 per cent) is at a place above Max. From full PTE in 2005-06, Reliance life has fallen to 25.7 per cent (2008-09), and has not reached above a score of 75.3 per cent (2012-13) after 2005-06, which reveals managerial incapability in Reliance Life. As per year-wise average PTE, the Indian life insurers have performed best in 2012-13 (89.7 per cent), in which eight (one public insurer and seven private insurers) out of thirteen DMUs are full pure technical efficient. The average PTE of private insurers has stood at 69.3 per cent

Table 3: Technical efficiency scores (CRS assumption)

DMU	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Average
Aviva	0.241	0.239	0.253	0.259	0.356	0.507	0.523	0.670	0.746	0.745	0.982	0.984	0.542
Bajaj Life	0.546	0.336	0.331	0.440	0.546	0.632	0.755	1.000	1.000	1.000	0.841	1.000	0.702
Birla	0.443	0.382	0.383	0.329	0.386	0.463	0.486	0.546	0.600	0.670	0.797	0.913	0.533
Exide	0.219	0.225	0.270	0.304	0.365	0.357	0.349	0.452	0.461	0.499	0.364	0.411	0.356
HDFC Life	0.432	0.456	0.422	0.307	0.448	0.584	0.648	0.857	0.971	0.973	0.841	0.768	0.642
ICICI Life	0.611	0.490	0.433	0.541	0.700	1.000	0.797	0.982	0.938	1.000	1.000	1.000	0.791
Kotak	0.458	0.378	0.342	0.337	0.503	0.546	0.578	0.598	0.585	0.508	0.517	0.500	0.487
Max	0.238	0.255	0.254	0.232	0.327	0.350	0.406	0.538	0.578	0.589	0.612	0.522	0.408
PNB Metlife	0.146	0.184	0.198	0.245	0.337	0.458	0.460	0.518	0.525	0.501	0.413	0.467	0.371
Reliance Life	0.247	0.241	0.294	0.237	0.381	0.403	0.437	0.730	0.596	0.600	0.581	0.698	0.454
SBI Life	0.598	0.717	0.786	0.804	0.930	1.000	1.000	1.000	1.000	1.000	0.959	1.000	0.900
Tata AIA Life	0.293	0.315	0.261	0.253	0.349	0.405	0.473	0.622	0.920	0.977	1.000	0.546	0.534
Average (Private Companies)	0.373	0.352	0.352	0.357	0.469	0.559	0.576	0.709	0.743	0.755	0.742	0.734	0.560
LIC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.954	1.000	0.935	0.991
Average (All Companies)	0.421	0.401	0.402	0.407	0.510	0.593	0.608	0.732	0.763	0.770	0.762	0.750	0.593

Table 4: Pure technical efficiency scores (VRS assumption)

DMU	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Average
Aviva	0.330	0.315	0.326	0.386	0.601	1.000	0.958	1.000	1.000	1.000	1.000	1.000	0.743
Bajaj Life	0.615	0.360	0.347	0.471	0.565	0.647	0.906	1.000	1.000	1.000	0.842	1.000	0.729
Birla	0.581	0.512	0.472	0.377	0.419	0.487	0.549	0.575	0.645	0.704	0.797	0.923	0.587
Exide	0.335	0.409	1.000	1.000	1.000	1.000	1.000	1.000	0.688	0.626	0.470	0.516	0.754
HDFC Life	0.529	0.559	0.485	0.338	0.470	0.584	0.668	0.900	1.000	0.980	0.871	0.777	0.680
ICICI Life	0.672	0.524	0.452	0.572	0.817	1.000	0.897	1.000	0.978	1.000	1.000	1.000	0.826
Kotak	0.925	1.000	0.915	0.558	0.937	1.000	1.000	1.000	0.789	0.601	0.608	0.545	0.823
Max	0.298	0.316	0.296	0.258	0.344	0.365	0.419	0.567	0.596	0.591	0.644	0.523	0.435
PNB Metlife	0.283	0.438	0.325	0.329	0.450	1.000	0.887	0.868	0.724	0.573	0.504	0.481	0.572
Reliance Life	1.000	0.338	0.340	0.257	0.398	0.403	0.498	0.753	0.598	0.643	0.583	0.710	0.543
SBI Life	0.955	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.996
Tata AIA Life	0.378	0.429	0.324	0.302	0.392	0.461	0.642	1.000	1.000	1.000	1.000	0.555	0.623
Average (Private Companies)	0.575	0.517	0.524	0.487	0.616	0.746	0.785	0.889	0.835	0.810	0.777	0.753	0.693
LIC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Average (All Companies)	0.608	0.554	0.560	0.527	0.646	0.765	0.802	0.897	0.847	0.824	0.794	0.771	0.716

that is much behind LIC (100 per cent). This shows that private sector has to enhance their managerial skills for attaining higher efficiency in maximizing the referred outputs.

SE scores are provided in Table 5. LIC (99.1 per cent) is the most scale efficient insurer that has remained 100 per cent scale efficient in ten out of twelve years under observation. Bajaj life (95.7 per cent) that has attained full SE in just four years (2012-13, 2013-14, 2014-15, and 2016-17) under reference, is the best performer among private insurers in terms of average SE. SBI Life (90.2 per cent) is 100 per cent scale efficient in six years during the study, still, is less scale efficient than Bajaj Life (95.7 per cent), ICICI Life (95.3 per cent), HDFC Life (93.4 per cent), and Max (92.5 per cent) that has attained full SE in four years or less during the study. With an average SE of just 52.8 per cent, Exide has become the weakest one in terms of choosing the right scale size. Kotak (62.2 per cent) and PNB Metlife (66.7 per cent) are staying above Exide respectively. Private insurers, with an average SE of 81.9 per cent, are still behind public insurer (LIC). The year-wise average scores show that there is constant enhancement in the SE of life insurers from 2011-12 onwards. From Tables 3, 4 and 5, the overall average TE is 59.3 per cent, PTE is 71.6 per cent and SE is 83.2 per cent, which shows that life insurers are better in choosing the appropriate scale size, however, are managerial weak(Rao *et al*., 2010,Lin *et al*., 2011, and Nandi, 2014). Further, eight private insurers (Bajaj Life, Birla, HDFC Life, ICICI Life, Max, PNB Metlife, Reliance Life and TATA AIA Life) have scored more in terms of average SE than average PTE. This provides additional evidence that the main cause of technical inefficiency in Indian life insurers is managerial inefficiency. However, LIC is full pure technical efficient and 99.1 per cent average scale efficient, which represents that scale inefficiency is the reason for technical inefficiency in public insurer.

