Economic Reforms and Productivity Growth in Indian Small Scale Industrial Sector: An Empirical Analysis

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Abstract

In the era of globalisation the growth of the Indian small scale industrial sector can brisk up with the investment driven growth and by enhancing the total factor productivity. The major thrust of the paper is to analyse the overall performance of Indian small scale industrial sector by analysing the partial and total factor productivity. The study is confined to the period 1980-81 to 2013-14 which is further divided in two phases i.e. pre reform period (1980-81 to 1990-91) and post reform period (1991-92 to 2013-14). The calculation of factor productivity requires data for which two inputs (number of labour units used by the SSIs and Capital invested by the SSIs) and one output (Gross Value Added). For the purpose of the study data has been curled from Annual Survey of Industries (ASI), statistics prepared by Small Industrial Development Organisation (SIDO) and Data compiled by Planning Commission. To preform the analysis the Malmquist Productivity Index (MPI) has been used. The result revealed that 6.04 percent overall compound annual growth rate and -5.72 percent of labor productivity. The multiple linear regression analysis have been used to analyse the determinants of productivity growth in Indian small scale industrial sector. Our policy suggestion is to harness the total factor productivity growth for which capital input be used judiciously as it is the major contributor to the output growth od Indian small scale industrial sector.

Keywords: *Small Scale Industrial Sector, Globalisation, Total Factor Productivity, Economic Reforms.*

Introduction

Indian economy witnessed high levels of economic growth with the gradual liberalisation which was initiated in the 1980s and intensified in the year 1991-92. Since the time of market reforms, the growth of the country has inclined wherein the annual rate of growth increased from 3.5 per cent in 1980s to 7 per cent by 2005. This tremendous increase in the growth of the national economy has been associated with the trade reforms as well as the policies and rules of the financial sector which aids industrial sector. The gradual development and the transition of the nation to adopt new market policies led the country to gain momentum to further research on the growth trends of the economy which was triggered by market reforms and policies (Panagariya, 2008). However, the liberal policies and globalisation of the nation's economy has intrigued certain aspects of development in the Indian small scale industries from the year 1991 wherein the sustainability of small scale industrial sector improvements in the country is questioned. Economic underdevelopment in Indian small scale industrial sector is still a problem and an issue to be addressed (Saikia, 2011). In the globalised regime, the Indian small scale industry has to face the international competition from the MNCs, which forced the entire sector to introduce the new products through the innovative process so as to enhance the output on sustainable basis. Apart from the production with innovative techniques, the improvement in the efficiency and productivity of the Indian small scale industrial sector is equally important. In this context, the Indian small scale industrial sector has to gear up to the challenges to compete with the multinational companies. Since independence the Indian small scale industrial sector has gone through several phases in its growth process.

However, in the era of globalization the growth of the Indian small scale industry can brisk up with both the investment driven growth and by enhancing the total factor productivity. The key objective of this chapter is to analyze the overall performance of Indian small scale industrial sector by analyzing total factor productivity growth with the help of Malmquist Productivity Index (MPI). "It is significant to note that TFP growth captures the technological improvements as well as the impact of better utilization of capacities, learning-by-doing and improved skills of labour. More specifically, TFP growth is a composite measure of technological progress and changes in the efficiency with which known technology is applied to production processes" (Ahluwalia, 1991).

Keeping in view the importance of the total factor productivity, the present chapter has exhaustively corroborate the theoretical and empirical findings of the total factor productivity growth in Indian small scale industrial sector during pre and post-reforms period.To fulfil the above mentioned objective the paper has been divided into four broad sections. Section I includes the method to measure the total factor productivity growth, the sources of data and construction of relevant input and output variables where as the Section II discusses the empirical results pertaining to partial factor productivity and total factor productivity growth of Indian small scale industrial sector. Section III discusses the regression results for the determinants of variation in partial factor productivity and total factor productivity growth in the Indian small scale industrial sector. The last section concludes the discussion along with some policy implications.

SECTION- I

Database and Measurment of Variables

In this section an attempt has been made to outline the database, concept and methodology to analyse the total factor productivity growth of Indian small scale industrial sector. For the analysis purpose the data has been culled out from various annual reports of Ministry of Micro, Small and Medium Enterprises, Government of India, Handbook of Industrial Policy and Statistics, Development Commissioner of Small Scale Industries and Handbook of Statistics on Indian Economy.The present study is confined to the period from 1980-81 to 2013-14, which is further divided into two sub-periods namely, pre reform period (1980-81 to 1990-91) and post reform period (1991-92 to 2013-14). For the analysis purpose we considered two inputs (gross fixed capital at constant prices and number of employees) and one output (gross value added at constant prices). The detailed definitions of the inputs and output has been given as follows:

Labour Input

The present study has used to number of employees consisting of both production and non production workers as a measure of labour input. As per the definition of ASI "The production workers related to all persons employed directly or through agency whether for wages or not and engaged in any manufacturing process or in cleaning any part of the machinery or premises used for manufacturing purposes are lying under the production workers"(ASI).

