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LITERATURE REVIEW OF MANUFACTURING SECTOR WITH SPECIAL REFERENCE TO TOTAL FACTOR PRODUCTIVITY GROWTH

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Abstract
The present paper is an endeavour to review the literature of manufacturing sector. It shared the view points of different authors emphasising on total factor productivity growth, its determinants, components of total factor productivity growth, impact of liberalisation on TFPG in the context of Indian Manufacturing Sector. It also highlighted the relation of Total factor productivity with value of output, capital intensity, R&D expenditure, exports and imports, infrastructure, foreign investment; adult literacy rate.It reviewed the impact of liberalisation on the manufacturing sector of India. Many previous studies reported that liberalisation resulted in improving the health of manufacturing sector via improving Total Factor Productivity Growth.

Keywords: Literature Review, Total Factor Productivity Growth, Determinants of TFPG, Manufacturing Sector, Impact on Liberalisation.

Introduction

Manufacturing sector is an important sector of an economy and can exert a significant influence on its growth and development. Therefore, a large body of literature has been devoted, both internationally as well as in India, to examine the performance of an industry through various performance measurement indicators like efficiency measurement, productivity measurement, growth rates etc. An attempt will be made in this study to review previous research work relating to performance of manufacturing as measured in terms of productivity, factors influencing productivity etc. Accordingly, section-1 analysed various studies as regards to decomposition of TFP growth. Section- 2 discusses the determinants of TFP growth. Section-3 throws light on some of the studies relating to TFP growth of Indian manufacturing. Section- 4 highlights the impact of liberalisation on TFP growth of Indian manufacturing as explained by different studies.

Review of Literature

Decomposition of Total Factor Productivity Growth

Total Factor Productivity growth (TFPG) is usually decomposed into technical progress (TP) and technical efficiency change (TEC). This decomposition throws light on which of the two factors is responsible for total factor productivity growth i.e. whether improvement in it is due to TP (i.e. shifting of the frontier) or TEC (i.e. moving towards the frontier or catching up effect).

Numerious studies (Jajri et.al. (2006), Kim and Park (2006), Mahadevan (2002), Margano et.al (2006), Tan (2006))found that though both TEC and TP contributed to TFPG but TE improvement have contributed more. Mahadevan (2002) using the data of 18 manufacturing industries for the period 1981 to 1996 analysed that TFP growth of these industrial groups came from technical change. 16 of these industrial groups operate at the low end of the manufacturing operations and hence have scope to use better and advanced technology. These industries enjoy efficiency gains through experience as these are using the same technology over the years. Hence, technical change contributes more to TFP growth. Natarajanet. al (2008) and Lee (2012) have found that technology has degraded (i.e. by -9.6 percent and -1.8 percent respectively), and it is only technical efficiency improvement that resulted in positive TFPG during the study period. Lee (2012) while analysing the TFP growth of 20 manufacturing industrial groups of Singapore for the period 2001 to 2010 observed that TFP growth was mainly driven by technical efficiency improvement. Lack of innovation and diffusion of technology resulted in technological regression. On the other hand, skills programmes initiated in the 2000's improved the efficiency of workers. Also, during this period, manufacturing sector has undergone major restructuring which resulted in efficient use of resources and improved management skills. Further, it is observed in this study that technical efficiency change and technological progress are inversely related. Improvement in technology and equipment resulted in decline in efficiency due to organisational slack. Contradicting it, Fare et. al (2001) and Mahdeswaran et. al (2007) are of the view that it is only TP that has contributed to TFPG. They have found that average TE degraded during the study period. Fare et.al (2001) decomposing TFP growth of Taiwan's manufacturing for the years 1978 to 1992 examined that technical progress contributed more than technical efficiency change. It was so because Taiwan authorities undertook many projects to upgrade production. A manufacturing sector has increased its R&D activities which resulted in technological progress. The percentage of firms with greater than four percent R&D intensity (R&D expenditure to sales revenue) increased from four percent in 1986 to 23 percent in 1989. All this resuted in technological progress.Madheswaran et.al (2007) using the data from 1979-80 to 1997-98 of 17 two digit