RTS of projected life insurers is presented in Table 6. CRS is the most productive scale size (Cummins, 1999, and Ashraf and Kumari, 2015). RTS results show that none of the life insurer is operating on CRS all through the observed period. LIC, the public life insurer, is the only one that is working over CRS for most part of the study (ten years). All private insurers are staying at IRS for first five years under reference (2005-06 to 2009-2010), however, Bajaj Life, ICICI Life and SBI Life have shifted to CRS during the second half of the observed period, which reveals that these three insurers are able to locate the most productive scale for themselves. It is observed that private insurers namely Aviva, Birla, Exide, Kotak and PNB Metlife are operating on IRS throughout the study period. Further, Tata AIA Life has resided on IRS for eleven years out of twelve years of study (except 2015-16). In addition, Reliance Life, HDFC Life and Max are also working over IRS for major part of the study. The insurers that are staying at IRS should expand their scale of working to attain higher TE. No insurer is operating

on DRS for more than two years under observation, which is a clear indication that life insurance sector has not hit maturity yet and has a lot of scope for increasing its level of activity.

Table 7 provides super efficiency scores of life insurance companies along with the ranks based on these scores. Public insurer (LIC) is the one that has attained first rank for most of the time under observation (seven years), which makes this insurer the topmost performer among the sample. SBI Life has attained top two ranks all through the referred period except for 2005-06 (third rank) and 2015-16 (fifth rank). ICICI Life has also performed well by being at top three positions for ten years during the observed period. Exide has remained at the last rank (thirteenth) for six consecutive years from 2011-12 to 2016-17 that makes it the weakest one among life insurers under the study. Additionally, PNB Metlife and Max have remained at last five positions (ninth to thirteenth ranks) throughout the referred period that represents their weakness in generating the referred outputs. Aviva has shown continuous improvement in the super efficiency scores from 2006-07 onwards, and in super efficiency ranking from twelfth rank (2007-08) to 4 rank (2015-16 and 2016-17). As per super efficiency score, a wide margin is appearing between the scores of first ranker and second ranker up to2008-09, however, this margin has reduced considerably from 2008-09 onwards. This signifies that private life insurers especially SBI Life, ICICI Life and Bajaj Life have attained better efficiency, and are providing healthy competition to well-established LIC, even when these insurers (SBI Life, ICICI Life and Bajaj Life) are not very old in the life insurance market. Further, it is suggested to the other life insurers to follow the super efficient insurers to improve their working efficiency.

Conclusion and Suggestions

It is concluded that Indian life insurance companies have not attained 100 per cent TE all through the observed period. Even though, LIC is the only one with full PTE during the study. As per overall efficiency scores, TE of all the life insurers is 59.3 per cent, PTE is 71.6 per cent, and SE is 83.2 per cent. Further, the year-wise average PTE is constantly lower than the year-wise average SE except for 2011-12 and 2012-13. This makes clear that life insurers are weaker towards managerial end (Rao *et al*., 2010,Lin *et al*., 2011, and Nandi, 2014). Ownership based results reveal that public insurer (LIC) is the most efficient insurer with an average TE of 99.1 per cent (Sinha, 2006, Sinha, 2007b, Shinde, 2012,Nandi, 2014, Sinha, 2015, Dash and Muthyala, 2018, andSen, 2019). However, private life insurers are much weaker in maximizing their outputs with average TE of just 56 per cent. The prime reason for technical inefficiency in private insurers is pure technical inefficiency. As regards RTS of the life insurers, LIC is the one that is operating on the most productive scale size (CRS) for ten years

Table 5: Scale efficiency scores

DMU	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Average
Aviva	0.731	0.760	0.775	0.673	0.593	0.507	0.546	0.670	0.746	0.745	0.982	0.984	0.726
Bajaj Life	0.888	0.934	0.956	0.935	0.966	0.976	0.833	1.000	1.000	1.000	0.998	1.000	0.957
Birla	0.762	0.747	0.810	0.873	0.920	0.952	0.885	0.950	0.930	0.952	0.999	0.989	0.898
Exide	0.654	0.550	0.270	0.304	0.365	0.357	0.349	0.452	0.670	0.796	0.776	0.796	0.528
HDFC Life	0.817	0.817	0.870	0.909	0.953	0.999	0.970	0.952	0.971	0.992	0.965	0.989	0.934
ICICI Life	0.909	0.936	0.959	0.946	0.856	1.000	0.889	0.982	0.960	1.000	1.000	1.000	0.953
Kotak	0.495	0.378	0.374	0.603	0.537	0.546	0.578	0.598	0.742	0.845	0.850	0.918	0.622
Max	0.799	0.805	0.859	0.898	0.950	0.957	0.971	0.948	0.970	0.997	0.950	0.999	0.925
PNB Metlife	0.517	0.421	0.610	0.744	0.748	0.458	0.519	0.597	0.725	0.874	0.820	0.970	0.667
Reliance Life	0.247	0.714	0.864	0.922	0.958	1.000	0.876	0.970	0.996	0.933	0.996	0.983	0.872
SBI Life	0.626	0.717	0.786	0.804	0.930	1.000	1.000	1.000	1.000	1.000	0.959	1.000	0.902
Tata AIA Life	0.776	0.733	0.805	0.839	0.890	0.878	0.736	0.622	0.920	0.977	1.000	0.985	0.847
Average (Private Companies)	0.685	0.709	0.745	0.788	0.806	0.803	0.763	0.812	0.886	0.926	0.941	0.968	0.819
LIC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.954	1.000	0.935	0.991
Average (All Companies)	0.709	0.732	0.765	0.804	0.820	0.818	0.781	0.826	0.895	0.928	0.946	0.965	0.832

Table 6: Returns to scale of projected life insurers

DMU	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Aviva	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS
Bajaj Life	IRS	IRS	IRS	IRS	IRS	IRS	IRS	CRS	CRS	CRS	CRS	CRS
Birla	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS
Exide	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS
HDFC Life	IRS	IRS	IRS	IRS	IRS	IRS	CRS	CRS	IRS	DRS	IRS	DRS
ICICI Life	IRS	IRS	IRS	IRS	IRS	CRS	IRS	DRS	DRS	CRS	CRS	CRS
Kotak	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS
Max	IRS	IRS	IRS	IRS	IRS	CRS	CRS	CRS	IRS	DRS	IRS	IRS
PNB Metlife	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS
Reliance Life	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	DRS	DRS	CRS	IRS
SBI Life	IRS	IRS	IRS	IRS	IRS	CRS	CRS	CRS	CRS	CRS	IRS	CRS
Tata AIA Life	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	IRS	CRS	IRS
LIC	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	DRS	CRS	DRS

Note: CRS=Constant Returns to Scale, IRS=Increasing Returns to Scale, DRS=Decreasing Returns to Scale.