Capital Input

In the present study, "we use the gross fixed capital stock as a measure of capital input. This procedure involves the following steps:

Step 1: The gross real investment (It) has been obtained by using relationship:

$$It = (Bt - Bt\text{-}1 + Dt) / Pt \qquad (1)$$

Where

Bt = Book value of fixed capital in the year t;

Dt = Value of depreciation of fixed assets in the year t; and

Pt = Price index of machinery and machine tools in the year t.

Step 2: The logarithm of gross real investment was first regressed against a timetrend to obtain its average growth rate ù and a trend value of investment at thebeginning of the same i.e. I0.

Step 3: Making the conventional assumption that the capital stock grows at asteady state at time t0 the value of capital stock for initial year (K0) has been thenestimated as:

$$K_0 \frac{I_0}{\omega + \delta} \quad (2)$$

Where

K_0 = Gross value of initial capital stock;

ω = Estimated growth rate of investment; and

δ = Annual rate of discarding of capital.

In the present analysis, we have taken annual rate of discarding of capital equal to5 percent.

Step 4: After obtaining the estimate of fixed capital for the benchmark year, the following equation has been used for the measurement of gross fixed capital series at 2004-05 prices:

$$Kt = Kt\text{-}1 + It - \delta Kt\text{-}1 \quad (3)$$

where

K_t = Gross fixed capital at 2004-05 prices by the end of year t;

It = Gross real investment in fixed capital during the year t; and

δ = Annual rate of discarding of capital.

"All the above variables has been deflated at 2004-05 prices using appropriate price deflators.

Gross Value Added

Gross value added is classified as the complete proceeds of the industry deducted by procurements of materials and amenities utilised in the manufacturing process (Castillo, 2015). The statistics of Gross Value Added are attained at by subtracting the price of total input from the value of total output.

$$GVA = TO - TI \quad (4)$$

where ;

GVA means gross value added,

TO and TI means total output and total input.

Total Factor Productivity (TFP) Growth: Concept and Measurment

"It is well acknowledged that economic growth depends both on the use of factors of production such as labour and capital, the efficiency in resource use and technical progress. This efficiency in resource use is often referred to as productivity. Some researchers note that growth in productivity is the only plausible route to increase the standard of living (see for example, Balakrishnan and Pushpangadan, 1998) and is therefore a measure of welfare" (Krugman, 1990). "According to production theory, three factors account for the output growth viz. quantity of inputs, technological progress and technical efficiency with which resources are utilized, the combined effect of technological progress and change in technical efficiency constitute productivity growth"(Antle and Capalbo, 1988).

"Technical change can be defined as the knowledge regarding the industrial acts existing at a point of time. The existing technology sets the condition for the optimum use resources and it sets the limit to how much can be produced with a given amount of inputs given the level of technology. It is the shift in the production function and it can visualized as an inward shift of the isoquants in case of two inputs"(Desai, 1993). Productivity can be measured by using partial productivity indices or by the multifactor indices which are discussed below. The partial productivity can be measured by calculating labour and capital productivity as given below in Equation 5 and 6.

$$\text{Labour Productivity} = Q/L \quad (5)$$

$$\text{Capital Productivity} = Q/K \quad (6)$$

Where, Q is total amount of labour and capital respectively.

The multifactor and TFP measures consider the joint use of inputs in the production. They are given as under in Equation 7 and 8.

$$\mathbf{TFP}_{\text{index}} = \frac{Q_1}{aL + bK} \quad (7)$$

$$\text{MFP}_{\text{index}} = \frac{Q_2}{aL + bK + cM} \quad (8)$$

The Frontier Approach To Measure TFP

"The crucial distinction between these approaches lies in the very definition of the word 'Frontier'. A frontier refers to a set of best obtainable position.

Thus a production frontier traces the set of maximum outputs obtainable from a given set of inputs and technology, and cost frontier traces the minimum achievable cost given input prices and output. The production frontier is an unobservable function that is said to represent the 'best practice' function as it is a function bounding or enveloping the sample data. This is different from the average function, which is often estimated by the Ordinary Least Square (OLS) regression as a line of best fit through the sample data. The frontier and non- frontier categorization is of methodological importance since the frontier approach identifies the role of technical efficiency in overall state performance, while the non-frontier approach assumes that the firms are technically efficient" (Arora, 2010)

In the present study the frontier Malmquist Index has been used to estimate the output index, input index and total factor productivity index. Among the many different methods used to measure TFP, based on distance function the following methods are used- Hicks Moorsteen productivity index (Diewert, 1992), Malmquist productivity index (Caves *et al*., 1982a), and Luenberger productivity indicator (Chambers, 1996). These indexes require problem solving techniques such as Data Envelopment Analysis (DEA) or methods such as regression to measure the distance of unknown frontier.