industrial groups viewed that TFP growth is mainly driven by technological progress. New industrial policy and economic reforms that initiated in 1985 encouraged new technological innovations and hence caused impressive technological progress. On the other hand, technical efficiency registered a negative trend. It is because of poor technical know how of Indian workers and weak socio- economic characteristics i.e. child labour, poverty, poor health of workers, non-firm income of the workers etc. Moreover, most of the industries are labour intensive in India and hence Indian workers lack labour skills. They have little knowledge about optimal utilisation of best practice technology. On the other hand, Fare et.al (1994), Kong et. al (2006), Mahmood and Afza (2008), and Sowlati et.al (2006) observed that though both TE improvement and TP resulted in improvement in total factor productivity growth, but TP have contributed more. Mahmmod and Afza (2008) considering the different sectors of Singapore worked out TFP growth of Singapore economy for the period 1986 to 2000. Of all the sectors, manufacturing sector experienced maximum technological progress. It was so because many manufacturing companies started using new technologies like high end computers and sophisticated machineries for production. Even transport and financial sectors adopted computerised software. Only community, social and persona services were laggards in technological upgradation because of their nature of operation. These sectors donot involve any technological capabilities. Sowlati et.al (2006) throws light on TFP growth of Canadian manufacturing sector with special emphasis on Wood products industries for the period 1994 to 2002. It revealed that on average, technological progress contributed more to TFP growth. Wood products industry experienced negative TFP growth due to negative technical efficiency with positive technological change. It is so because the labour is not efficient enough to operate the technologically advanced equipments. Education level is low in Canada and most of the labour force is unskilled and it becomes difficult for them to work on new equipments.

Technical efficiency change (TEC) is further decomposed into pure technical efficiency change (PTEC) and scale efficiency change (SEC)[1]. Most of the studies (Jajiri et. al (2006), Lee (2012), Mahadevan (2002), Natarajan et. al (2008), Raj and Duraiswamy (2004), and Tan (2006)) observed that PTE improvement contributed more to TEC while according to Fare et.al (1994), Fare et.al (2001), and Mahmood and Afza (2008), it is SEC that resulted in TE improvement.

Determinants of Total Factor Productivity

Economists have found that besides, TEC and TP, TFP is influenced by many other factors. TFP is affected by capital intensity. Different studies have come up with different viewpoints regarding the relation between both. Fu (2005) found that capital intensity had insignificant relation with total factor productivity of manufacturing industries in China. Sharma et.al (2000) while supporting his viewpoint found insignificant relation between total factor productivity of Nepal's manufacturing and capital intensity. Contradicting it, Yean (1997) observed that with improvement in capital intensity, the productivity in Malaysia's manufacturing declined. The study observed that there were labour constraints like declining skill intensity (ratio of skilled to semi- skilled labour), illiteracy, etc. that put hindrances in the absorption of productivity gains from the growth in capital in Malaysia. Opposing it, Babu and Natarajan (2013) found that the insignificant relation of TFP growth with capital intensity is because of lack of technological progress in this sector for over a period of time. There is a need for making more capital investment in this sector. Supporting it, Sharma et.al (2000) also finds the same relationship between both for Nepal's manufacturing. On the other hand, Kiran and Jain (2012) observed that more capital intensity resulted in improving productivity of Punjab's manufacturing. It means that there is no unanimity as regards relation of capital intensity with total factor productivity in different countries.

Exports and imports also have a positive and significant relation with TFP of manufacturing industries (Baldwin (2003), Biescbroeck (2003), Fu and Gong (2011), Sharma et.al (2007), Sjoholm (1997), Yean (1997)). But Sharma et.al (2000) is of the view that more exports have no influence on TFP. Supporting him, Fu (2005) also found the same. He observed that Chinese government was eager to develop non-export industries such as metallurgical industry, the electrical and machinery industries and the Chemical industry. Majority of the imported machinery and equipment goes to these industries. Secondly, whatsoever FDI comes in China mainly provides market and trade facilities and do not provide many new techniques. So, Exports has insignificant relation with technical change and hence, TFP growth. Yean (1997) viewed that TFP has negative relation with imports in Malaysian manufacturing sector. Sjoholm (1997) observed that importing high-tech technology resulted in improved productivity of Indonesian establishments. Halpern et. al (2006) supports his viewpoint and observed that imported inputs improved productivity of Hungarian manufacturing. Vogel and Wagner (2008) also observed a positive relation between imports and productivity of manufacturing in Germany. He viewed that imports act as an important vehicle for knowledge and technology transfer. Further, import of intermediate goods helps a firm to specialise in activity where it

