International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

Productivity Analysis of Transport Industry in Post-Liberalization Period from 1994-95 to 2010-11

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Abstract: *This paper analyzes productivity in Transport Industry in the post-liberalization period with an aim to know the causes behind the trends in the productivity in the sample period (1994-95 to 2010-11). Based on the outcome, suggestions have been put forth that could bring positive difference in growth of Transport Industry in India. Secondary data has been used in the paper sourced from the Annual Survey of Industries and website of Central Statistical Organization*

Introduction: Firm level economics, like the nation-level economics, has one focus: growth. Growth comes from higher productivity that leads to more output with the same amount of inputs, or the same output with lesser amount of inputs. Eventually, more output would mean more profit which turns into more investments, more investments means expansion or growth. Higher output can be achieved through factor accumulation as well as through better productivity of factor inputs such as labour and capital. Since factor accumulation is subjected to diminishing marginal returns, better productivity is a more sought after option for achieving growth. India was grappling with sluggish economy when economic reforms were brought about in a phased manner in the early 1990s. Not only did the economy integrate with the world economy through globalization measures but non-performing public units were aimed to be privatized to improve their productivity. A yet more significant move came in form of economic liberalization that happened at the financial and trade level.

The major changes that financial liberalization entailed were: easing the entry of new private and foreign banks; liberalizing interest rate control; enhancing role of market forces and reduce state pre-emption of bank credit through reductions in reserve and statutory liquidity requirement , which together stood at more than 50% of assets in 1992 (Mrs. Poonam Gupta et al(March 2011). The idea behind financial liberalization was to make credit availability easier to the private firms, thus facilitating capital to them which is believed to be a way to raise productivity. Trade liberalization, on the other hand, can be seen as policies that diminish restriction on the free international movement of goods and services. It is done through measures like bringing down import quotas, lowering of import tariffs, bringing down restrictions to exports, and lowering of export taxes. Trade liberalization brings economic efficiency through different ways: allocative efficiency, productive efficiency, dynamic efficiency and X-effiicency. Allocative efficiency happens when competition from lower cost import sources drives market prices down and in this reduces the supernormal profits in monopoly. Productive efficiency is specializing and selling in larger markets lead to increasing returns to scale lowering long run Average Cost. Dynamic efficiency is when open economies experience more R&D and investment in human capital to raise productivity. X-efficiency will provide discipline in business to keep their unit costs under control to remain competition. In short, financial and trade liberalization help in better resource allocation and utilization. How the productivity in the Food Industry, of which India is

the second biggest producer in the world, changed during the post-liberalization period is going to be the focus of this paper.

Transport system in a country is compared with the nervous system in humans. Transport spreads like nerves through a network and has linkages with most industries in all sectors and all regions of a country for distribution purpose, travel purpose and so on. It is also one of the biggest employment providers. In fact, faster an economy grows, more the need for faster and reliable mode for transport for movement of goods and people. High growth of Indian economy is driving the demand for transportation industry (www.mordorintelligence.com).

Transport Industry is a consumer durable goods industry. It covers all aspects of manufacturing of a means of transport, be it the auto-component, the automobile, passenger transport such as trains, buses, planes etc and its ancillary parts such as railway tracks and so on. Though transport vehicle can be used for both personal and occupational purpose or as a means of commutation for public, but since ultimately the consumer utilizes a product which he does not have a buy in shorter span, it is called a consumer durable good.

Here's a brief trivia about this industry: With liberalization in India, about seventy five percent of the total FDI approvals were made in the country in the priority sector which includes energy, communication, electrical equipments, transport equipments, metallurgical equipments etc. Percentage of total FDI inflow in various sectors between 1991 and 2002 show that Transport Industry was one of the highest recipients of actual FDI. The largest recipient was Electrical Equipments Industry that received 13.9% of FDI followed by Telecommunication that received 12.9% of FDI, then Transport Industry that received 10.8% FDI, finally Energy sector that received 10.4% FDI. Rest all of the industries received FDI in single digit percent (K.R.Gupta, 2005).

