Article No. 6

PANEL DATA ANALYSIS FOR ENTREPRENEURIAL AND INDUSTRIAL PERFORMANCE OF INDIAN STATES

Kumar Ambedkar
PGPM, S. P. Jain Institute of Management & Research, Andheri West

Ashish Deepankar
PGPM, S. P. Jain Institute of Management & Research, Andheri West

Abstract: *Industrial competitiveness of the region attracts entrepreneurial pursuits, and entrepreneurship, in turn, drives the economic growth of any country or a region. The evolution of industrial capability for any country takes place over a span of time. Initially, industrial growth is largely driven by the 'factor of production.' The factor productivity fetches investment from outside. The competitiveness now rides on the magnitude of financial investment. Finally, technological innovations ensure the superior industrial performance of the region or a country.*

In recent times India has emerged as a prominent player in the world economy. However, not all Indian states are contributing equally in this economic rise. This research paper attempts to understand Entrepreneurial and Industrial Performance of Indian states those are driving industrial activity. This study tries to reveal strength of Indian economy i.e. which one or the combination; factor productivity- financial productivity- innovation productivity is driving industrial growth.

For the first time this paper has attempted to find out linkages among entrepreneurial activities represented by number of entrepreneurship memorandum filed, labour productivity described by net value added per unit of workforce, capital productivity, and innovativeness propensity- depicted as patents filing rate of higher income Indian states.

Industrial competitiveness reflected by entrepreneurship activity is assumed as dependent variable whereas labour productivity, financial productivity, and technological innovation are taken as independent variables. The panel data analysis of eight different Indian states over a time period of six years using STATA has been carried out. The panel data analysis successfully reveals the relationship between the dependent variables, i.e., entrepreneurship activity and independent variables- labor productivity, financial productivity, and technological innovation. The study indicates that the high-income Indian States are dependent upon their Technological Innovativeness propensity for attracting entrepreneurial pursuits. The analysis reveals that Innovations are driving new entrepreneurs for fuelling the growth of the business environment to ensure the competitiveness of Indian States, whereas Financial Productivity and Labour productivity seems to have little significance on entrepreneurship activity in such states.

These finding are quite significant- as it comes out that the Indian States are driving their entrepreneurial and industrial performance through Innovations rather than factor of production and investment, the present research practically challenges usually accepted theory of stages of industrial evolution as factor-

driven – investment-driven – innovation-driven sequence and therefore, present research findings may create significant policy impact for stakeholders.

Keywords: *Entrepreneurship, Innovation, labour productivity, financial productivity*

Introduction

Industrial competitiveness of any country or region depends upon the productivity of capital- human - natural resources in producing goods and services. Productivity, eventually, is nothing but the result of the microeconomic capability of an economy as well as the quality of the national business environment (Porter et al., 2006). The development of industrial capability progresses through various stages. In the initial stages of industrial growth, competitiveness is largely driven by 'factor of production,' i.e., low-cost labour and natural resources. The factor productivity brings investment from outside, which results in shifting the onus of competitiveness on the magnitude of financial investment. Ultimately, it is technological innovations that ensure the superior industrial performance of the region (Dahlman, Carl 2007). Theoretically, the aforementioned three stages come in factor-driven – investment-driven – innovation-driven sequence. However, in a country like India, all these stages are present at a time, owing to its vast geographical spread and unique federal structure. It is observed that while some Indian States excel in high-tech products and services, other states struggle even in producing basic commodities (Singh, Nirvikar 2007). Naturally, entrepreneurial endeavours also get influenced by different components of industrial performance in different states.

The present paper attempts to investigate factors that affect entrepreneurial pursuit is relatively higher per capita income states of India in recent times (2010-2015) by using Panel data analysis.

Gaps in Research

After going through available literature, it is noticed that there are very few articles/papers on said subject. Most of the research papers have focused on the understanding linkage between entrepreneurship and economic growth (Erik Stam and André van Stel 2009; Stam 2008); however, almost none have attempted to investigate the significance of different components of industrial productivity on entrepreneurial activities of Indian States. Moreover, for the first time, this paper has attempted to find out linkages among entrepreneurial activities represented by the number of entrepreneurship memorandum filed, labour productivity described by net value added per unit of the workforce, capital productivity, and innovativeness propensity- depicted here as patents filing rate of higher-income Indian states.