The Malmquist Productivity Index (MPI) calculates the changes in productivity with respect to variations in time and could further be fragmented into efficiency and technology changes with a non-parametric approach such as DEA. Decomposition of productivity into efficiency catch-up and technical change requires the data and the variants of technology existing in the same study period. In terms of the distance function, MPI is expressed at both time 't' and 't+*1*' in Equation 9 and 10 respectively.

$$\mathrm{MPI}_{\mathrm{I}}^{\mathrm{t}} = \frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)} \tag{9}$$

$$\mathrm{MPI}_{\mathrm{I}}^{t-1} = \frac{\mathrm{E}_{\mathrm{I}}^{\mathrm{t+1}}(\mathrm{x}^{\mathrm{t+1}}, \mathrm{y}^{\mathrm{t+1}})}{\mathrm{E}_{\mathrm{I}}^{\mathrm{t+1}}(\mathrm{x}^{\mathrm{t}}, \mathrm{y}^{\mathrm{t}})} \tag{10}$$

where the notation I denotes the MPI model orientation. Equation 11 gives the geometric mean of the two MPI which is as follows:

$$MPI_I^G = (MPI_I^t \mathrm{MPI}_{\mathrm{I}}^{\mathrm{t+1}})^{1/2} = [\left(\frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)}\right) \cdot \left(\frac{E_I^{t+1}(x^{t+1}, y^{t+1})}{E_I^{t+1}(x^t, y^t)}\right)]^{1/2} \tag{11}$$

However, the above equation denotes the input oriented geometric mean of the MPI which could be fragmented into input oriented efficiency change (EFFCH) and input oriented technical change (TECHCH) which is defined in Equation 12.

$$MPI_I^G = (EFFCH_1).(TECHCH_I^G) =$$

$$\left(\frac{E_I^{t+1}(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)}\right) \cdot [\left(\frac{E_I^t(x^t, y^t)}{E_I^{t+1}(x^t, y^t)}\right) \cdot \left(\frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^{t+1}(x^{t+1}, y^{t+1})}\right)]^{1/2} \tag{12}$$

From the above equation, two terms efficiency change and the technology change are acquired respectively. However, MPI is defined using distance function (DEA) which is the MPI components derived from distance function estimation defined on frontier technology. Fare *et al*. (1994) derived the equation for MPI and is the most widely accepted method to calculate production technology (Coelli *et al*., 2005a; Thanassoulis, 2001). By using both VRS and CRS DEA frontiers, the distance functions are estimated in Equation 12. Furthermore, technical efficiency is fragmented into pure technical efficiency and scale efficiency. In this context, pure technical efficiencychange is denoted in Equation 13 as:

$$\mathrm{PECH} = \frac{\mathrm{E}_{VRS}^{\mathrm{t+1}}(\mathrm{x}^{\mathrm{t+1}}, \mathrm{y}^{\mathrm{t+1}})}{\mathrm{E}_{\mathrm{CRS}}^{\mathrm{t+1}}(\mathrm{x}^{\mathrm{t}}, \mathrm{y}^{\mathrm{t}})} \tag{13}$$

Furthermore, scale efficiency change is denoted as:

SECH =

$$[\frac{\mathrm{E}_{VRS}^{\mathrm{t+1}}(\mathrm{x}^{\mathrm{t+1}}, \mathrm{y}^{\mathrm{t+1}}) / \mathrm{E}_{\mathrm{CRS}}^{\mathrm{t+1}}(\mathrm{x}^{\mathrm{t+1}}, \mathrm{y}^{\mathrm{t+1}})}{\mathrm{E}_{VRS}^{\mathrm{t+1}}(\mathrm{x}^{\mathrm{t}}, \mathrm{y}^{\mathrm{t}}) / \mathrm{E}_{CRS}^{\mathrm{t+1}}(\mathrm{x}^{\mathrm{t}}, \mathrm{y}^{\mathrm{t}})} \cdot \frac{\mathrm{E}_{VRS}^{\mathrm{t}}(\mathrm{x}^{\mathrm{t+1}}, \mathrm{y}^{\mathrm{t+1}}) / \mathrm{E}_{\mathrm{CRS}}^{\mathrm{t}}(\mathrm{x}^{\mathrm{t+1}}, \mathrm{y}^{\mathrm{t+1}})}{\mathrm{E}_{VRS}^{\mathrm{t}}(\mathrm{x}^{\mathrm{t}}, \mathrm{y}^{\mathrm{t}}) / \mathrm{E}_{CRS}^{\mathrm{t}}(\mathrm{x}^{\mathrm{t}}, \mathrm{y}^{\mathrm{t}})}]^{1/2} \tag{14}$$