Table 7: Super efficiency scores and ranks

DMU	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Aviva	0.241(10)	0.239(11)	0.253(12)	0.259(9)	0.356(10)	0.506(7)	0.523(7)	0.670(7)	0.746(7)	0.745(7)	0.981(4)	0.984(4)
Bajaj Life	0.546(4)	0.336(7)	0.331(7)	0.440(4)	0.546(4)	0.631(4)	0.755(4)	1.044(3)	1.058(2)	1.056(2)	0.841(6)	1.046(2)
Birla	0.442(6)	0.382(5)	0.382(5)	0.329(6)	0.386(7)	0.463(8)	0.486(8)	0.546(10)	0.600(8)	0.670(8)	0.797(8)	0.913(6)
Exide	0.219(12)	0.225(12)	0.270(9)	0.304(8)	0.365(9)	0.357(12)	0.349(13)	0.452(13)	0.461(13)	0.498(13)	0.364(13)	0.411(13)
HDFC Life	0.432(7)	0.456(4)	0.422(4)	0.307(7)	0.448(6)	0.584(5)	0.648(5)	0.857(5)	0.971(4)	0.973(5)	0.841(7)	0.768(7)
ICICI Life	0.611(2)	0.490(3)	0.433(3)	0.541(3)	0.700(3)	1.049(2)	0.797(3)	0.982(4)	0.938(5)	1.023(3)	1.113(1)	1.009(3)
Kotak	0.458(5)	0.378(6)	0.342(6)	0.337(5)	0.503(5)	0.546(6)	0.578(6)	0.598(9)	0.585(10)	0.508(11)	0.517(11)	0.500(11)
Max	0.238(11)	0.255(9)	0.254(11)	0.232(13)	0.326(13)	0.350(13)	0.406(12)	0.538(11)	0.578(11)	0.589(10)	0.611(9)	0.522(10)
PNB Metlife	0.146(13)	0.184(13)	0.198(13)	0.245(11)	0.337(12)	0.458(9)	0.460(10)	0.518(12)	0.524(12)	0.501(12)	0.413(12)	0.467(12)
Reliance Life	0.247(9)	0.241(10)	0.294(8)	0.237(12)	0.381(8)	0.403(11)	0.437(11)	0.730(6)	0.596(9)	0.599(9)	0.581(10)	0.698(8)
SBI Life	0.598(3)	0.717(2)	0.786(2)	0.804(2)	0.930(2)	1.234(1)	1.211(2)	1.052(2)	1.082(1)	1.056(1)	0.959(5)	1.191(1)
Tata AIA Life	0.293(8)	0.315(8)	0.261(10)	0.253(10)	0.349(11)	0.405(10)	0.473(9)	0.622(8)	0.920(6)	0.977(4)	1.009(3)	0.546(9)
LIC	3.275(1)	6.067(1)	5.857(1)	4.282(1)	1.456(1)	1.006(3)	1.259(1)	1.061(1)	1.055(3)	0.954(6)	1.048(2)	0.935(5)

Note: Figure in parenthesis represents rank.

out of twelve years under reference. SBI Life has stayed at CRS for six years during the study. All other private players are operating at IRS for most of the observed period (Borges *et al*., 2008, Rao *et al*., 2010, and Bawa and Ruchita, 2011). As per super efficiency, LIC is the top performer, followed by SBI Life. Exide is the weakest one among the sample insurers as per super efficiency.

It is suggested that private life insurers have to work towards development of managerial efficiency by making proper arrangements of skill development programmes and lectures for the employees of the company. SE can be improved by enhancing the scale size as private players are operating at IRS for most part of the study. Public insurer (LIC) should also pay attention towards the scale size as this insurer has slipped to DRS during the latter half of the study for two years. Further, it is suggested that insurers should maintain proper balance between their inputs and outputs to become full technical efficient.

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Stakeholders Perspective of G2C eGovernance Systems : Empirical Evidences from Higher Education Sector of India

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Abstract: The present study examines Government to Citizen (G2C) eGovernance initiatives of Higher Education Institutions (HEIs) of India from internal and external stakeholder's perspective. The term G2C eGovernance widely recognized as a vital approach to augment stakeholders trust in administrative systems through enhanced transparency and efficient citizen oriented public service delivery. The study highlights the status of G2C eGovernance and major factors liable for structural gaps. Five prominent central and state HEIs i.e. MNIT, NITK, GNDU, MDU, and BPSMV were included in the study and responses were collected from 100 internal and 500 external respondents. The results of the analysis would enable the HEIs of India to accredit the stakeholder's viewpoint for enhancing the efficiency of G2C eGovernance systems in higher education sector of India.

Keywords: Government to Citizen (G2C), eGovernance, Transparency, Efficiency, Information Communication Technology (ICT), Digital Divide.

Introduction

The present millennium insist and inspire governments, organisations, public and private institutions to integrate state-of-the-art Information Communication Technology (ICT) into their development strategies, and also in routine activities for evolving efficient citizen oriented collaborated eGovernance system. The integration of ICT in governance has transformed the relationship, and interaction structure of institutions with their stakeholders and had a profound significant impact on every aspect in a cost-effective manner. However, the transformation also raises novel challenges, especially in developing and underdeveloped countries viz. inadequate infrastructure and other resources, digital divide, human capacity, education level, data security and privacy, political and cultural constraints and many more which hinder the critical transformation process.

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Rapid advances in ICT have enabled the development of applications such as eCommerce, eBusiness, eLearning, eHealth, eSociety, eAdministration, eGovernment, eGovernance, eCitizens and many more.

The eGovernance (originated in early 1990s) phenomenon is barely three decades old (Belanger and Carter, 2012) but its significances should not be underestimated (Njuru, 2011). eGovernance emphasized upon improvements in the performance of institutions especially public sector through integration of ICT in development and routine activities.