Transportation industry is classified into majorly three segments i.e. aviation, roads and railways. In the present scenario, Transportation industry contributes roughly 6.3% of GDP and is majorly dominated by road sector. More than 50% of freight and 90% of passenger traffic are handled by road. Government as well private investments, rising exports, increasing interstate movement of goods and passengers, growing FMCG sector and rising disposable income are the major drivers of transpiration industry in India. In order to boost the connectivity across country, 100% FDI has been allowed in roads and Highway sector via automatic route. In case of aviation sector, government has increased the FDI limit from 79% to 100% of which up to 49% is available under automatic route (www.mordorintelligence.com).

As for the R&D investments across sectors and shares of capital and current account in Total R &D Expenditure (1990-91 to 2006-07), it is found that within the transport industry, the largest R&D expenditure is spent on manufacturing of motor vehicles, trailers and semi-trailers, followed by manufacture of other transport equipments, only about 0.8 million on road and virtually nothing on water and Air Transport. (www.nistads.res.in).

Along with the unequal allocation for R&D in various segments of the Transport Industry, there are certain other challenges too that this Industry is facing such as seasonal uncertainty in supply and demand, poor infrastructure, too much dependence on road transport rendering other modes of communication less attended to and so on. Moreover, trade in transport factor is usually dominated by imports. Despite having some of the best engineers, India is not able to compete with major automobile manufacturers in the world or develop its unique selling proposition. However, the missing points in the spectrum of the given situation cannot be

understood until the firm-level productivity in the Food Industry is analyzed particularly in the post liberalization period, which was meant to facilitate growth in industries by bringing about high productivity and greater efficiency and also improve India's trade.

In the context of the above, the aim of this paper is to:

1. Measure Partial Factor Productivity of Labour and Capital as well as Total Factor Productivity in the Transport Industry from 1994-95 to 2004-05 and also analyze the cause behind it.
2. Explore changes required in the Transport Industry on the basis of the factor input with highest factor elasticity.

Data Source and Methodology:

This paper uses secondary data collected from the publication of Annual Survey of Industries for the period: 1994-95 to 1997-98. Data beyond 1998 has been collected from the website: www.csoisw.gov.in/ which presents the time series data on the Annual Survey of Industries. Selected characteristics of factory sector at 2-digit level of disaggregation have been taken which includes No. of Factories, Total Persons Engaged, Fixed Capital, Net Value Added and Net Value of the Output. The above-mentioned characteristics would be put to use to analyze the data to meet the following objectives in two steps:

Objectives:

1. Measurement of Partial Factor Productivity of Labour and Capital as well as Total Factor Productivity in the Transport Industry from 1994-95 to 2004-05 and analyzing the causes behind it with the help of a few select productivity and inverse productivity ratios.
2. Estimating the predictor variable that has maximum marginal effect on the 'net value of output' through regression. Extending suggestions to optimize that variable and putting forth submissions to make insignificant variables significant. Achieving the above-mentioned ends should expectantly bring the costs down and make Transport products more competitive in domestic as well as foreign markets.

First Stage of Calculation:

Measurement of Partial Factor Productivity of Labour and Capital as well as Total Factor Productivity in the Transport Industry from 1994-95 to 2004-05 and analyzing the causes behind it :

Productivity in the sample period is found at two levels, labour and capital productivity and Total Factor Productivity which also depicts the 'technological progress' in the Transport Industry. The reason why these three factors are stressed upon is that in the long run, the economy's supply of goods and services depends on its supplies of labour and capital as well as the available production technology to turn these capital and labour into goods and services (Joshua Gans et al., 2018).

