Chapter 2
Literature Review

Chapter 2 contains the following:-

2.1 Literature Review

2.1.1. Review of Literature on Productivity Growth

Ahluwalia's (1991) extensive study attempts to analyse the long-term trends in total factor and partial factor productivities in the organized manufacturing sector in India over the period from 1959-60 to 1985-86. Ahluwalia, in her 1991 study on productivity and growth in Indian manufacturing, came to the conclusion that there was a marked acceleration in total factor productivity growth (TFPG) in Indian manufacturing in the 1980s. According to her estimates, the growth rate of TFP in Indian manufacturing was 3.4 per cent per annum in the period 1980-81 to 1985-86, as against an estimated growth rate of -0.3 per cent per annum for the period 1965 to 1979-80. Her estimates of TFP growth rate were based on the single-deflated value added method, Balakrishnan and Pushpangadan (1994) and Rao (1996) have pointed out the inadequacies of TFP estimates based on the single-deflated value added measure of output, and have given strong arguments for using the double-deflated value added method or the gross output function framework.

Balakrishnan and Pushpangadan (1994) in their study, estimates of total factor productivity for aggregate manufacturing having adjusted for changes in relative price. They argued in favour of the separate deflation of the output and material input components of value added by their respective price indices and against the use of a common output price deflator which Ahluwalia and others had employed. Their results indicate that, contrary to what is believed, productivity growth in the 1980s may, actually, have been slower than in the earlier decade. They have tried to show that measurement of real value added by the double deflation method, instead of single deflation method which is more widely used by the researchers, it not only alters quantitatively the estimate of TFPG, but also affects qualitative conclusions about the behaviour of TFPG over time.

Dholakia and Dholakia (1994) found fault on a number of points in the empirical exercise reported by Balakrishnan and Pushpangadan, e.g. (1) the study is based on the ASI data, but remains silent on the adjustments for the non-reporting units; (2) presence of aggregation bias in using weights from input-output transaction table which is further aggregated to form 19 input groups that may distort the results; (3) while the Balakrishnan and Pushpangadan study considers at best a large part of the registered manufacturing sector only, the I-O table is based on the inputs and outputs of entire manufacturing sector which can introduce significant biases and distort the deflator used, etc. They have identified 19 input groups as the components of the overall material input for the organised manufacturing sector and have obtained their respective weights from the input-output transactions matrix prepared by the CSO for the reference year 1973-74 by reclassifying various categories into these 19 groups but as we have seen input-output transaction matrix, different industries using different types of material input so 19 input groups is a very small group to using weight in deflating the material input.

A study by Balakrishnan et al. (1998) investigates the trend in productivity growth by adopting two approaches i.e. growth accounting as well as econometrics, two equally mainstream approaches for estimation which may yield significantly different results. They used a sample of 2300 firms and 11009 observations, spanning the period 1988-89 to 1997-98 and found no evidence of acceleration in productivity growth since the post reform period but this study observed a shift in productivity growth from the year 1991-92 to 1997-98. However, this period is too short for investigating the impact of trade liberalization on productivity of manufacturing sector.

Krishna and Mitra (1998) in their study covering four Indian industries found that in the post-reform period, markup declined significantly in three of the four industries, using the structural regression approach of Hall to study the effect of economic reforms on markups in Indian industries and employing a post-reform dummy variable . The decrease was to such a level that the markup parameter for firms dropped to a value of less than one, i.e. the firm would incur losses. They found evidence of a significant favorable effect of reforms on industrial productivity.

Trivedi. et al. (2000) estimated the total productivity and the total factor productivity (TFP) indices within the growth accounting framework using translog index for estimation, whose superiority over the rival productivity indices has been amply demonstrated in the literature, using both single and double deflation methods. They are using two alternative series of capital stock, one series of capital stock derived by using investment deflator and another series obtained by using WPI for machine and tools. They found the Indian manufacturing sector recorded positive rates of growth of TP, TFP (single deflation method) and TFP (double deflation method) in manufacturing sector were 1.0 per cent, 2.6 per cent and 4.4 per cent per annum, respectively, during the period 1973-74 to 1997-98. Using the double deflation method for estimating TFP is higher than the single deflation method.