Research studies testified that eGovernance has potential to transform diverse aspect of public administration (Lau, et al. 2008), ability to persuade the intrinsic worth of governance within society (West, 2001), minimize the ills present within the society (Chhabra and Jaiswal, 2009), refining and strengthen association between G2C (Backus, 2001), improve efficiency of back office and frontline operations, and also provides ethical platform for equity, democracy, and transparency (Contreras, 2002). Promotion of good governance is a pre-requisite for inclusive and sustainable development (UN, 2010). Kannabiran, et al. (2005) found significant positive relationship between integrated implementation Citizen Information System (CIS), Citizen Interface Centers (CIC) and reduced public services deliver costs and enhanced efficiency. Digital have potential to attain social welfare (Jensen, 2007).

eGovernance emphasis should be on Governance rather than on computerization (Ray and Mukherjee, 2007) and shall also emphasized upon citizens' first (Munson et al., 2001). Non-technical issues viz. complex integrated sociotechnical system and multi-stakeholder engagements (Bubou et al 2018), culture (Gupta, 2004), citizens' attitudes (Kolsaker and Kelley, 2008), self-motivation and citizen's readiness (Muhlberger, 2005) plays major role in to harness the enormous potential of G2C eGovernance for inclusive development. Realizing maximum governance, minimum government and through Technology Enabled Services to Cyber Security framework with citizen-centricity vision is core aspects of eGovernance. Wong, et al. (2007) depicted that eGovernance is much more than ICT project and eGovernance Strategy shall be developed from the perspective of various stakeholders i.e. citizens, government, and organisations (Carroll, 1996; Freeman, 1984; Byrson, 2004).

The significant utilities of eGovernance has also attracted governing bodies and Higher Education Institutions (HEIs) of India to achieve excellence and good governance. As on 31.03.2019, Indian Higher Education comprises 21825 Colleges and 911 Universities (51 Central, 397 State Public, 334 State Private, 126 Deemed to be Universities, etc.) (UGC Annual Report, 2018-19). The governing and accredited bodies of HEIs commended for use of eGovernance

G2C systems for providing end-to-end solutions to all the stakeholders efficiently. eGovernance initiatives indispensable for governing and managing academic affairs between the University and colleges (Mufeed Ahmad, 2011). Automated University Integrated Examination System (AUIES) can enhance operational efficiency, minimise academic frauds and corrupt practices at low operating cost. However, security threats (Bhardwaj and Singh, 2011) and benchmarking of G2C eGovernance needs to be addressed (Gunmala and Sarabjeet, 2013).

The National eGovernance Service Delivery Assessment (NeSDA) conducted by Union Government of India in 2019 evaluated services delivery of eGovernance portals of six major sectors of India including education on the basis of seven key dimensions i.e. "Accessibility, Ease of use, End service delivery, Integrated service delivery, Content Availability, Information security & privacy, and Status & Request tracking" derived on the pattern of Online Service Index (OSI) of UNDESA eGovernment Survey. The outcome of the survey published in February 2020 (NeSDA, 2020) evinced low satisfaction of stakeholders especially in education sector. Further, substantial gaps in eGovernance models theoretically and practically evident in various research outcomes. These contrary research outcomes making it imperative for more empirical studies to address this issue. Surprisingly, only few studies examined the major issues concerning G2C eGovernance in Higher Education Sector of India.

The emergence of eGovernance abetted by ICT has transformed the mode of delivery of educational services and the higher educational institution lagging behind in espousal shall perished. Irrespective of nature, type, and location, HEIs of India utilizing G2C eGovernance technologies to connect with stakeholder's viz. students, channel partners, employees, government, and other citizens to deliver efficient and transparent services. The review of literature highlighted gaps in the existing studies showed that there was a dire need to make a fresh attempt to analyze the diverse dimensions of HEIs G2C eGovernance initiatives from the stakeholder's perspective as a number of improvements can be incorporated on account of gaps in the existing literature.

Objectives

the objectives of the study are:

- To assess the status of stakeholder's perspective towards HEIs G2C eGovernance initiatives
- To ascertain the factors responsible for structural gaps between the users and developers of HEIs G2C eGovernance initiatives

Hypotheses

H_{01} : There is no significant difference between internal stakeholders (employees) perspective related to eGovernance initiatives of HEIs

H_{02} : There is no significant difference between external stakeholders (Students and Citizens) perspective related to eGovernance initiatives of HEIs

H_{1a} : Strong association exist between internal stakeholders (employees) perspective and structural gaps of eGovernance initiatives.

H_{1b} : Strong association exist between external stakeholders (Students and Citizens) perspective and structural gaps of eGovernance initiatives.

Research Methodology

The current study was exploratory and descriptive in nature. Internal (employees) and external (students, and citizens) stakeholders of five prominent higher educational institutions of India established by Central/State Government (National Institute of Technology - Kurukshetra, Haryana (NITK); Maharsahi Dayanand University – Rohtak, Haryana (MDU); Guru Nanak Dev University – Amritsar, Punjab (GNDU); Bhagat Phool Singh Mahila Vishwavidyalaya – Khanpur Kalan, Haryana (BPSMV), and Malavyia National Institute of Technology – Jaipur, Rajasthan (MNIT)) has been considered as sample units. The diverse HEIs and respondents have been selected for inclusive analysis. The respondents were selected using Judgmental cum Quota Sampling and primary data was obtained from 600 respondents consisting 100 internal (20 employees from each HEI) and 500 external (100 students and citizens from each HEI) stakeholders of the selected HEIs (Krejcie and Morgan, 1970 and Comfrey and Lee, 1992).

Employees having more than five years of experience and students and citizens possessing smartphone with hands-on knowledge, ready to interact and participate in the survey were included in the study. Responses were collected via interview using structured questionnaire during the period from January 2018 to January 2020. The respondents were apprised regarding objective of the research before starting the interview. Further, the respondents were assured that their identity shall not be revealed.

Analysis

The responses of the stakeholders were coded and tabulated in Jamovi (Version .09.5.12) open source analytical software. For data analysis and hypotheses testing various statistical tools viz. One-Way ANOVA, Cronbach's alpha, Correlation, Post Hoc. and GAP analysis methodology etc. were applied at 95 per cent confidence level. The constructs of the eGovernance were extracted on the basis of extensive literature review, previous models, NeSDA-2019 and

UNDESA survey methodology.

Further, in order to assess the construct, content validity Cronbach's alpha (Table 1.0) was applied and Items with lower factor loadings (< .5) and cross loadings were removed after pre-testing. 31 statements under Citizens' eGovernance Constructs and 18 statements under Employee eGovernance constructs were used to record the responses on Likert seven point scale (SA -7 to SD -1).