[1]PTE improvement implies better and more efficient utilisation of existing resources with given technology whereas SE improvement means improvement in efficiency due to changed scale of production.

has particular strengths. It provides opportunities for exploiting global specialisation. Thus in all, imports enhances the productivity of a firm/ industry.

Regarding research and development expenditure, some studies (Fu and Gong (2011), Mitra (1991), Saunders (1980)) found that introducing new techniques, innovation and increasing expenditure on research and development also improve productivity of manufacturing sector while Fu (2005) observed that it has no influence on productivity.

Foreign investment also influences productivity. Yean (1997) is of the opinion that more the foreign investment, more will be the productivity of industry. But, Saunders (1980) observed that foreign investment decreases the productivity of domestic industry. Further, Sharma et.al (2000) and Mahmood and Afza (2008) viewed that productivity has no relation with foreign investment. Mahmood and Afza (2008) pointed out that FDI has a stronger relation with total value added. He viewed that for productivity growth, internally developed technology and production methods alongwith local policy inititatives are more important than foreign investment.

(Goldar and Kumari (2002), Kiran and Jain (2012), Babu and Natarajan (2013), Raj and Duraiswamy (2004), Sharma et.al (2000), and Yean (1997)) opined that TFP is directly influenced by output growth, i.e. more the annual rate of growth of output of an industry, more will be its TFP. These studies follow 'Verdoon's Law' in this view which states that output growth is positively related with productitivity growth as economies of scale acts as a source of productivity growth.

Further, some economists found that higher growth rate of agricultural sector improves the productivity of manufacturing sector (Goldar and Kumari (2002), Babu and Natarajan (2013), Raj and Duraiswamy (2004)). In support of it, Goldar and Kumari (2002) found in their study that agricultural growth declined in the post reform period which in turn resulted in decline in productivity in the post reform period. It is so because slower agricultural growth resulted in slow demand for industrial products which in turn cause under utilisation of resources and hence lower productivity. Also, good infrastructure has a positive influence on the productivity of manufacturing sector (Babu and Natarajan (2013), Goldar and Kumari (2002), Mitra (1998), and Raj and Duraiswamy (2004)). Babu and Natarajan (2013) measuring the productivity of Indian states found that regional infrastructure availability influences regional manufacturing productivity growth in India. Regions with good infrastrucuture facilities enjoy greater productivity than those with poor infrastructure facilities. In addition, more the adult literacy in an economy, more will be the productivity of manufacturing sector (Goldar and Kumari (2002); Natarajan (2008)). Babu and Natarajan (2013) viewed that improving the education base of workers in the unorganised manufacturing sector increases the productivity growth.

Apart from the above determinants of productivity, productivity of manufacturing sector has a positive relation with efficient utilisation of resources (Mitra (1999)), real exchange rate, non-tariff barriers (Goldar and Kumari (2002)). It has a negative relation with one year lagged technical efficiency (Fu (2006)), pre-productivity growth rate (Natarajan (2008)) and investment ratio (Goldar and Kumari (2002)). Productivity has no relation with firm size, nominal rate of protection, and ownership structure (Sharma et.al (2000).

Thus, total factor productivity is influenced by numerous factors. Also, the relation of these factors with productivity varies in different studies.

Total Factor Productivity Growth of Indian Manufacturing

To reflect TFP in India, some studies have used statewise-data (Babu and Natarajan (2013), Deb (2013), Kumar (2006), Kumar et.al (2010), Mukherjee and Ray (2004), Natarajan et.al (2008), Ray (2002) Unni et.al (2001)); and some have used industry-wise data (Ahluwalia (1991), Das (2003), Pradhan and Barik (1999), Unel (2003), and Veermani and Goldar (2005)); and some others have used both state-wise and industry-wise data ((Mitra (1999), Mitra et.al. (2002)).