Durbin Watson Test

"Durbin-Watson test is most celebrated statistic test for detecting the presence of serial autocorrelation (a relationship between values separated from each other by a given time lag) in the residuals (prediction error) from the regression analysis" (Gujrati, 2007).

$$\mathbf{d} = \frac{\sum_{t=2}^{n} (\mathbf{e}_t - \mathbf{e}_{t-1})^2}{\sum_{t=1}^{n} \mathbf{e}_t^2} \quad (15)$$

where 'n' stands for the number of observations, et the observed error term (i.e., residuals) or ($Y_{t \to t}$) = Yt – a – bX_t. It can be shown that the value of d will be between zero and four; zero corresponding to perfect positive correlation and four to perfect negative correlation. As a rough rule of thumb, if Durbin–Watson is less than 1.0, there may be cause for alarm. Small values of d indicate successive error terms are, on average, close in value to one another, or positively correlated. If d > 2, successive error terms are, on average, much different in value from one another, i.e., negatively correlated. In regressions, this can imply an underestimation of the level of statistical significance" (Gujrati, 2007).

SECTION- II

The present study endeavor to analyze the partial productivity and total factor productivity growth in Indian small scale industrial sector and it also examine the factors explaining the productivity growth.

In this section empirical results pertaining to partial productivities .i.e. (labour productivity and capital productivity) and total factor productivity growth in Indian small scale industrial sector have been presented. "It has been well acknowledged in the literature that the labour productivity defines a ratio of output (i.e., gross value added in the present study) to the total number of labour employed in the industry" (Kumar, 2001).

The labour productivity for Indian small scale industrial sector is defined as a ratio of output (Gross Value Added) to labour input (employment). Symbolically, it can be expressed as in Equation 16.

$$LP = Q/L \quad (16)$$

The capital productivity for Indian small scale industrial sector is defined as a ratio of output (Gross Value Added) to capital input (fixed capital). Symbolically, it can be expressed as in Equation 17.

$$CP = Q/C \quad (17)$$

Table 1 presents the annual growth rate of labour productivity and capital productivity of Indian small scale industrial sector during 1980-81 to 2013-14. The compound annual growth rate has been given for the entire period(1980-81 to 2013-14), pre-reforms period (1980-81 to 1990-91) andpost-reforms period (1991- 92 to 2013-14).It has been observed that the labour productivity of Indian small scale industrial sector has grown at compound annual growth rate of 0.51 percent during the entire study period. However, this figure has been observed to be 9.37 percent for the pre-reform period which is decelerated to 2.46 percent during the post-reform period. The empirical result shows that the labour productivity growth has observed higher growth rates during the pre-reforms period in relation to the post-reforms period.Firstly, it is revealed that during the pre-reforms period, Indian SSIs witnessed steep growth in labour productivity which is clearly depicted in Figure1. Indian small scale industrial sector had witnessed increased labour productivity during the pre-reforms period; however, with the economic reform policies established in the year 1990-91, the sector suffered from a drastic downfall. For years even after the economic liberalisation, the small scale industrial sector in India was suffering from negative valued labour productivity which revived to growth position during the year 1995-96. In a previous study by Garg (1996), an analysis was made to identify whether growth of SSIs in India is set in an inclining pace. While the previous paper was published in 1996, it covered the growth rates of large and small SSIs wherein the period of study considered was till 1994-95. These findings further discern the fact that capital accumulation had been evident during the time when liberal policies were established and labour productivity was however not of a great concern.

On the other hand, the partial factor productivity measure of capital productivity of Indian small scale industrial sector has been given as the ratio of Gross Value Added (GVA) to the gross fixed capital at constant prices. Table 1 illustrate the trends of the capital productivity measure for the Indian small scale industrial sector. During the entire study period the compound annual growth rate of capital productivity in Indian small scale industrial sector is recorded to the tune of -8.25

percent. The comparison of capital productivity between pre-reforms and post-reforms reveals that the liberalization, privatization and globalization (LPG) process has failed to bring any significant dent in the performance of capital productivity growth of Indian small scale industrial sector, because the trend of compound annual growth rate of capital productivity exist in the post-reforms period to the tune of 1.06 percent and 2.07 percent in the pre reform. One major drawback of measuring partial productivities is that with changing production levels, the measure of productivity in terms of labour and capital are either overestimated or underestimated but not accurate. In simple terms, the calculation of partial productivities often leads to biased estimation or results (Majumder, 2004). Furthermore, the measurement of partial productivities does not provide the platform for decomposing efficiency effects. These limitations lead to the computation of TFP which could overcome such defects.