Table 1: Reliability coefficients of final construct items

Citizens' eGovernance Constructs	Cronbach's Alpha
Ease of use	.924
Competence	.825
Reliability	.802
Usefulness	.844
Responsiveness	.800
Product Portfolio	.811
Security	.851
Employees' eGovernance constructs	Cronbach's Alpha
Performance expectancy	.734
Compatibility	.787
Job Fit	.700
Facilitating conditions	.838
Intention to use	.961

The researcher has used blend of WebQual Index, SERVQUAL, SITEQUAL, Heek's Reality Design Gap, and eQual methodology to develop Gap Analysis methodology to assess the status of stakeholder's perspective and ascertain structural gap between the user and developer of HEIs G2C eGovernance initiatives.

Demographic Status

Table 2: Frequencies of internal stakeholders gender

	Higher Education Institution					
	BPSMV	GNDU	MNIT	NITK	MDU	Total
Gender						
Male	8	7	10	13	10	48
Female	12	13	10	7	10	52
Total	20	20	20	20	20	100
Qualification						
Ph. D.	9	5	6	4	5	29

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Post Graduate	8	7	8	14	9	46
Under Graduate	3	8	6	2	6	25
Total	20	20	20	20	20	100
Qualification						
Assistant	3	5	5	5	3	21
Superintendent	3	4	3	2	2	14
Assistant Registrar	2	4	2	4	4	16
Deputy Registrar	1	3	1	2	2	9
Head of Department/ Branch	5	2	4	4	5	20
Dean	6	2	5	3	4	20
Total	20	20	20	20	20	100

Table 2.0, evinced that out of 100 internal stakeholders responses, 52 (52.0%) were females and 48 (48.0%) were males; 46 (46.0%) were Post Graduate (25 females and 21 male), 29 (29.0%) were Ph. D. (12 females and 17 males) and remaining 25 (25.0%) were undergraduate (15 females and 10 males); 21 (21.0%) were serving as Assistant, 20 (20.0%) as Head of Department/Branch, 20 (20.0%) as Dean, 16 (16.0%) as Assistant Registrar, 14 (14.0%) as Superintendent and 9 (9.0%) as Deputy Registrar.

Table 3: Frequencies of external stakeholders gender

	Higher Education Institution					
	BPSMV	GNDU	MNIT	NITK	MDU	Total
Qualification						
Male	25	56	52	46	39	218
Female	75	44	48	54	61	282
Total	100	100	100	100	100	500
Qualification						
Student	53	50	54	56	65	278
Parents	29	26	25	23	27	130
Service Providers	5	13	9	11	5	43
Others	13	11	12	10	3	49
Total	100	100	100	100	100	500
Qualification						
Urban	33	38	27	35	37	170
Rural	34	23	33	33	33	156
Metro	33	39	40	32	30	174
Total	100	100	100	100	100	500

Contd...

Contd...

Qualification						
Post Graduate	26	23	23	23	26	121
Under Graduate	23	23	23	24	30	123
12th	25	28	31	29	29	142
Others	26	26	23	24	15	114
Total	100	100	100	100	100	500

Table 3 exhibit that out of 500 external stakeholder responses, 283 (56.4%) were females and 218 (43.6%) were males; 75 females and 25 males were related to BPSMV, 44 females and 56 males were related to GNDU, 48 females and 52 males were related to MNIT, 54 females and 46 males were related to NITK, and 61 females and 39 males were related to MDU; 278 were students, 130 were parents, 43 were service providers and 49 related to other occupation; 170 (34.0%) were residing in Urban area, 156 (31.2%) were residing in Rural area and 174 (34.8%) were residing in Metro Cities; 121 (24.2%) were Post Graduate, 123 (24.6%) Under Graduates, 142 (28.4%) were 12^{th} and 114 (22.8%) were under other category of education qualification.

Discussion

To assess the status of stakeholder's perspective and to ascertain the responsible factors for structural gaps between the users and developers of HEIs G2C eGovernance initiatives, the interviews of internal and external stakeholders was conducted separately and comprehensive analysis has been carried out in three phases. In the First and Second phase GAP score of internal (employees) and external (citizens) has been assessed and analyzed on the basis of Five and Seven Constructs of G2C eGovernance Initiatives of select HEIs, respectively and in the Third phase collective analysis of reasons of identified GAP was carried out.

Overall, 88 (88.0%) internal stakeholders acknowledged that G2C eGovernance technology purchase decision was taken by the Top Level Management, remaining 12 (12.0%) accepted that G2C technology purchase decision was taken by the Middle Level Management and interestingly, there was no involvement of Lower Level Management in G2C technology purchase decision. Overall, 58 (58.0%) internal stakeholders confirmed that G2C technology purchase decision was a group decision and remaining 42 (42.0%) believed it was individual decision; further, Overall 92 (92.0%) of the surveyed internal stakeholders confirmed that there was no involvement of end user in G2C technology purchase decision. Further, the results of the analysis of HEI individually were in accordance with overall results.

The overall unweighted GAP score of internal stakeholders was 0.0164 and after considering importance weights the subsequent Overall average weighted gAP score was 0.0965. Both the depicted scores were in positive zone which affirms the positive perspective of internal stakeholders towards HEIs G2C eGovernance initiatives.