Single Factor Productivity and Total Factor Productivity are calculated in the following way:

Labour Productivity or PFPL = Net Value Added to Output/Value of Labour

Capital Productivity or PFPK =Net Value Added to Output/Value of Capital

Total Factor Productivity = TFPI= $\sqrt{\text{PFPI (K) x PFPI(L)}}$

V(t)= index of value added for the year t

K(t)=index of capital employed for the year t

L (t)= index of Labour employment for the year t

The PFPL here would give the value added by each unit of labour; PFPK is the value added by each unit of capital. There are a couple of methods to calculate TFP. In the present study, the Direct Method has been chosen to calculate TFP. In this method, the square

root of the product of partial factor productivity of labour and capital in terms of their respective value-added, would result in the Total Factor Productivity, i.e. it is the geometric average of the PFP indices.

The resultant values of productivity would be put adjacent to the inverse productivity ratios which will bring forth trends existing in the Transport Industry.

The principal characteristics of the factory sector for the Transport Industry that would be used for this paper are:

Table 1: Principal Characteristics in the Transport Industry :

Year	No. of factories	Total Persons Engaged	Fixed Capital	Net Value-Added	Net Value of Output
	Number	Number	(Rs.Lakh)	(Rs. Lakh)	(Rs.Lakh)
1994-95	4057	542683	839908	622946	3161682
1995-96	4106	621880	1217915	1073979	4766414
1996-97	4012	605138	1665124	1070249	4781862
1997-98	4011	553585	1531088	991351	4943966
1998-99	2833	281652	2049134	588828	3107513
1999-2000	2810	288485	2437065	734381	4342366
2000-01	2684	257924	2403014	541098	4194408
2001-02	2736	251047	2197408	591883	4236681
2002-03	2902	267864	1930213	763870	5735695
2003-04	2757	285666	1999582	1200166	7024388
2004-05	3093	336820	2448153	1678997	14345878
2005-06	3069	274467	2631737	2347565	12072889
2006-07	3261	408444	3052750	2287265	14084379
2007-08	3310	466667	4574226	2469927	16329633
2008-09	3662	509741	6796621	2126779	17495763
2009-10	4186	619588	8074427	3408244	23522439
2010-11	5139	715550	9779408	3845185	30044070
CAGR %	**1.49**	**1.74**	**16.58**	**12.05**	**15.11**

Table 2: PFP and TFP of Food Industry and their Compound Annual Growth Rates from 1994-2009:

Year	PFPL=Net Value Added/Total Persons Engaged	PFPK=Net Value Added / Total Fixed Capital	Total Factor Productivity
1994-95	1.15	0.74	0.92
1995-96	1.73	0.88	1.23
1996-97	1.77	0.64	1.07
1997-98	1.79	0.65	1.08
1998-99	2.09	0.29	0.78
CAGR in %	**16.17**	**-21.1**	**-4.26**
1999-2000	2.55	0.3	0.88
2000-01	2.1	0.23	0.69
2001-02	2.36	0.27	0.8
2002-03	2.85	0.4	1.06
2003-04	4.2	0.6	1.59
CAGR in %	**13.34**	**18.8**	**16.04**
2004-05	4.98	0.69	1.85
2005-06	8.55	0.89	2.76
2006-07	5.6	0.75	2.05
2007-08	5.29	0.54	1.69
2008-09	4.17	0.31	1.14
CAGR in %	**-4.35**	**-17.81**	**-11.34**
2009-10	5.5	0.42	1.52
2010-11	5.37	0.39	1.45
CAGR of the Entire Study Period (in %)	**10.13**	**-3.89**	**2.88**

Table 3: Average of Productivity and Inverse Productivity Ratios of Food Industry on a sub-period basis:

Sub-periods:	O/L	O/K	K/L	K/O	ICOR
1994 -1999	1.7	0.64	3.26	1.81	-23.53
2000-2005	2.81	0.36	8.14	3.13	-0.52
2005-2009	5.72	0.64	9.49	1.79	-78