Research Hypothesis

As stated, this study attempts to understand the significance of various components of industrial competitiveness on the growth of entrepreneurship activity in states under consideration. Accordingly, the analysis would test the following hypothesis to understand the subject matter

Null Hypothesis $\mathbf{A_0}$: Labour productivity has a significant influence on entrepreneurship propensity

Alternate Hypothesis $\mathbf{A_1}$: Labour productivity has no significant influence on entrepreneurship propensity

Null Hypothesis $\mathbf{B_0}$: Financial productivity has a significant influence on entrepreneurship propensity

Alternate Hypothesis $\mathbf{B_1}$: Financial productivity has no significant influence on entrepreneurship propensity

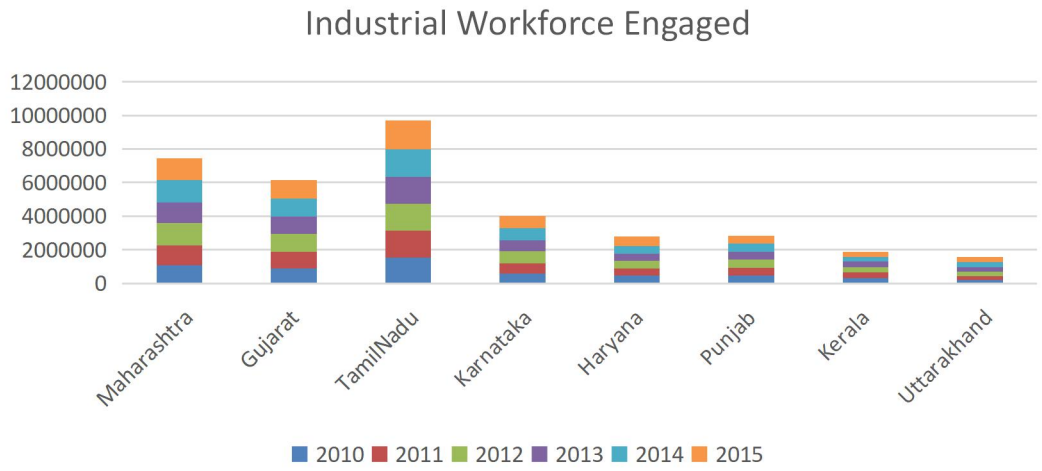
Null Hypothesis $\mathbf{C_0}$: Technological Innovations has a significant influence on entrepreneurship propensity

Alternate Hypothesis $\mathbf{C_1}$: Technological Innovations has no significant influence on entrepreneurship propensity