Acceleration of TFP growth in Indian manufacturing during the post-reform period in the studies of Unel (2003), estimate of average annual growth rate in TFP in aggregate manufacturing is 1.8 per cent per annum for the period 1979-80to 1990-91 and 2.5 per cent per annum for the period 1991-92 to 1997-98.2 The estimate is based on the value added function framework, taking value added as output, and labour and capital as inputs. The income shares of labour and capital are used as weights for computing the growth rate of TFP. The main short coming in his study was Unel has not used a investment series prior to the base year to get a good estimate of base year capital stock and not presented the output-input series in the paper nor explained in sufficient detail how output of the manufacturing sector has been measured.

A relatively slow growth in TFP in Indian manufacturing in the post-reform period, as compared to the pre-reform period, has also been reported in a study undertaken recently by the Goldar and Kumari (2002) major industry groups for the period 1981-82 to 1997-98. This study has focused on the impact of trade reform on productivity growth of Indian manufacturing sector. Main findings of the study are (i) Substantial liberalization of imports in India in the 1990s, did not result in any surge in manufactured imports nor did it lead to a sharp rise in the extent of import penetration in the manufacturing sector. (ii) There was significant growth in total factor productivity in Indian manufacturing in the 1980s. In the post-reform period, there has been a notable decrease in the growth rate of TFP in manufacturing. (iii) The gestation lag in investment projects may have had an adverse effect on productivity and this appears to be an important cause of the deceleration in total factor productivity growth in Indian manufacturing in the 1990s.

Chand and Sen (2002) in their studies found the effect of trade liberalization on the TFPG in Indian manufacturing using panel data on 30 industries which accounted for 53 percent of gross value added and 45 percent of employment in manufacturing over this period over 1973-74 to 1988-89. They measure protection by the proportionate wedge between the Indian and U.S. price and estimate TFPG in the three industry groups averaged over three non-overlapping periods: 1974-78, 1979-83 and 1984-88. They then relate this productivity growth to liberalization. They found trade reforms in India during this period, the Indian economy has witnessed a slow but steady liberalization of the trade regime pertaining to the manufacturing sector and it has been that it has almost exclusively focused on the intermediate and capital goods sectors with little change in import controls on consumer goods imports. The impact of the liberalization of the intermediate goods sector on productivity turns out to be statistically significant in all of their regressions.

A study by Goldar and Kumari (2003) on productivity and import liberalization, using industry level data from Annual Survey of Industries (ASI) and incorporating some trade –related variables explicitly into the econometric analysis, estimates that there was substantial liberalization of imports in India in the 1990s under the economic reforms programme. This did not, however, result in any surge in manufactured imports nor did it lead to a sharp rise in the extent of import penetration in the manufacturing sector. There was significant growth in total factor productivity in Indian manufacturing in the 1980s. In the post-reform period, there has been a notable decrease in the growth rate of TFP in manufacturing. The deceleration in productivity growth in manufacturing in the 1990s does not seem to have been caused by import liberalization. Rather, the reduction in effective protection to industries appears to have had a favourable effect on productivity growth in Indian industries. The main limitation of this study is the time taken for the post liberalization was too small. Owing to the time lag for post liberalization measures, a long term perspective is necessary to observe the impact of such liberalization on the economy. Since the Goldar and Kumari study takes only a seven years period, the results/impact may not be reliable or conclusive.

In the Goldar study (2004), estimates of TFP growth for the period of pre- and post-reform periods, are based on the gross output function framework. Value of gross output deflated by the wholesale price index for manufactured products has been taken as the measure of output. Three inputs have been considered: labour, capital and intermediate input. Number of employees has been taken as the measure of labour input. Net fixed capital stock at constant prices has been taken as the measure of capital input. Expenditure on materials, power and fuel deflated by the wholesale price index for manufactured products has been taken as the measure of intermediate input. The TFP estimates made in his study indicate a fall in the growth rate of TFP in the post-reform period. The average annual growth rate in TFP is found to be 0.92 per cent for the period 1981-82 to 1990-91 and 0.68 per cent for the period 1991-92 to 1999-2000.