Source: Annual Survey of Industries (Factory Sector), CSO, New Delhi

On referring Table 2, it is clear that the first sub-period is the time when capital is seriously underutilized hence its negative compound annual growth rate (-21.1%). This can be said with certainty since Table 4 suggests that capital has a very high growth rate of 24.8%. Capacity under utilization is also confirmed since labour productivity is high at 16.17%. TFP growth in this sub-period is -4.26 owing to considerable underutilization of capital. In the second sub-period, both labour and capital productivity have a double digit positive growth rate and hence TFP growth is also positive. Table 4 indicates negative growth rate of both labour and capital , which has led to full utilization of the two factors of production as both these factors work to the top of their efficiency. In the third sub-period, both labour and capital productivity growth are negative and Table 4 suggests that it is because of growth in labour and capital in the Industry. Again, capacity utilization seems to mar capital productivity whereas more labour taken on board than the requirement, has kicked in diminishing marginal returns for labour. There is negative technical progress, in fact technical regress in form of negative TFP growth. According to Trueblood and Osborne (2001), technical regress can be seen as loss in technical efficiency and shifting of frontier inward (loss in technical change) which is likely due to input supply disruptions, lack of credit and spare parts etc. which inhibits the use of previously used inputs (Congu and Swinnen (2003), Transition and Total Factor Productivity in Agriculture, 1992-1999, Page 2). Productivity of labour, capital and TFP for the entire study period shows that labour productivity is highest at 10.13, capital productivity is at -3.89 which indicates that capital remained under utilized in Transport Industry during the study period, TFP for the entire sample period is 2.88.

Table 3:

Labour productivity has grown consistently, however capital productivity has hovered at the same average which means there has been no path breaking technical progress in the study period. Capital intensity shows sizeable capital deepening in the industry. Capital Output ratio shows some degree of improvement in capital utilization over the sub-periods since there was a major rise in it in the second sub-period but a certain level of moderation has come in the third sub-period. ICOR is negative through which shows that industry is constantly dealing with lack of funds, which may be attributable to lack of profits in it.

Inferences drawn from the calculations done so far are:

1. Signs of increase in labour-intensity especially by the third sub-period, i.e. 2004-05 onwards.
2. Low TFP for the entire study period, negative TFP for two sub-periods out of three along negative ICORs indicate in no uncertain terms that Transport Industry is grappling with lack of credit, which has become a hurdle in optimizing Technical change and efficiency. Since investments can be categorized as change in inventory as well as depreciation, when depreciation is more than new inventories, ICOR could get negative. Depreciation which means breakage in the machines and equipments, it can get quite high which usually happens at the time of intense loss of profits during times with low

demand or economic down-turns time of upkeep of the capital www. fredblog.stlouisfed.org

Second Stage of Calculation:

Economic thought at various times have suggested the vital role that the technical progress plays in industrial growth. It has also been suggested time and again, the role that value-addition plays in structural change of an industry since more value-addition in the product of an industry would make the industry more productive which would be manifested in form of higher TFP since TFP is the residual that explains the value-added after accounting for labour and capital (OECD, Perspective on Global Development 2014).

The next step is to see whether any variable moves in tandem with TFP. As seen in Table 2, TFP is highest in the second sub-period that is between 1998-99 and 2003-04, at 16.04% and Table 4 shows that CAGR of 'Net Value Added' in the second sub-period is the highest amid labour and capital at 13. 07%. According to this rough estimation, value-added makes maximum difference in the TFP, however, this can be confirmed by conducting multiple regression on values of labour, capital and net value-added on the net value of output. Table 5 does just that. With r-square at 97%, and significance of F-value less than 0.5%, it is clear that null-hypotheses can be rejected. Moving ahead in the table, it can be seen that coefficients of capital and net value-added are statistically significant whereas labour is negative and statistically insignificant in explaining the net value of output. Coefficient of value-added (5.25) is almost five times the coefficient of capital (1.12).