Total Factor Productivity Growth Analysis Using Malmquist Productivity Index

Total Factor Productivity (TFP) measures the output that could not be explained by the inputs used in the production. Most often, TFP is also calculated as the production function shift. It is deemed that TFP is considered to be synonymous to technological change and hence, shift in production function is taken as technological change. However, with inefficient production, change in TFP is associated with technical efficiency change. This became the premise of the present research wherein Malmquist Productivity Index is used to estimate total factor productivity growth. The calculation of TFP takes the form

$$TFPG = (MALINDEX - 1) \times 100$$

where MALINDEX is calculated using the equation. The calculation of TFP growth is listed in Table 2.

In addition to this, Table 3 show the results for sources of output growth viz. percentage contribution of labour input, capital input and contribution of total factor productivity in Indian small scale industrial sector. The analysis reveals that the contribution of TFP growth turned out to be the predominant source of the output growth in Indian small scale industrial sector during the entire study period as well as in the post-reforms period. On the other hand, the contribution of labour input growth towards output growth has shown the fluctuating trend, though it is contributing positively to the output growth from 1980-81 onwards. Moreover, the contribution of capital input growth to output growth of Indian small scale industrial sector was either negligible or negative during the entire study period. Therefore, the introduction of economic reforms has no significant and positive impact on the capital input growth in Indian small scale industrial sector. In this context, there is need to accelerate the capital input growth in Indian small scale industrial sector because the capital stock of a industry increases through the process of net investment where as the capital investment is essentially required to update the capacity of the sector on sustainable basis. Thus, the empirical analysis reveals that the output growth of Indian small scale industrial sector is predominantly technology-driven and not the input- driven in the post-reforms period. The picture of the contribution of all three i.e. input growth, output growth and total factor productivity growth is given in the Figure 2 in the form of a graph during the entire study period , pre reform period and post reform period.

SECTION - III

Determinants of Labour Productivity, Capital Productivity and Total Factor Productivity Growth of Indian Small Scale Industrial Sector

The partial productivities (labour and capital) and TFP growth in Indian small scale industrial sector a-priori assumed to be affected by various factors, viz. growth of output (OUTGROW), growth of capital intensity (KLGROW), profitability (RETURNS) and proportion of non production employees to total employees (SKILL). "The variable 'OUTGROW' represents the growth of output, the rate of growth of output is hypothesized to influence the growth of technical progress. The usual presumption in the literature is that such variable is necessary to control the effect of scale economies on total factor productivity growth"(Denison,1979 and Kaldor, 1970). "The explanatory variable 'KLGROW' represents average annual growth rate of capital intensity, which reflects growth in the capital accumulation per employee. It is a measure of the relative degree of mechanisation in the production process. A high capital-labour ratio signifies a greater degree of mechanisation and is expected to facilitate higher productivity growth. "The variable RETURN (profitability) is defined as the ratio of contribution of Capital (GVA-emoluments) to gross fixed capital. The variable 'RETURN' is used as a proxy for the level of profitability in the industry. "The variable SKILL represents the availability of human skills and highlights the availability of the trained manpower including supervisory, administrative and managerial staff, where it has been measured as the ratio of skilled persons (i.e., all employees minus production workers) to all employees" (Ghosh and Neogi,1993 and Kumar and Arora,2007). The following are the regression equations for partial productivity and total productivity growth:

$$TFPG = \beta 0 + \beta 1OUTGROW + \beta 2KLGROW + \beta 3RETURNS + \beta 4SKILL + \mu i \quad (5.19)$$

$$LPG = \beta 0 + \beta 1OUTGROW + \beta 2KLGROW + \beta 3RETURNS + \beta 4SKILL + \mu i \quad (5.20)$$

$$CPG = \beta 0 + \beta 1OUTGROW + \beta 2KLGROW + \beta 4RETURNS + \beta 4SKILL + \mu i \quad (5.21)$$

where

TFPG	stands for total factor productivity growth
LPG	stands for labour productivity growth
CPG	stands for capital productivity growth
OUTGROW	stands for growth of output
KLGROW	stands for growth of capital investment
RETURNS	stands for level of profitability
SKILL	stands for the availability of skilled manpower

Table 4 represent the result of the estimates of factors affecting TFP growth in Indian small scale industrial sector, it has been observed that barring the explanatory variable 'OUTGROW' is significantly affecting the total factor productivity growth at 1 percent level of significance however the other variables SKILL, RETURNS AND KLGROW are negatively affecting the total factor productivity growth of Indian small scale industrial sector. thus it could be inferred from the results that the growth of output are positively affecting TFP while the others have negative impact on TFP growth. Moreover the general proposition of rapid output growthis likely to be more pronounced TFP growth is valid in case of Indian small scale industrial sector. On the other hand, Durbin-Watson statistics value of 2.46 shows that there is no problem of serial auto-correlation and the value of variance inflation factor shows that there is absence of multicollinearity among the selected variables.