Kaur and Kiran (2008) analysis the trends in output and inputs as well as partial productivity and total factor productivity at aggregate level as well as at disaggregate level for twenty-two industrial classification. To calculate total factor productivity growth, they used Translog index method. The period for the study is 1980-81 to 2002- 03, the whole period divide into two sub-periods: period I - pre reform period 1980-81 to 1990-91 and period II – post reform period 1991-92 to 2002-03. The study the data from Annual Survey of Industries by Central Statistical organization, tries to view the changes in growth of output and inputs and productivity in the pre and post reform period. At aggregative level an overall long term growth of 7.78 percent per annum in value added in manufacturing sector during 1980-81 to 2002-03 is associated with a rapid growth of capital i.e. 6.05 percent per annum and a low growth of employment i.e. 0.65 percent per annum. The estimate of total factor productivity growth of Indian manufacturing is 1.24 per cent per annum over the entire period 1980-81 to 2002-03.

Gupta (2008) has found that output growth in India till 1980s is associated with factor accumulation while the acceleration in the economic growth in the post 1980s has been mainly due to the rise in the productivity growth. He calculate productivity growth by using growth accounting techniques for the period of 1961 to 2004 and this period divided into 1960-1980 and 1980-2004. The results for trends in productivity growth shows that in 1960s the average annual TFP growth was a modest 0.22%. It curved in to -1.16% in 1970s and reached to an average of

1.63% from 1981 to 1990. Productivity growth rate increase to 2.57% to 2.95% to 3.08% from the period 1991-1995 to 1996-2000 to 2001- 2004. He also calculated growth rate of productivity by using human capital accounting with Mincer Earnings regression. His empirical results show that without accounting for human capital, differences in total factor productivity over the time accounts for 48% to 69% of output variation. TFP growth accounts for 35% to 70% of the total GDP growth between 1960 and 2004 depending on measure of human capital.

Rajan et al. (2008) estimate growth rate of productivity of three selected industries in organized manufacturing sector using conventional growth accounting approach, over the period of 1973-73 to 2004-05. The entire analysis divide into two phase i.e. pre-reform period (1973-74 to 1992-93) and post-reform period (1993-94 to 2004-05). Growth rate of productivity of aluminium and refined petroleum products industries increased during the post liberalization period whereas, productivity growth rate of iron and steel industries decline during post reform ear. They also applied econometric production function approach and finds that total factor productivity growth or the residual factor plays a very important role in growth of the selected industries, and by and large, in the manufacturing sector of India

In the Das and Kalita study (2009), estimates of TFP growth for 2-digit sectors are derived by aggregating up from the 3-digit industry level estimates, using the Domar measure of aggregate productivity growth. Further, an attempt is also made to compare the Domar measure of productivity with the aggregate value added measure, a technique commonly used in studies on measurement of aggregate productivity growth. Period of estimation of TFP started from 1980-81 to 1999-2000 and this period further divided into four sub period i.e. 1980-85, 1986-90, 1991-95 and 1996-2000. For the period 1980-85, we observe sharp variation in TFP growth rates across the different 2-digit industries. A majority of the industries exhibited either negative or low positive growth rates in TFP. The 10-industry average for the TFP growth rate was negative, though the growth in value added was around 3.41 per cent per annum. The second period of 1986-90 confirming the partial liberalization of the Indian economy showed a marginal improvement as far as the number of sectors recording positive growth in productivity is concerned. The average TFP growth for the period is around 1.74 per cent per annum and records an improvement over the negative growth observed in the first period. The third period of 1991-95 the average TFPG declined from that of the second half of the 1980s. The final sub-period of the study, 1996-2000, constitutes the period of major economic reforms that were started in the late-1980s and early 1990s. This period along with the earlier ones witnessed major overhauling of the trade and industrial business environment. As expected, we observe an improvement in the TFP growth rates for most of the industry groups.