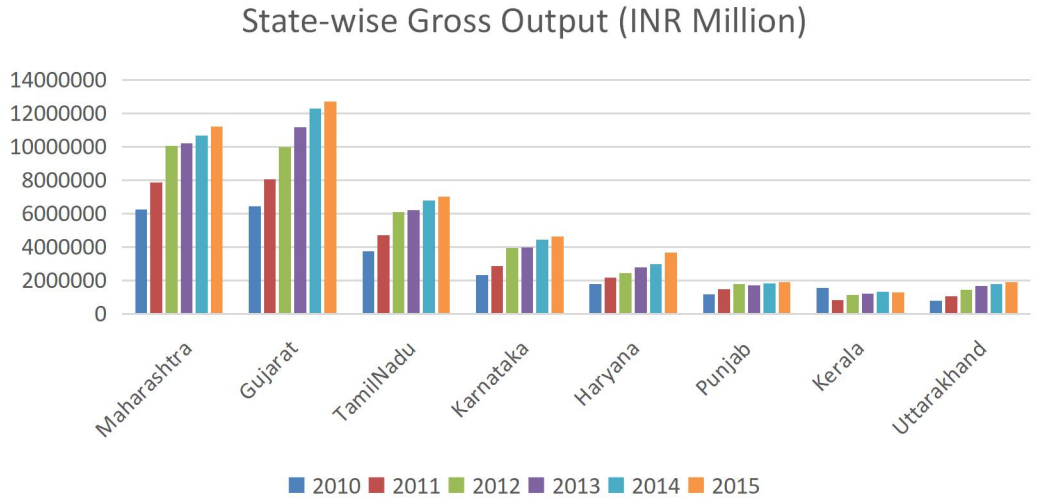
Data, Model Used and Analysis

At first major states have been segregated in terms of per capita annual income. While seven states namely Odisha, Assam, Jharkhand, Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh have per capita income less than the national per capita income, other major Indian states such as Haryana, Gujarat, Karnataka, Kerala, Maharashtra, Tamil Nadu, Punjab, and Uttarakhand have higher per capita annual income than the national per capita income as per RBI Report, 2017. The present research is restricted to the states where per capita annual income is more than the national per capita annual income. The panel data of these states has been created using industrial performance figures of 2010-2015 sourced from Ministry of Statistics & Programme Implementation, Government of India (Annual Survey of Industries, 2009 to 20015), Entrepreneurs Memorandum (Part-II) Data On MSME Sector, 2007-08 To 2014-15, Ministry Of Micro, Small & Medium Enterprises, Nirman Bhawan, New Delhi and Annual Reports (2010-15) of The Office of The Controller General of Patents, Designs, Trade Marks and Geographical Indications, Government of India.

Labour productivity, which represents factor-of-production contribution towards industrial competitiveness, here is conceived as Net Value added in industrial activity divided by the number of workers engaged. It is clear from Graph-1 and Graph-2 that while the state of Gujarat has the highest gross domestic output, Tamil Nadu engages the maximum number of the industrial workforce.

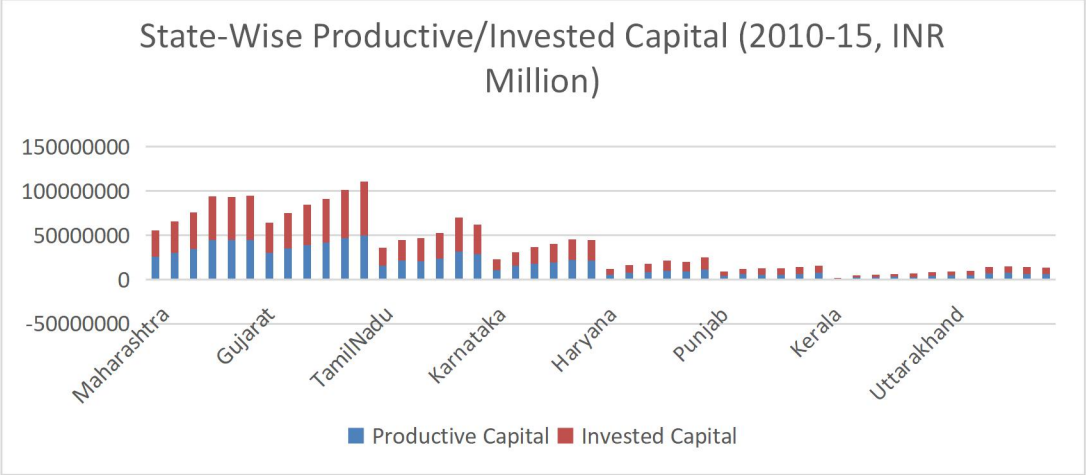


Graph 1: Industrial workforce engaged in different States
Source - Annual Survey of Industries



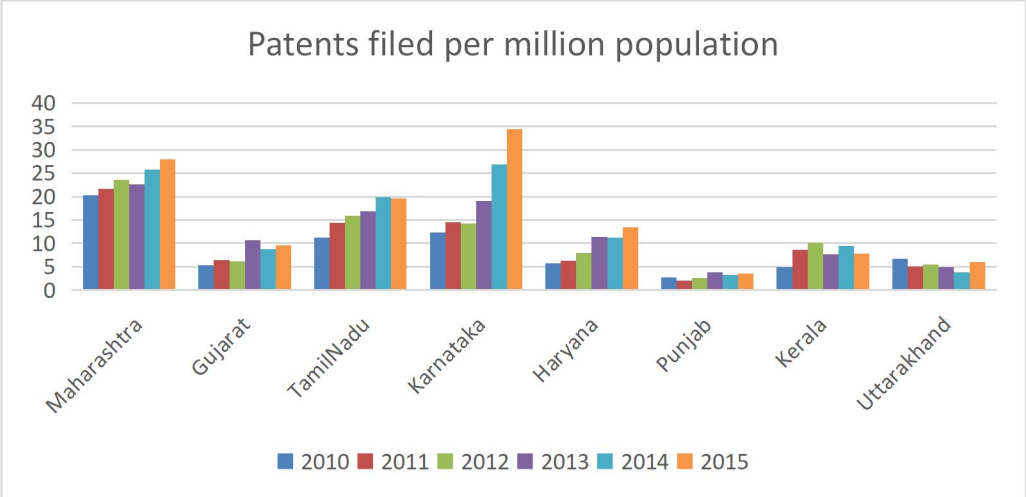
Graph 2: State-wise Gross Industrial Output
Source – Reserve Bank of India Reports, 2017