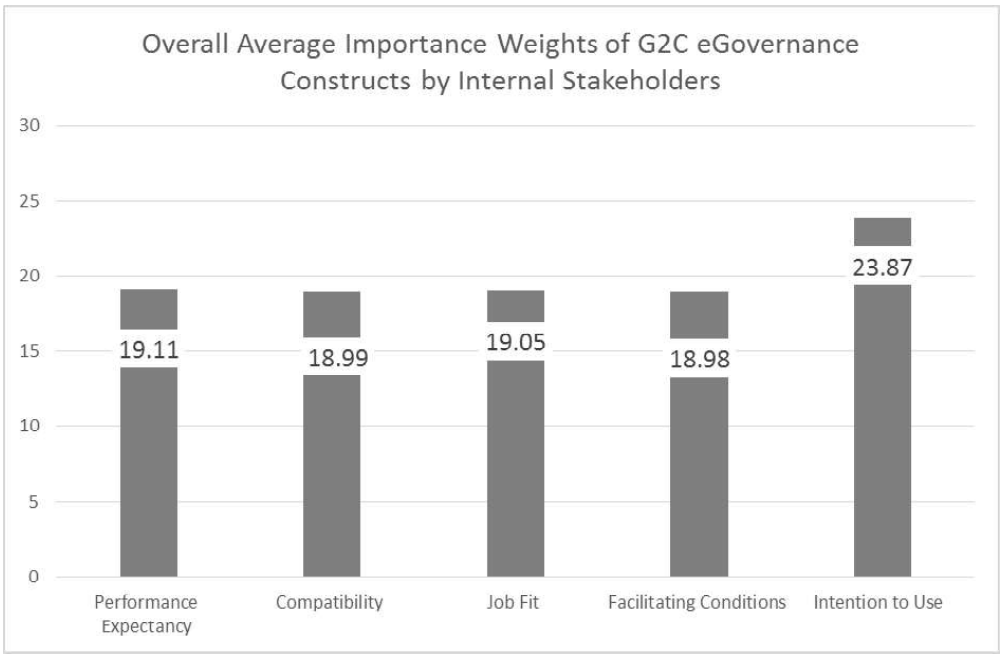

Figure 1: Overall construct wise importance weights (n=100)

The Figure 1.0 revealed that *Intention to use* (23.87) was accorded maximum weight followed by *Performance Expectancy* (19.11), *Job Fit* (19.05), *Compatibility* (18.99) and *Facilitating Conditions* (18.98) was ranked lowest by the internal stakeholders. Analysis depicted that internal stakeholders were ready to compromise on *Compatibility and Facilitating Conditions*.

It was depicted (Table 4) that the respondents were satisfied with Compatibility, Intention to Use and Job Fit constructs. Further, Performance Expectancy construct was also on the edge of the positive side. However, it was revealed that the internal stakeholders were extremely unsatisfied with facilitating conditions i.e. overall average unweighted GAP Score -2.0033 and overall average weighted GAP score was -38.

Table 4: Overall construct wise GAP score of internal stakeholders

Overall unweighted GAP score		Performance Expectancy	Compatibility	Job Fit	Facilitating Conditions	Intention to Use
	Mean	0.0225	0.9467	0.5167	-2.0033	0.5994
	SD	0.07191	0.94959	1.00434	1.07882	0.736
Overall weighted GAP score		Performance Expectancy	Compatibility	Job Fit	Facilitating Conditions	Intention to Use
	Mean	0.435	17.8733	9.92	-38	14.2985
	SD	1.39154	17.9354	19.19064	20.63297	17.63507

The analysis revealed that the extreme unsatisfaction has significant negative impact on the overall perspective of the internal stakeholders towards HEIs G2C eGovernance initiatives.

Both the GAP scores of external stakeholders i.e. Overall average unweighted GAP score (-.4765) and Overall average weighted GAP Score (-9.9636) were in highly negative zone which affirms that the external stakeholders (Students and Society) perspective towards HEIs G2C eGovernance initiative was very low.

It is clearly evident (Figure 2.0) that *the Security* construct (21.93) was accorded maximum weight followed by *Easy To Use* (13.04), *Reliability, Responsiveness and Competence (*13.02), Product Portfolio (13.00) and Usefulness (12.97) ranked lowest by the external stakeholders implies that, the respondents were ready to compromise on Product Portfolio and Usefulness of the HEIs G2C eGovernance initiatives but security remain always the top priority.

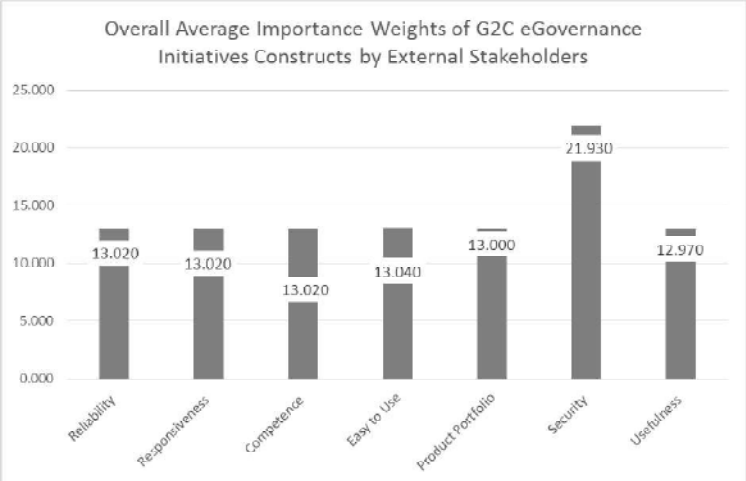

Figure 2: Overall average importance weight

Table 5: Overall construct wise GAP score of external stakeholders (n=500)

Overall unweighted GAP score		Reliability	Responsi-veness	Competence	Easy to Use	Product Portfolio	Security	Useful ness
	Mean	0.060	0.026	-0.508	-0.026	0.099	-2.942	-0.044
	SD	0.993	1.006	1.137	0.910	1.205	0.676	0.691
Overall weighted GAP score		Reliability	Responsi veness	Competence	Easy to Use	Product Portfolio	Security	Useful ness
	Mean	0.763	0.366	-6.601	-0.354	1.190	-64.563	-0.546
	SD	12.912	13.147	14.860	11.851	15.801	16.157	8.951

It is depicted (Table 5) that the external stakeholder were marginally satisfied with product portfolio, reliability and responsiveness constructs however, it was also clearly evident that the external stakeholders were extremely unsatisfied with security construct i.e. overall average unweighted GAP score -2.942 and overall average weighted GAP score was -64.563. The analysis revealed that this extreme unsatisfaction has significant negative impact on the overall perceptive of external stakeholders towards HEI G2C eGovernance initiatives. Further, the unsatisfaction related to Competence, Usefulness and Easy to Use constructs have also contributed significantly negative impact on the overall satisfaction level of the external stakeholders.

Hypotheses Testing

H_{01} : There is no significant difference between internal stakeholders (employees) perspective related to eGovernance initiatives of HEIs

Before applying One-Way ANOVA for testing H_{01} hypotheses, the assumption viz. normality, equality of variances etc. were verified by applying Shapiro-Wilk and Levene's test. The testing outcome of the assumptions (Table 6 and 7) i.e. significant value more .050 confirms the application of One-Way ANOVA for hypothesis testing.