Virmani and Hashim (2011) in their study expected a positive effect on growth as well as total factor productivity, which are expected to broadly follow an S-shape pattern in moving from the lower steady state to a higher steady state level. At more disaggregated level of manufacturing sub-sectors we would expect a majority of sub-sectors to follow an S-curve pattern, but to also find some sub-sectors that will in fact decline because they are fundamentally non-competitive. The puzzle of India's reforms was that such a pattern was indeed found consequent to the 1980s reforms, but no such pattern or perhaps even an inverse pattern was found after the 1990s reforms. The latter appeared to lend support to the ideological opponents of reforms who related negative effects of productivity to reforms.

Ghose and Biswas (2009) in their study tried to explain the intra-industrial differences in TFPG, considering the effect of real effective exchange rate along with some other trade-related variables and also some other determinants of TFPG, bearing in mind that the effect of real effective exchange rate on a specific industry group will jointly depend on movement of trade related variables and industrial characteristics of that particular industry group. They explain the variation in TFPG at disaggregated level of manufacturing industries of India in view of the differences in inter-industrial structure and highlighting the role of trade-related factors. They found positive relationship between Effective Exchange Rate (REER) and TFPG, analysis regarding the relationship between real effective exchange rate, other trade-related variables and TFPG broadly reports that realistic adjustment of real effective exchange rate and lowering of tariff, non-tariff barriers, shifting of products from restricted list to OGL category may have contributed positively to Total Factor Productivity Growth of different manufacturing industries.

There is a strong support for the efficiency enhancing effects of trade liberalisation in the Indian context. Sen (2009) investigate trade reform in Indian manufacturing has had a positive impact on

TFP growth and a negative impact on the domestic prices. Sen finds strong evidence i.e reduction in quantitative restrictions has had a positive effect on Total Factor Productivity. A reduction in price distortions, along with an increase in intra-industry trade in intermediate and capital goods, showed a strong positive impact on Total Factor Productivity. Author also finds that an increase in quantity competition from abroad has a statistically significant and negative impact on domestic market power, and in domestic prices. With respect to price competition from abroad, he finds that the depreciation in exchange rate in the mid-1980s to 1990s may have had a countervailing effect on domestic prices by providing more protection for import-competing sectors. The net effect of price competition from abroad was such that it brought about an increase in domestic prices and in domestic market power, in spite of a reduction in tariffs since 1991.

Very few issues in Indian economic development have generated so much debate than the measurement of TFPG in Indian manufacturing. This debate has intensified following the major economic reforms in 1991. Using three different techniques - growth accounting (non-parametric), production function accounting for endogeniety (semi-parametric) and stochastic production frontier (parametric), Kathuria, Raj and Sen (2013) attempt a robustness testing of productivity estimates for organized and unorganized manufacturing sectors in India for the period from 1994-95 to 2005-06. Their results indicate that TFP growth of organized and unorganized sector has differed greatly during this period and that the estimates are sensitive to the technique used. The authors therefore suggest that any inference on productivity growth in India since the economic reforms of 1991 is conditional on the method of measurement used, and that there is no unambiguous picture emerging on the direction of change in TFP growth in post-reform India.

Thomas (2014) argues that growth in manufacturing sector during the 1990s has not been consistent, and is marked by large regional and industrial variations. While capital-intensive industries such as petroleum refining recorded fast rates of growth in terms of value-added, employment generation occurred largely in export-oriented industries such as garments and textiles, and also in industries linked to construction such as the manufacture of bricks, cement and furniture. The study also finds that economic reforms have helped the international ambitions of a group of fast growing Indian firms; however, certain features of the reform process have been harmful to growth and innovation among large numbers of relatively small firms in the country.

The author argues further that growth of these small-scale units is constrained due to power shortages, limited opportunities for technological modernization and insufficient availability of cheap credit.