The financial productivity has been used to indicate the investment performance of a particular state and is defined in the research paper as the ratio of Productive capital to Total capital invested in industrial activity. In Graph-3, it is clearly depicted that Maharashtra, Gujarat, Tamil Nadu & Karnataka are attractive destinations for investment while, on the other hand, Panjab, Haryana, Kerala & Uttrakhand are lagging in attracting investment.



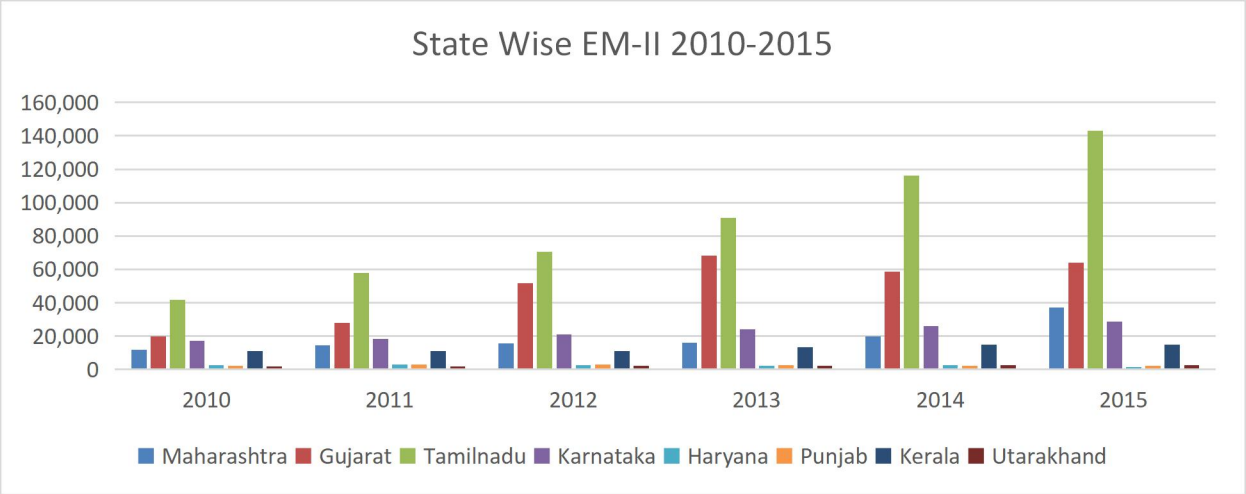
Graph 3: State-wise Industrial Productive Capital and Invested Capital
Source- Annual Survey of Industries

As patent filing reflects the creation of new knowledge in any industrial eco-system, the research takes into account the number of patents filed per million population of the respective state as a key determinant of Technological Innovation propensity. From Graph-4, it is clear that while the number of patents filed per million in Maharashtra is highest till the year 2014, Karnataka overtook Maharashtra in 2015. It can also be inferred from the graph that technological innovation has increased over time in most states with Karnataka showing a maximum increase in the number of the patent filed per million of population.



Graph 4: Patents filed per million population
Source- The Office of The Controller General Of Patents Annual Report

Moreover, as Entrepreneurs Memorandum Part-II (EM-II) filed by entrepreneurs after the commencement of the new project as per MSME act 2006, EM-II has been taken in the present study as an indicator of entrepreneurial activity in a state. In the research paper number of EM-II per million population of the respective state has been used to reflect the entrepreneurial momentum of that state (see Graph-5).