Table 5 presents the result for the estimates of the determinants of the labour productivity growth in Indian small scale industrial sector, the result shows that only'OUTGROW' is positively and significantly affecting the labour productivity in Indian small scale industrial sector. The coefficient of SKILL, KLGROW and RETURNare insignificantly determining the variations in labour productivity growth at 1 percent level of significance. However, the variable'OUTGROW'satisfy a-priori expectations about the directions of their impact on labour productivity growth in Indian small scale industrial sector and they are equally important for policy formulation. Durbin-Watson statistics value of 1.50 indicate that there is no problem of presence of serial auto- correlation and the value of Variance Inflation Factor implies that there is no problem of multicollinearity.

Table 6 shows the estimated regression results for the factors explaining the variations of capital productivity growth in Indian small scale industrial sector. All the selected variables except 'SKILL'and RETURN has a significant effect on the capital productivity growth, the results indicates that'KLGROW' and 'OUTGROW' are significantly effects the capital productivity growth at 1 percent level of significance. Therefore, the results revealed that the growth of output and the growth of capital investment leads to higher capital productivity of the Indian small scale industrial sector. The values of Durbin-Watson statistics and Variance Inflation Factor implies that there is no problem of presence of serial auto-correlation and multicollinearity in selected variables.

SECTION IV

Conclusion

It can be concluded from the empirical results of the partial factor productivities growth that economic reforms of 1991 has no significant impact on the labour productivity growth and has negative impact on the capital productivity growth in Indian small scale industrial sector.

The result for the decomposition of output growth of Indian small scale industrial sector reveals that the inspiration component (TFP growth) is significantly contributing to the output growth, as the growth of TFP in Indian small scale industrial sector has found to be growing at a positive during the entire study period. Therefore, the economic reforms of 1991 seems to foster the output growth of Indian small scale industrial sector because the economic reforms has brought about various changes in Indian industry by opening up the markets to the multinational companies, lifting various trade and tariff barrier and the integration of small scale industrial sector to world's modern technology. Moreover, the compound annual growth rate of the total factor productivity during the entire study period worked out to be -1.53 percent, whereas the comparative analysis of total factor productivity growth of Indian small scale industrial sector during the pre-reforms and post-reforms period revealed that the compound annual growth rate has decreased from -7.02 percent during the pre-reforms period to 1.69 percent during the post-reforms period. Therefore, the total factor productivity growth of Indian small scale industrial sector has positively contributing to output growth of same during the post-reforms period.

Hence, in order to accelerate the output and productivity growth of Indian small scale industrial sector in the current economic scenario, a significant amount of investment in human resource development and technology up-gradation of research and development capabilities in Indian small scale industry is essentially required in post-reforms period. Moreover, the government must initiate the measures to promote public investment in research and development activities for the sustainability of Indian small scale industrial sector. Therefore, the Indian small scale industrial sector should become globally competitive through world class capabilities both in terms of quality and cost efficiency so as to enhance its output and productivity on sustainable basis in the post-reforms period.

Table 1 : Labour and Capital Productivity Growth of Indian Small Scale Industrial Sector (% Age)

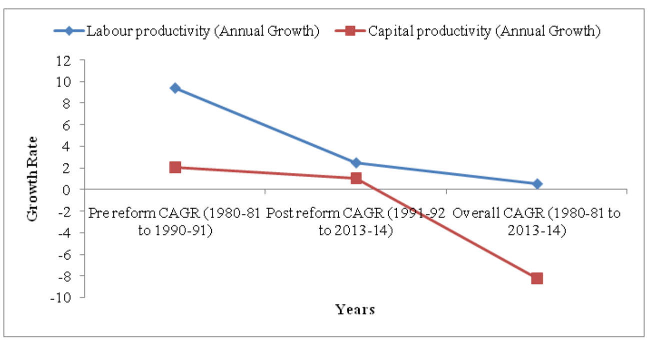
Years	Labour productivity (Annual Growth)	Capital product-ivity (Annual Growth)
1980-81	-	-
1981-82	11.98	10.20
1982-83	1.72	-1.05
1983-84	13.92	12.18
1984-85	15.09	8.04
1985-86	14.88	7.14
1986-87	12.66	4.83
1987-88	15.24	4.92
1988-89	15.52	0.69
1989-90	18.31	5.15
1990-91	-50.23	-50.84
1991-92	-13.02	-10.39
1992-93	23.67	16.75
1993-94	-35.14	-36.09
1994-95	-90.84	-91.16
1995-96	-13.20	-14.15
1996-97	61.75	62.86
1997-98	38.67	42.11
1998-99	35.35	36.54
1999-00	20.23	21.16
2000-01	17.37	16.27
2001-02	7.91	6.42
2002-03	14.80	13.39
2003-04	22.97	21.49
2004-05	24.72	23.03
2005-06	-10.37	17.22
2006-07	-66.65	-74.68