Parameswaran (2014) examines the productivity growth of Indian manufacturing industry during the post liberalization period. The study focuses on two sources of productivity growth that one could expect in a liberalizing economy, namely resource reallocation and catching up. Using firm-level panel data for the period 1992-93 to 2005-06, the study shows that the portion of productivity growth accounted by the reallocation of resources to more productive firms is not only significant but also increasing over time in majority of the industries. Regarding the catching up, the study finds that in majority of the industries, the catching up process and consequent convergence in productivity across firms is present, particularly during the second half of the study period. The study also finds that, in most of the industries, exporting firms have higher productivity and that resource allocation to exporting firms increased industry-level productivity. This provides evidence for an additional source of aggregate productivity growth from trade liberalization. The study shows that resource allocation and catching up, stimulated by the liberal policy regime and heightened competition, accounted for a significant portion of the productivity growth in majority of the industries. According to the study, the significance of resource allocation and catching up in the aggregate productivity growth, therefore, stresses the need for complementary policy changes, such as removal of restrictions on the size of the firm, in order to maximize the benefits from the already implemented reforms such as trade liberalization.

Datta (2014) in her study, estimates TFP growth for the Indian registered manufacturing sector for the period 1980-81 to 2003-04. The analysis is performed for the entire period as well as for two sub-periods, 1980-81 to 1990-91 and 1990-91 to 2003-04. The study notes that the registered manufacturing sector at the all-India level appears to have fared much better in terms of TFPG in the decade prior to liberalization in 1991 as compared to the post-liberalization period. It is the pre-liberalization period that saw the highest rate of growth of labour productivity, lowest rate of decline in capital productivity and thus a comparatively high rate of TFPG. The study also points out that observed fall in TFPG in the reform period was more marked during 1995-96 to 2003-04.

The author maintains that the movement of the indicators of development point to a Mandan pattern of development in this sector during this phase.

A study by Mehta (2014), measures the technical inefficiency for the organized manufacturing industries in India by estimating the stochastic frontier model with the time-varying inefficiency model for the period, 1980-81 to 2005-06. The study also tried to investigate the impact of reforms on different technology-intensive industrial sub-groups — High-technology (HT), Medium-High technology (MHT), Medium-Low technology (MLT) and Low-technology (LT), a classification put forward by the OECD. The results using panel dataset shows that there exists a higher level of inefficiency in most of the industries in the manufacturing sector in India. The results at disaggregate level show that the LT industries which were near the frontier in the pre-reform period, have seen a fail in their efficiency level in the reform period. The author argues that the earlier methods of production in the LT sector became redundant and the sector remained reluctant in adopting and mastering the new techniques. On industries from the MHT industrial sub-group the other hand, certain have seen a rise in their efficiency, level in the post-reform period as compared to the pre-reform period. The study also notes that high inefficiency in the post-reform period as compared to the pre-reform period and increasing capital intensity in the reform period have led to lower employment elasticity in the HT sub-group.

Bhandari et al. (2014) find that the effects of the economic reforms on TFP growth of Indian manufacturing industries using an industry-level panel dataset from 1980-2003. They use a nonparametric technique, namely, Data Envelopment Analysis (DEA) to measure TFP that also allows isolating catching up to the frontier from shifts in the frontier. The study finds that the productivity growth in Indian manufacturing is mainly efficiency-driven during the pre-reform period and constant technical progress has been the main barrier in achieving high levels of TFP during this period. The study also finds significant variation in performance across industries. The study finds that reforms failed to contribute to productivity growth as TFP showed decline during the reform period. Despite significant technical progress, TFP declined due to lack of improvement in technical efficiency. This indicates that the majority of the industries failed to catch up with the shifting frontier technology, resulting in a decrease in their relative efficiency. According to the authors, the challenge before policymakers, therefore, lies in addressing the question as to what reduces efficiency and why the degree of efficiency has eroded despite the introduction of market-oriented reforms. The study finds that growth in technical progress failed to contribute to the productivity growth in Indian manufacturing industries, owing principally to the failure to improve efficiency in the post-reform period.