Graph 5 – State-wise EM-II (2010-2015)
Source- Entrepreneurs memorandum (Part-II) data on MSME sector

About Panel Data Analysis

Panel data analysis is used here to investigate the industrial performance of the Indian States. It is a method of exploring data set, having spread in two dimensions, i.e., space and time. The time-series or cross-sectional data analysis alone cannot provide insight into an analytical question (Studenmund, A.H., 2014, Greene, William H. 2012) if the data is spread in two dimensions. In the present study, too, state-wise behavior or annual performance of industry alone may not be sufficient in predicting possible interdependencies of different parameters because the Indian States are not only nearly independent economic and political entities but also their policies cannot be assumed to be continuous over a very long span of time. In order to overcome such limitations, panel data analysis using STATA has been performed to understand the statistical significance of different industrial performance indicators of the Indian States over a relatively stable time window. In the Industrial research data of different states over a duration of six years (2010-2015) has been taken into account to investigate Industrial competitiveness and their development.

The Panel model is presented as

$$\boldsymbol{EMi,t=Ci+\beta 1*Innovation\_Indci,t+\beta 2*Invest\_Prodi,t+\beta 3*Labour\_Prodi,t+\varepsilon\, i,t}$$

Where,

$EM_{i,t}$ is Entrepreneurship Memorandum for 'i' state and 't' year

Innovation_Indc is Innovation propensity

Invest_Prod is Investment productivity

Labour_Prod is Labour productivity

β1, β2, and β3 are coefficients of independent variables

$\varepsilon_{i,t}$ is the error term

For analysis, Random Effect and Fixed Effect regressions are performed on panel data of eight Indian states using Stata. After this Hausman Test is carried out to check the appropriateness of the model.

Descriptive Statistics

The summary of the data used in the present analysis is given in Table 1. Total 48 (six years of data from eight Indian states) The number of data sets is taken into consideration for panel data analysis, which is fairly good sample size for analysis. While all the values are positive, the minimum values of Investment productivity are negative. This is due to the negative productive capital of the State of Kerala in 2009 as per the Reserve Bank of India. Further, the number of Entrepreneurship Memorandum-II is calculated as EM-II per Million of the population, so population bias (higher or lower population) of a particular state could not distort the regression results.

Stats.	Invest_Prod	Labour_Prod	EM-II Per Million	Innovation_indc
Mean	0.860848388	8.134038101	416.9575184	11.71666102
Std. Error	0.021982481	0.569660802	61.28972525	1.131176703
Median	0.870376587	7.727118749	291.5854554	9.537702799
Std. Deviation	0.152299096	3.946725811	424.6276724	7.837022089
Sample Variance	0.023195015	15.57664462	180308.6602	61.41891522
Range	1.10493776	13.71626772	1925.046906	32.42280899
Minimum	-0.088684899	2.281802532	58.45816703	1.982457915
Maximum	1.01625286	15.99807025	1983.505073	34.40526691
Count	48	48	48	48

Table 1: Descriptive Statistics

Panel Data Regression

The results of Random effects GLS and Fixed-effects (within) regression on panel data along with Hausman test to check the appropriateness of the aforesaid regression model in Stata, is presented in Table 2.

Random-effects GLS regression					
corr(u_i, X) = 0 (assumed)			Wald chi2(3) = 11.26 Prob > chi2 = 0.0104		
EM-II per Million	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
Labour_Prod	20.11735	16.41876	1.23	0.220	-12.06284 52.29754
Innovation_indc	**23.21947**	**8.119987**	**2.86**	**0.004**	**7.304591 39.13435**
Invest_Prod	-52.78154	217.4461	-0.24	0.808	-478.968 373.405
_cons	26.70445	280.9457	0.10	0.924	-523.9389 577.3478
sigma_u 483.62776 sigma_e 202.6071 rho .85069898 (fraction of variance due to u_i)					
Fixed-effects (within) regression					

corr(u_i, Xb) = -0.4275				F(3,37) = 3.97 Prob > F = 0.0150	
EM-II per Million	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
Labour_Prod	26.38458	17.63377	1.50	0.143	-9.344835 62.114
Innovation_indc	24.68305	8.705575	2.84	0.007	7.04388 42.32222
Invest_Prod	-48.7528	221.9101	-0.22	0.827	-498.3854 400.8798
_cons	-44.88984	236.4283	-0.19	0.850	-523.9392 434.1595
sigma_u 443.58245 sigma_e 202.6071 rho .82738838 (fraction of variance due to u_i)					
F test that all u_i=0: F(7, 37) = 21.62 Prob > F = 0.000					
Hausman Test					
	---- Coefficients ---				
	(b)Fixed	(B)Random	(b-B)Diff	sqrt(diag(V_b-V_B)) S.E.	
Labour_Prod	26.38458	20.11735	6.267234	6.432272	
Innovation_indc	24.68305	23.21947	1.463577	3.138924	
Invest_Prod	-48.7528	52.78154	4.028748	44.28653	
b = consistent under Ho and Ha; obtained from xtreg B = inconsistent under Ha, efficient under Ho; obtained from xtreg Test: Ho: difference in coefficients not systematic chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 1.21 Prob>chi2 = 0.7507					