2007-08	6.01	0.63
2008-09	5.81	0.86
2009-10	5.81	-7.89
2010-11	5.87	10.99
2011-12	11.60	23.26
2012-13	0.08	-0.58
2013-14	0.11	-0.78
Pre reform CAGR (1980-81 to 1990-91)	9.37	2.07
Post reform CAGR (1991-92 to 2013-14)	2.46	1.06
Overall CAGR (1980-81 to 2013-14)	0.51	-8.25

Note: CAGR stand for Compound Annual Growth Rate in Percent

Source: Author's calculation

Figure 1: Compound Annual Growth Rate of Labour Producitivity, and Capital Productivity of Indian Small Scale Industrial Sector



Source: Author's calculation

Table 2 : Trend in Indices (Malmquist Index) of Output, INput and TFP in Indian Small Scale Industrial Sector

Year	Input Index	Output Index	TFPI
1980-81	26.74	270.68	-243.94
1981-82	29.95	298.27	-268.32
1982-83	30.46	295.14	-264.67
1983-84	34.70	331.08	-296.38
1984-85	39.94	357.71	-317.77
1985-86	45.88	383.23	-337.35
1986-87	51.69	401.71	-350.02
1987-88	59.57	421.53	-361.96
1988-89	68.81	424.43	-355.61
1989-90	81.42	446.28	-364.86
1990-91	40.52	219.38	-178.86
1991-92	-12.98	-14.00	1.02
1992-93	-16.05	-16.37	0.32
1993-94	-10.41	-10.45	0.04
1994-95	-0.95	-0.94	-0.01
1995-96	12.28	12.43	-0.15
1996-97	19.86	20.30	-0.44
1997-98	27.55	28.83	-1.28
1998-99	37.29	39.38	-2.09
1999-00	44.83	47.68	-2.84
2000-01	52.62	55.47	-2.84
2001-02	56.79	58.98	-2.19
2002-03	65.20	66.88	-1.68
2003-04	80.18	81.25	-1.07
2004-05	100.00	100.00	100.00
2005-06	89.63	117.18	-27.55
2006-07	29.89	29.65	0.24
2007-08	31.69	29.65	2.04
2008-09	33.53	29.65	3.88
2009-10	35.48	29.65	5.83
2010-11	37.56	29.65	7.91
2011-12	41.92	36.61	5.31
2012-13	41.96	36.34	5.62
2013-14	42.01	36.12	5.89

Source: Author's calculation

Table 3 : Decomposition of Output Growth of Indian Small Scale Industrial Sector Into Input Growth and Total Factor Productivity Growth

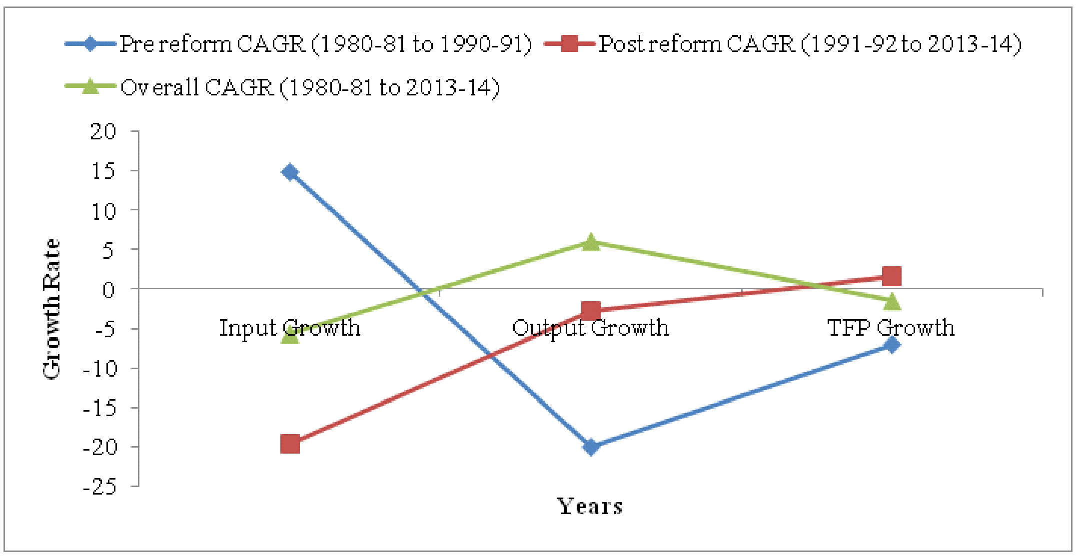
Years	Input Growth	Output Growth	TFP Growth	Contribution of Labour	Contribution of Capital	TFPC
1980-81				1.98	5.77	-3.78
1981-82	11.98	10.20	1.78	2.22	6.35	-4.14
1982-83	1.72	-1.05	2.77	2.26	6.29	-4.03
1983-84	13.92	12.18	1.74	2.57	7.05	-4.48
1984-85	15.09	8.04	7.05	2.96	7.62	-4.66
1985-86	14.88	7.14	7.74	3.40	8.17	-4.77
1986-87	12.66	4.83	7.83	3.83	8.56	-4.73
1987-88	15.24	4.92	10.32	4.41	8.98	-4.57
1988-89	15.52	0.69	14.83	5.10	9.04	-3.94
1989-90	18.31	5.15	13.16	6.03	9.51	-3.48
1990-91	-50.23	-50.84	0.61	3.00	4.67	-1.67
1991-92	3.59	419.899	-25.63	-0.96	-0.30	-0.66
1992-93	23.68	16.75	6.93	-1.19	-0.35	-0.84
1993-94	-35.14	-36.09	0.94	-0.77	-0.22	-0.55
1994-95	-90.85	-91.16	0.31	-0.07	-0.02	-0.05
1995-96	-139.20	-146.15	56.96	0.91	0.27	0.64
1996-97	61.76	62.86	-1.10	1.47	0.43	1.04
1997-98	38.68	42.11	-3.43	2.04	0.61	1.43
1998-99	35.36	36.54	-1.19	2.76	0.84	1.92
1999-00	20.23	21.16	-0.92	3.32	1.02	2.31
2000-01	17.38	16.27	1.11	3.90	1.18	2.72
2001-02	7.91	6.42	1.49	4.21	1.26	2.95
2002-03	14.81	13.39	1.42	4.83	1.43	3.41
2003-04	22.98	21.49	1.49	5.94	1.73	4.21
2004-05	24.72	23.03	1.69	7.41	2.13	5.28
2005-06	-10.37	17.22	-27.60	6.64	2.50	4.14
2006-07	-66.65	-74.68	8.03	2.21	0.63	1.58
2007-08	6.01	0.00	6.01	2.35	0.63	1.72
2008-09	5.81	0.00	5.81	2.48	0.63	1.85
2009-10	5.81	0.00	5.81	2.63	0.63	2.00
2010-11	5.88	0.00	5.88	2.78	0.63	2.15
2011-12	11.61	23.26	-11.65	3.11	0.78	2.33
2012-13	0.09	-0.58	0.67	3.11	0.77	2.33
2013-14	0.11	-0.78	0.90	3.11	0.77	2.34