While analyzing the extent of regional manufacturing performance of India, Babu and Raj (2014) find that the geographical spread of industrial activity shows no significant change during the last two and a half decades, thereby indicating that the pro-market reforms have not been able to alter the regional dimension of industrialization. The study maintains that regions which were already industrialized in the former planning era continue to register faster growth and reap benefits of early-mover advantages. What is even more interesting, according to the study, is the fact that the states which have assumed the status of early-movers in implementation of reforms such as Andhra Pradesh does not seem to have yielded significant outcomes. On the other hand, there seems to be a compelling need for the latecomers, like West Bengal to accelerate the process of industrialization as their share declined dramatically. The study also finds that majority of the states have witnessed a decline in their respective shares pointing to an intensification of concentration of manufacturing activity in the era of economic reforms especially in the western and southern regions of the country. The authors also make an attempt to analyze the trends in productivity across states to understand the consequences of reforms, if any, in accelerating productivity growth. They report MPI of total factor productivity growth (TFPG) estimated using DEA. Their study noted an improvement in TFPG in most of the states during the reforms period. The decomposition exercise carried out by the study notes that most of the states have recorded technological progress in the reforms period but could not translate the gains in technology to higher productivity growth due to considerable decline in efficiency.

The study by Saha (2014) attempts to estimate the aggregate total factor productivity for the Indian economy using the conventional method of growth accounting over the period of 1961 to 2008. He observed that on an average the TFP has grown by 1.49 per cent during the 1961 to 2008. During 1961 to 1970 the average TFP growth in India was positive but it was very low and it was close to zero. In the same way, the manufacturing sector experienced on an average negative TFP growth during the period 1971 to 1980 implying that instead of technical progress, there had been technological regress in the economy, he provided probable reasons for low productivity of the economy due to external shocks like drought, war, oil price-hike along with rigid rules and regulations.

The micro-level study by Das (2014), examines the productivity and efficiency of jute mills in India using firm-level data for the organized sector. The effect of reforms on the performance of the jute industrial sector is also examined. The study has used both the conventional production function approach and the non-parametric frontier approach to evaluate the contributions of labour and capital and the level of efficiency and capacity utilization. By applying the conventional production function approach, this study observes that the contribution of labour to output growth in jute industry was much higher than that of capital everywhere in the country. According to the study, the labour's contribution witnessed a marginal decline as compared to that of capital during the reforms period. The study also finds that the industry survived mainly on the basis of cheap labour and raw materials without any significant technological improvement. While employing non-parametric frontier approach, the study observes that jute industry in India experienced a fall in technical efficiency during the 1980s. The 1990s, according to the study, witnessed an improvement in technical and scale efficiency in the jute sector but this has been achieved without significant technological progress. However, the efficiency level and the capacity to utilize the plant were significantly low even after one and a half decade of reforms in India.