Table 2

Result

From Hausamn Test it is clear that Random Model is appropriate for our Panel Data analysis. The result of Random Model depicted in table 2, reveals the significance of independent variables for explaining dependent variable which is nothing but entrepreneurship propensity (number of Entrepreneurship Memorandum filed per million of population)

The panel data Regression result reveals:

- Innovation Propensity (Innovation_indc) explains the number of Entrepreneurship Memorandum (EM-II per Million) significantly
- Labour Productivity (Labour_Prod) and Investment Productivity (Invest_Prod) of States does not explain the number of Entrepreneurship Memorandum (EM-II per Million) significantly

Conclusion

The panel data analysis of the Entrepreneurial and Industrial Performance of industrially growing Indian States successfully reveals the strengths of the economy. The study

indicates that the high-income Indian States are dependent upon their Technological Innovativeness propensity for attracting entrepreneurial pursuits. Clearly, innovations are driving new entrepreneurs for fuelling the growth of the business environment to ensure its competitiveness. Further, it is observed that Financial Productivity and Labour productivity seems to have little significance in entrepreneurship activity in such states.

These findings are quite significant- as it comes out that the Indian States are driving their entrepreneurial and industrial performance through Innovations rather than a factor of production and investment. The research outcome of paper practically challenges usually accepted theory of stages of industrial evolution as a factor-driven – investment-driven – innovation-driven sequence. The way, as shown in results, innovations are driving the growth of entrepreneurship in these Indian States, it may be concluded that industrial competitiveness could be anchored around Innovativeness propensity. Therefore, present research findings may create a significant policy impact for stakeholders.

In brief, this paper successfully depicts that Innovations hold the key to industrial competitiveness, and therefore, it needs focused policy attention on the performance of the industrial ecosystem.

References:

1. Porter, M. E., Ketels, C. and Delgado, M. (2006). The Microeconomic Foundations of Prosperity: Findings from the Business Competitiveness Index.The Global Competitiveness Report 2006–2007. London: Palgrave Macmillan. 51–80.
2. Stam, Erik & Stel, André. (2009). Types of Entrepreneurship and Economic Growth. UNU World Institute for Development Economics Research (UNU-WIDER), Research Paper No. 2009/47.
3. Stam, E. (2008). Entrepreneurship and Innovation Policy. In B. Nooteboom, and E. Stam (eds), Micro-Foundations for Innovation Policy. Amsterdam: Amsterdam University Press and Chicago: Chicago University Press.
4. Dahlman, Carl (2007). Technology, globalization, and international competitiveness: Challenges for developing countries. Industrial Development for the 21st Century: Sustainable Development Perspectives. Department of Economic and Social Affairs, United Nations. 29-84
5. Singh, Nirvikar (2007). Services-led industrialization in India: prospects and challenges. Industrial Development for the 21st Century: Sustainable Development Perspectives. Department of Economic and Social Affairs, United Nations. 235-291
6. Annual Survey of Industries, (2009 to 20015), Ministry of Statistics & Programme Implementation, Government of India
7. Annual Reports (2010-15), The Office of The Controller General Of Patents, Designs, Trade Marks and Geographical Indications, Government of India.
8. Handbook of Statistics on Indian States (2016-17), Reserve Bank of India

9. Entrepreneurs Memorandum (Part-II) Data On MSME Sector, 2007-08 To 2014-15, Ministry of Micro, Small & Medium Enterprises, Nirman Bhawan, New Delhi – 110 108
10. Studenmund, A.H., (2014). Using Econometrics, A Practical Guide, Pearson Education Limited
11. Greene, William H. (2012). Econometric Analysis Seventh Edition, Pearson Education Limited