Pre-reform CAGR (1980-81 to 1990-91)	14.83	-20.04	-7.02			
Post-reform CAGR (1991-92 to 2013-14)	-19.58	-2.78	1.69			
Overall CAGR (1980-81 to 2013-14)	-5.72	6.04	-1.53			

Note: CAGR stand for Compound Annual Growth Rate in Percent

Source: Author's calculation

Figure 2 : Trends in Compound Annual Growth Rate of Output, Input and Total Factor Productivity in Indian Small Scale Insustrial Sector



Source: Author's calculation

Table 4 : Regression Results For Determinations of TFP Growth in Indian Small Scale Industrial Sector

	Beta	Standard Error	R Square	t value	p value	Durbin-Watson-statistics	Variance Inflation Factor
(Constant)	48.416	43.503	0.358	1.113	0.276	2.468	
OUTGROW	-0.023	0.006		-3.501	**0.002****		1.068
SKILL	9.639	7.516		1.282	0.211		9.660
KLGROW	-24.333	14.354		-1.695	0.102		3.290
Return	0.184	0.629		0.292	0.773		5.031

Dependent Variable: TFPG, **p<0.01

Source: Author's calculation

Table 5 : Regression Results For Determinants of Labour Productivity Growth in Indian Small Scale Industrial Sector

	Beta	Standard Error	R Square	t value	p value	Durbin-Watson-statistics	Variance Inflation Factor
(Constant)	-47.038	52.655		0-.893	0.380	1.505	
OUTGROW	0.961	0.008	1.001	123.364	**0.000****		1.068
SKILL	-4.844	9.097	-0.013	-0.532	0.599		9.660
Return	-0.504	0.761	-0.012	-0.662	0.514		5.031
KLGROW	15.752	17.374	0.026	0.907	0.373		3.290

Dependent Variable: Growth of labour productivity, **p<0.01

Source: Author's calculation

Table 6 : Regression Results for Determinants of Capital Productivity Growth in Indian Small Scale Industrial Sector

	Beta	Standard Error	R Square	t value	p value	Durbin-Watson-statistics	Variance Inflation Factor
(Constant)	5.852	0.817		7.158	0.000	0.701	
OUTGROW	0.000	0.000	0.229	3.277	**0.003****		1.089
SKILL	-0.136	0.165	-0.203	-0.823	0.419		3.533
Return	0.020	0.012	0.256	1.725	0.099		4.917
KLGROW	-1.026	0.312	-0.921	-3.288	**0.003****		7.453

Dependent Variable: Cappro.Log, **p<0.01

Source: Author's calculation

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