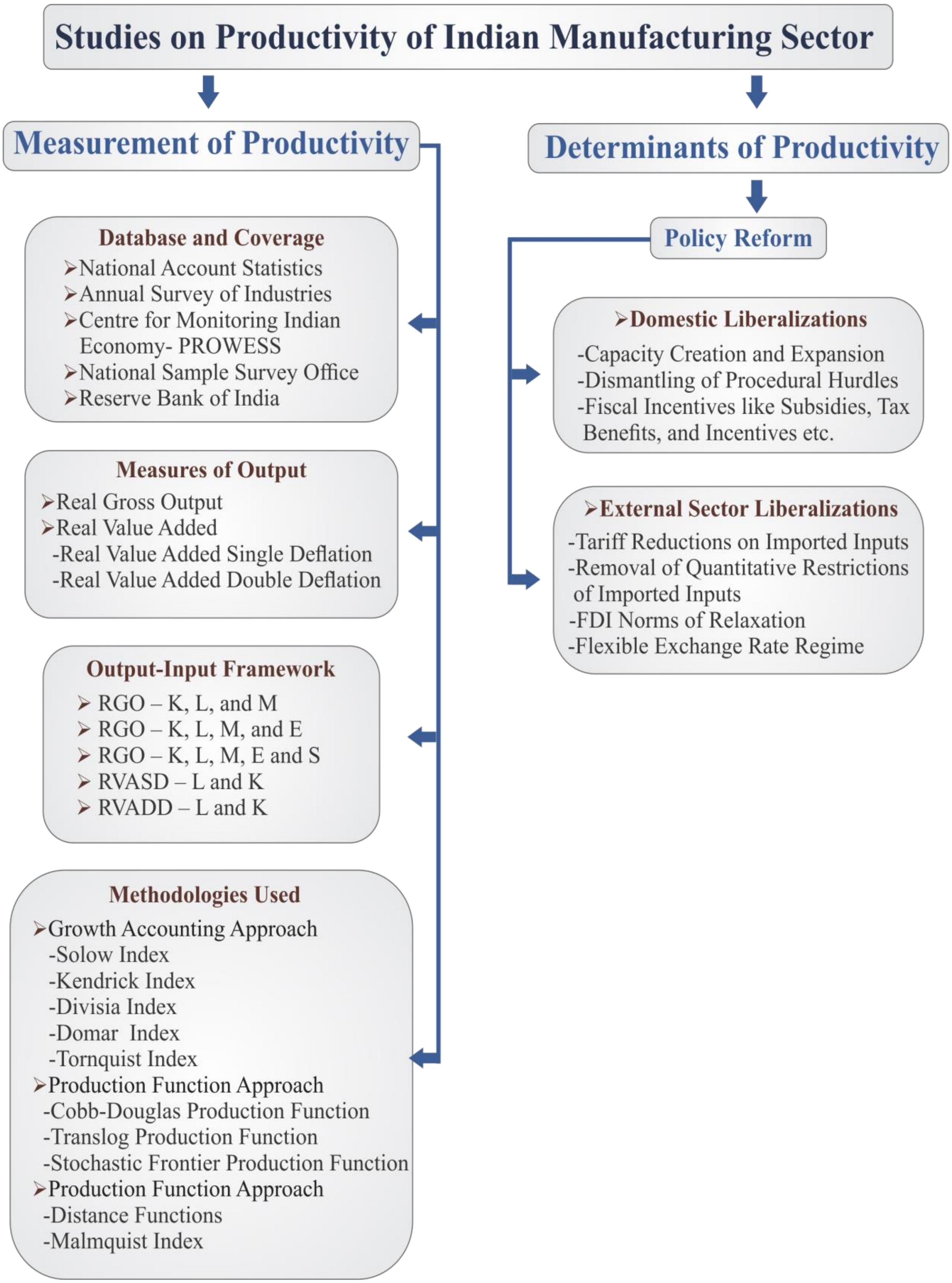
Nataraj (2011) estimates the impact of India's trade liberalisation on the productivity of registered and unregistered manufacturing firms. By using Index number method of Aw, Chen and Roberts (2001), he calculate total factor productivity over the period of 1989-90 to 1998-99. In addition, quantile regression techniques he used and examine whether or not fluctuations within the distributions of productivity and firm size per entry and exit of the firms. He finds the negative relationship between final goods tariffs and productivity is driven by the unregistered sector and the relationship between final goods tariffs and registered sector productivity is statistically insignificant. He found that in unregistered manufacturing sector, exit of a firm rises the unregistered sector productivity but exit of the registered manufacturing firm, in most of the cases productivity unchanged. A study by Distidar (2015) attempts to find the reasons behind the differential performance of the registered and unregistered manufacturing sectors of India for the period of the post-reform. He finds that average productivity in the sector went up with the elimination of the inefficient units during the post-reform period.

Moreover, most of these studies have been plagued by both conceptual and empirical shortcomings. The studies rarely pay attention to the explicit theoretical mechanisms through which trade policy may impact on productivity growth.

Figure 2.1 present a synoptic view of the criteria for classifying the studies on the productivity of Indian manufacturing sector.