Table 6: Test of normality (shapiro-wilk) – internal stakeholders

	W	p
Overall Unweighted Gap Score	0.977	0.080
Overall Weighted Gap Score	0.974	0.045

*Note. A low p-value suggests a violation of the assumption of normality

Table 7: Test for Equality of Variances (Levene's) – Internal stakeholders

	F	df1	df2	p
Overall Unweighted Gap Score	1.21	4	95	0.310
Overall Weighted Gap Score	1.62	4	95	0.175

The significance value of One-Way ANOVA in both the cases of internal stakeholders i.e. Overall unweighted Gap Score 0.975 and Overall weighted Gap Score 0.962 was more than .050 (Table 8) accordingly null hypotheses H_{01} was failed to be rejected. Meaning thereby there is no significant difference between internal stakeholders (employees) perspective related to eGovernance initiatives of HEIs and all the employees serving in selected HEIs have similar assessment regarding eGovernance initiatives. The inter comparison of the HEIs also endorse the same results.

Table 8: One-way ANOVA – Internal stakeholders

	F	df1	df2	p
Overall Unweighted Gap Score	0.120	4	95	0.975
Overall Weighted Gap Score	0.152	4	95	0.962

H_{02} : There is no significant difference between external stakeholders (Students and Citizens) perspective related to eGovernance initiatives of HEIs

The significant value of Shapiro-Wilk and Levene's test (Table No. 9 and 10) depicts that the significant value was more .050 implies the application of One-Way ANOVA for hypothesis testing.

Table 9: Test of normality (Shapiro-Wilk) – external stakeholders

	W	p
Overall Unweighted Gap Score	0.998	0.914
Overall Weighted Gap Score	0.998	0.768

*Note. A low p-value suggests a violation of the assumption of normality

Table 10: Test for equality of variances (Levene's) – external stakeholders

	F	df1	df2	p
Overall Unweighted Gap Score	0.601	4	495	0.662
Overall Weighted Gap Score	0.704	4	495	0.589

The significance value of One-Way ANOVA in both the cases of external stakeholders i.e. Overall unweighted Gap Score 0.093 and Overall weighted Gap Score 0.117 was more than .050 (Table 8) accordingly null hypotheses H_{02} was

failed to be rejected. Meaning thereby there is no significant difference between external stakeholders (students and citizens) perspective related to eGovernance initiatives of HEIs and all the external stakeholders (students and citizens) of the selected HEIs have similar assessment regarding eGovernance initiatives. The inter comparison of the HEIs also endorse the same results.

Table 11: One-Way ANOVA – external stakeholders

	F	df1	df2	p
Overall unweighted gap score	2.00	4	495	0.093
Overall weighted gap score	1.86	4	495	0.117

To assess the reasons behind the revealed Structure Gap in HEIs G2C eGovernance initiatives, the researchers asked the internal and external stakeholders to rate the prominent reasons of their unsatisfaction and analysis clearly indicated that on overall basis '*Working Environment and Service Vision*' (4.11) was considered major reason of structural GAP between the users and developers of HEIs G2C eGovernance initiatives. The high mean value of '*G2C* eGovernance Initiatives Launched Without Strategy' , 'G2C eGovernance Initiatives Launched Without End User Input', 'Insufficient or Inappropriate Information', 'No Integration of Top Down Leadership and Employees Efforts', 'G2C eGovernance Initiatives Considered as an IT Project – Not Education Initiatives Leveraging Technology' and 'G2C eGovernance Initiatives Strategy is Not Vital for HEI Strategy' also indicated that stakeholders mind these as foremost hindrances in the success of HEIs G2C eGovernance initiatives. The moderate mean value of remaining statements were considered as universal hindrances by the stakeholders of the HEIs (Table 19.0). The inter comparison of the select HEIs confirm the similar results excluding exception in one or two cases.

Table 12: Reasons of structure gap

Sr. No.	Reasons	Score	Rank
R11	Working Environment and Service Vision	4.11	01
R10	G2C eGovernance Initiatives Launched Without Strategy	4.08	02
R7	G2C eGovernance Initiatives Launched Without End User Input	4.05	03
R12	Insufficient or Inappropriate Information	4.04	04
R14	No Integration of Top Down Leadership and Employees Efforts	4.03	05
R16	G2C eGovernance Initiatives Considered as an IT Project – Not Education Initiatives Leveraging Technology	4.02	06
R1	G2C eGovernance Initiatives Strategy is Not Vital for HEI Strategy	4.01	07

Contd...

Contd...

R6	G2C eGovernance Initiatives Tool-Sets are Based upon Someone Else's Success	3.99	08
R13	Insufficient or Inappropriate Information	3.99	09
R2	G2C eGovernance Initiatives Tool-Sets are Launched With No-Regard to Employees or Customer Interfaces	3.97	10
R3	G2C eGovernance Initiatives Launched Without Defined Metrics and Objectives	3.96	11
R5	G2C eGovernance Initiatives Implementation Considered as One Time and One Step Process	3.95	12
R9	Modifying Solutions of G2C eGovernance Initiatives to Accommodate Current Administrative Process and Behavior	3.93	13
R4	Inappropriate or Poorly Applied Procedures	3.92	14
R8	Low Technical Skills of Service Providers	3.91	15
R15	Lack of Integration among Departments and Services	3.9	16
R17	Team Mate Resistance and Lack of Coordination	3.82	17

Hypotheses Testing

H_{1a}: Strong association exist between internal stakeholders (employees) perspective and structural gaps of eGovernance initiatives.

Assumptions of normality and equality of variance through Shapiro-Wilk and Levene's test were verified and in both cases of hypotheses i.e. H_{1a} and H_{1b}, the significant value was more than .050 implies that One-Way ANOVA can be applied.

Table 13: One-Way ANOVA – Internal stakeholders

Respondents Category		Sum of Squares	df	Mean Square	F	Sig.	
Internal stakeholders	R1	Between Groups	11.640	4	2.910	.847	.499
		Within Groups	326.400	95	3.436		
Employees		Total	338.040	99			
	R2	Between Groups	9.640	4	2.410	.626	.645
		Within Groups	366.000	95	3.853		
		Total	375.640	99			
	R3	Between Groups	6.540	4	1.635	.461	.764
		Within Groups	336.900	95	3.546		
		Total	343.440	99			
	R4	Between Groups	5.900	4	1.475	.339	.851

Contd...

Contd...