The above table clears that net value of output is utmost influenced by the value that is added in the products of Transport Industry, followed by capital that brings the final product together. Since value-added comprise of the intermediate inputs such as wood, glass, rubber, steel, electricity, other types of fuels and so on, if these inputs can be made more cost-effective, it would make the products of Transport Industry quite competitive. Acquiring more efficiency in capital management would also make capital better utilized in the Industry. Capacity under-utilization is the main cause behind TFP being low. Since the available capital is not utilized, the installed capital is not able to add value to the product it is capable of adding, to be enough productive in the production process.

When net value-added is subtracted from net value of output, the difference is not too high, which shows that a large part of the market price of the Transport Industry is due to the value-additions made in it. If the prices of the intermediate goods are rationalized, price of the Transport products is also going to come down, making it more competitive.

On the basis of the above text, following suggestions can be put forth:

1) Value-additions in the Transport Industry is making maximum marginal effect on the net value of products. However, during times of economic downturn there comes a deficiency of spare parts, intermediate products which does not just bring the efficiency down, but makes the final product quite expensive. Moreover, since cyclical nature of demand makes capacity underutilized in times of deficient demand,

production costs increases further more due to negative capital productivity.

2) Labour is not able to make any significant difference in the net value of output since it is not capable enough to work on a capital and technology intensive production technique.

Conclusion:

Though, there are indications of investments flowing into the Transport Industry in the post-reform period, the Industry grapples with considerable crest and trough in its growth rate or productivity during economic cycles, by virtue of the very nature of consumer durable goods Industry being pro-cyclical. However, it does not go unnoticed that there are a number of challenges on the way to better productivity and growth in the Transport Industry. Bad infrastructure, poor road network are just to name two exogenous factors. There were certain endogenous factors as well, impeding the way to growth in Transport Industry. During the paper, the statistical measurements suggested that since value-addition is the most important component of net value of output in this industry, expensive or deficient intermediate goods increases the cost in Transport Industry. Rigorous research has to go into finding substitutes of those intermediate inputs that India imports from outside. Moreover, factors such as power supply, uninterrupted flow of fuel also needs to be ascertained. Capital under utilization can be reduced by improving inventory management by keeping the stock lean and so on. This will also save on the level of depreciation in the Industry. Labour in the industry is not contributing, hence there is an urgent need for training labour by imparting requisite skills in them.

Appendix

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Table 4: Compound Annual Growth Rate of Factor Inputs in the Food Industry through three sub-periods:

Total Persons Engaged		**Fixed Capital**		**Net Value-Added**	
Number		(Rs.Lakh)		(Rs. Lakh)	
542683		839908		622946	
621880		1217915		1073979	
605138		1665124		1070249	
553585		1531088		991351	
281652	-15.12	2049134	24.98	588828	-1.40
288485		2437065		734381	
257924		2403014		541098	
251047		2197408		591883	
267864		1930213		763870	
285666	-0.25	1999582	-4.83	1200166	13.07
336820		2448153		1678997	
274467		2631737		2347565	
408444		3052750		2287265	
466667		4574226		2469927	
509741	10.91	6796621	29.08	2126779	6.09
619588		8074427		3408244	
715550		9779408		3845185	

Table 5: Summary Output when Net Value of Output is explained by labour, capital and Net Value-Added.

Regression Statistics	*Column1*
Multiple R	0.99
R Square	0.97
Adjusted R Square	0.97
Standard Error	1482823.83
Observations	17

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Column1	**Column2**	**Column3**	**Column4**	**Column5**	**Column6**
Regression	3	9.91541E+14	3.30514E+14	150.32	0.00

Residual	13	2.8584E+13	2.19877E+12		
Total	16	1.02012E+15			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	**-762138.9786**	**1065994.214**	**-0.714956018**	**0.487278016**	**-3065079.462**
X Variable 1	-1.87	2.74	-0.68	0.51	-7.79
X Variable 2	1.12	0.30	3.80	0.00	0.48
X Variable 3	5.25	0.75	7.01	0.00	3.63