To measure TFP, two broad techniques were used. Deb (2013); Kumar (2004); Natarajan et.al.(2008); and Rajesh et.al. (2009) have used DEA technique i.e. MPI while others (Goldar (2004); Madheswaran et.al. (2007); and Mitra (1999)) have used SFA for measuring total factor productivity. Kumar (2006) compared total factor productivity productivity results by using both MPI and SFA.

Impact of Economic Reforms on Indian Manufacturing Productivity

While measuring TFP, most of the studies found impact of economic reforms on Indian manufacturing. Some are of the view that liberalisation of Indian economy has resulted in improved growth rate of TFP ((Deb (2013); Krishna and Mitra (1998); Madheswaran et.al. (2007); Natarajan et.al.(2008); Pattnayak and Thangavelu (2003); Unel (2003)), while others showed that economic reforms have adversely affected productivity ((Balakrishnan et.al. (2000); Datta (2011); Goldar (2004); and Unni

et.al. (2001)). Kumar (2006) using the data on 15 states viewed that productivity has improved from 1.7 percent during 1982-83 to 1990-91 to 3 percent during 1991-92 to 2000-01. Deb (2013) using the data on 22 states observed that liberalisation has increased TFP growth from 1.06 percent during 1970-91 to 2.74 percent during 1991-08. Patnayak et.al (2005) while using the data on 13 industrial groups experienced that with the onset of liberalisation, 10 out of 13 industrial groups experienced a growth in total factor productivity. Contradicting the above studies, Goldar and Kumari (2002) found that TFP decreased from 1.89 percent during 1981-90 to 0.69 percent during 1991-98. Further, liberalisation resulted in reduced productivity from 2.23 percent during 1979-90 to 1.65 percent from 1991-2000 according to Goldar (2004). Supporting it, Datta (2011) predicts that productivity fell from 2.05 percent during 1980-91 to -0.45 percent during 1991-04. Using almost the same time period, Pardeep et.al (2005) also found that liberalisation has resulted in fall in TFP of Indian manufacturing from 1.7 percent to -0.4 percent. Unni et.al (2001) found that in case of organised sector, TFP has decreased from 1.13 percent during 1978-90 to -1.28 percent during 1990-95 while in case of unorganised sector, it increased from -2.66 percent to 3.13 percent as per the same period. Natarajan et.al (2008) using the data of 15 Indian states for the period 1978 to 2001 observed that liberalisation resulted in improving the TFP growth from 1.6 percent per annum in pre-reform period to 8.1 percent per annum in post reform period.

Further, while examining the role played by TE and TP in TFPG during post reform period, Pradeep et.al (2005) viewed that no doubt technology has improved, but TE has fallen. This is due to the fact that the present entrepreneur and skills were not able to adopt the new technology and hence their efficiency growth declined (from five percent per annum to -1.9 percent per annum) more than technological change (0.1 percent per annum to 2.0 percent per annum). This resulted in decline in TFP in post reform period. But, Kumar (2006) observed that technological progress overweighed technical efficiency regress and thus resulted in improvement in TFP growth. Natarajan et.al (2008) observed that technical efficiency improvement resulted in TFP growth. On the other hand, technological regression took place at a lower rate in post reform period when compared with pre-reform period. It is so because industrial units work for improving the technological capabilities of the production process. States started investing more in fixed capital stock which resulted in improving technical progress.

Conclusion

It thus can be concluded from the above discussion that there are differences in opinions of the studies being reviewed. Differences arise while evaluating that whether technical efficiency change or technological change results in total factor productivity growth. It has been noticed by different researchers that total factor productivity is affected by many factors like capital intensity, foreign investment, research and development expenditure, exports and imports, output growth, capital-labour ratio etc. Among the above reviewed studies, some studies showed a direct relation of these factors with TFPG/TE; some examined an inverse relation while others experienced no relation between them. This section also reviewed the studies relating to measuring the performance of Indian manufacturing sector. It has also highlighted the opinion of different studies regarding the impact of liberalisation on Indian manufacturing.

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