	Within Groups	412.850	95	4.346		
	Total	418.750	99			
R5	Between Groups	10.660	4	2.665	.732	.572
	Within Groups	345.850	95	3.641		
	Total	356.510	99			
R6	Between Groups	4.240	4	1.060	.239	.916
	Within Groups	421.200	95	4.434		
	Total	425.440	99			
R7	Between Groups	5.240	4	1.310	.345	.847
	Within Groups	360.600	95	3.796		
	Total	365.840	99			
R8	Between Groups	17.460	4	4.365	1.344	.259
	Within Groups	308.500	95	3.247		
	Total	325.960	99			
R9	Between Groups	26.640	4	6.660	1.845	.127
	Within Groups	343.000	95	3.611		
	Total	369.640	99			
R10	Between Groups	3.440	4	.860	.187	.944
	Within Groups	436.000	95	4.589		
	Total	439.440	99			
R11	Between Groups	5.240	4	1.310	.367	.832
	Within Groups	339.350	95	3.572		
	Total	344.590	99			
R12	Between Groups	17.100	4	4.275	1.048	.387
	Within Groups	387.650	95	4.081		
	Total	404.750	99			
R13	Between Groups	8.660	4	2.165	.563	.690
	Within Groups	365.300	95	3.845		
	Total	373.960	99			
R14	Between Groups	6.160	4	1.540	.358	.838
	Within Groups	408.750	95	4.303		
	Total	414.910	99			

Contd...

Contd...

R15	Between Groups	37.840	4	9.460	2.403	.055
	Within Groups	374.000	95	3.937		
	Total	411.840	99			
R16	Between Groups	13.660	4	3.415	.944	.442
	Within Groups	343.700	95	3.618		
	Total	357.360	99			
R17	Between Groups	11.260	4	2.815	.835	.507
	Within Groups	320.450	95	3.373		
	Total	331.710	99			

The significance value of One-Way ANOVA in both the cases (internal and external stakeholders) was depicted more than .050 (Table 13 and 14) accordingly both the hypotheses H_{1a} and H_{1b} were accepted. Implies that strong association exist between stakeholder's perspective and structural gaps of eGovernance initiatives. The inter comparison of the select HEIs confirm the similar results.

H_{1b}: Strong association exist between external stakeholders (Students and Citizens) perspective and structural gaps of eGovernance initiatives.

Table 14: One-Way ANOVA – external stakeholders

Respondents category		Sum of Squares	df	Mean Square	F	Sig.
External stakeholders	R1	Between Groups	19.772	4	4.943	1.244	.291
		Within Groups	1967.580	495	3.975		
		Total	1987.352	499			
Citizens	R2	Between Groups	35.612	4	8.903	2.249	.063
		Within Groups	1959.930	495	3.959		
		Total	1995.542	499			
	R3	Between Groups	14.032	4	3.508	.889	.470
		Within Groups	1952.440	495	3.944		
		Total	1966.472	499			
	R4	Between Groups	3.180	4	.795	.196	.940
		Within Groups	2005.370	495	4.051		
		Total	2008.550	499			
	R5	Between Groups	28.448	4	7.112	1.882	.112
		Within Groups	1870.400	495	3.779		
		Total	1898.848	499			

Contd...

R6	Between Groups	21.032	4	5.258	1.327	.259
	Within Groups	1962.000	495	3.964		
	Total	1983.032	499			
R7	Between Groups	6.040	4	1.510	.383	.821
	Within Groups	1951.710	495	3.943		
	Total	1957.750	499			
R8	Between Groups	16.012	4	4.003	.909	.459
	Within Groups	2180.580	495	4.405		
	Total	2196.592	499			
R9	Between Groups	30.512	4	7.628	1.926	.105
	Within Groups	1960.600	495	3.961		
	Total	1991.112	499			
R10	Between Groups	9.132	4	2.283	.534	.711
	Within Groups	2117.690	495	4.278		
	Total	2126.822	499			
R11	Between Groups	21.488	4	5.372	1.273	.279
	Within Groups	2088.200	495	4.219		
	Total	2109.688	499			
R12	Between Groups	11.532	4	2.883	.733	.570
	Within Groups	1946.730	495	3.933		
	Total	1958.262	499			
R13	Between Groups	17.072	4	4.268	1.126	.344
	Within Groups	1876.800	495	3.792		
	Total	1893.872	499			
R14	Between Groups	11.292	4	2.823	.675	.610
	Within Groups	2070.650	495	4.183		
	Total	2081.942	499			
R15	Between Groups	13.108	4	3.277	.814	.517
	Within Groups	1992.620	495	4.025		
	Total	2005.728	499			
R16	Between Groups	7.932	4	1.983	.507	.731
	Within Groups	1936.490	495	3.912		
	Total	1944.422	499			
R17	Between Groups	16.668	4	4.167	1.012	.401
	Within Groups	2039.050	495	4.119		
	Total	2055.718	499			

The inference of hypotheses test strongly establish that all the stakeholders (internal as well as external) have similar perspective towards eGovernance initiatives of HEIs and strong association exist between stakeholder's perspective and structural gaps of eGovernance initiatives. Accordingly, the policy and decision makers of HEIs shall take cognizance of the identified gaps and all other inferences to address them efficiently.

Conclusions

The analysis clearly revealed that the perspective of the internal stakeholders was positive towards HEIs G2C eGovernance initiatives. However, the internal stakeholders were extremely unsatisfied with respect to facilitating conditions of G2C eGovernance initiatives. On the contrary the perspective of external stakeholders was in highly negative zone and the external stakeholders were extremely unsatisfied with Security, Competence, Usefulness and Easy to Use constructs in reference to G2C eGovernance initiatives. Working Environment and Service Vision along with initiating G2C eGovernance Initiatives without strategy and end user input have been considered as major hindrance for the success of G2C eGovernance in HEIs of India. The outcome of hypotheses test establish that all the stakeholders have similar perspective towards eGovernance initiatives of HEIs and strong association exist between stakeholder's perspective and structural gaps of eGovernance initiatives. The research conclude that the Indian HEIs understood the potential of G2C eGovernance applications but for efficient execution the involvement of end users (backend as well as frontend) and citizens shall be ensured right from planning phase. Further, the G2C eGovernance initiative shall not be considered as automation project and the projects shall be initiated and governed in accordance with appropriate strategy. Furthermore issues related to security, facilitating conditions, competence, privacy policy, training, usefulness and easy to use constructs shall be addressed expeditiously to enjoy the fruits of G2C eGovernance.

Implications

The study may guide the policy and decision makers of HEIs to develop comprehensive and enrich eGovernance strategy to deal with the identified shortcomings of eGovernance initiatives.

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