Figure 2.1: Classifying the studies on the productivity of Indian manufacturing sector

Sources: Trivedi et al. (2011)



Sources: Trivedi et al. (2011)

2.1.2. Review of Literature on Exchange Rate

Marston (1986) in his study, estimates of the effects of relative productivity growth on real exchange rates and relative wage growth in the United States and Japan over the period of 1973-83. He develop a model for real exchange rates defined in terms of value added deflators, relative unit labor costs, and general price indexes. Marston also examines the productivity and relative price behaviour of separate industries. He finds that Japanese productivity grew 73.2% faster in its traded sector than in its nontraded sector over the 1973-83 period. Real exchange rates based on broad price indexes needed to adjust sharply to keep U.S. traded goods competitive. U.S. traded goods became much more expensive relative to Japanese goods and to maintain the competitiveness of the U.S. traded sector, the real exchange rate based on the GDP deflator would have had to fall by almost 140% relative to unit labor costs in the traded sector during the same period.

Rogoff (1992) take a broad view the Balassa-Samuelson model by permitting for aggregate demand shocks as well as aggregate supply shocks, matter for real exchange rate dynamics. He incorporates nontraded goods into an empirical intertemporal model, his main focus is on explaining the random walk behavior of real exchange rates. He used ratio of government spending to GDP is used to proxy the demand side component. He applied open capital markets as well as fixed factor model to the Yen/Dollar exchange rate over the period of 1975 to 1990. He empirically shows a positive supply shock in favour of Canada leads to an appreciation in real exchange rate, which was consistent with the Balassa-Samuelson hypothesis and commodity price shocks tend to be an important determinant of exchange rate movements over the short and medium run, but supply shocks have the largest impact over the long run.

In contrast, the Balassa-Samuelson effect is not as convincing for other industrialized countries. Asea and Mendoza (1994) developed a neo-classical general equilibrium model to investigate the cross-sectional implications of the Balassa-Samuelson effect. They modelled the real exchange rate as a function of the relative traded to non-traded sector productivity and of the marginal rate of substitution between traded and non-traded goods. Their model incorporats both the supply and the demand sides of the economy. Their model is applied to sectoral data for 14 OECD countries between 1975 and 1985 and concluded that while sectoral differences in labour productivity growth helped explain cross-sectional differences in long-run relative prices, they failed to explain the variation in the prices of non-traded and traded goods.

DeGregorio et al. (1994) examines the relationship between the CPI-based real exchange rate and productivity in growth terms. Results favourable to the Balassa–Samuelson hypothesis are reported, in the sense that the coefficients on productivity in the two sectors are statistically significant and correctly signed. Ito, Isard and Symansky (1999) document a positive correlation between growth rates and real exchange rate appreciation for a group of East Asian economies. However, they find that the relationship between the real exchange rate and the relative price of nontradables rarely conforms to the B-S model.

Harris (2000) argued that, within a macroeconomic framework, productivity treat as an endogenous variable, in which the exchange rate regime is either fixed or floating. The competitiveness approach highlights that real exchange rate depreciations accelerate productivity growth in certain circumstances.

Choudhri and Hakura (2000) explore the influence of the pattern of international trade and production on the overall productivity growth of a developing country by estimating a multi-sector framework based on Krugman's "technological gap" model. They investigate that effect of increased openness on productivity growth varies across sectors and the effect depends on the growth potential of the sector. In low growth (traditional) manufacturing sectors, increased international trade has little or no effect on productivity growth. For medium-growth sectors, however, greater import competition is found to have a significant growth-enhancing effect. There is evidence that export expansion in high-growth sectors leads to an increase in productivity growth.

Richard Harris (2001) gave evidence for panel model that supports the competitiveness view of the positive short run effects of exchange rate depreciation on productivity i.e. in the short run the results are consistent with the competitiveness hypothesis which suggests that exchange rate depreciations boost productivity growth in the short run and the long term negative supply consequence as a of undervalued exchange rates affects productivity growth i.e. real exchange rate depreciation have negative consequences for long term productivity growth.

Parida, Kamaiah and Mathiyazhagan (2001) study the effects of productivity differences in the traded and non-traded sectors[1] on real exchange rate in the context of India and Japan during the period of 1974 to 1998. By applying the cointegration technique, the study concludes that in addition to the unit labour costs differentials, the differences in productivity in the traded and non-traded sectors have a stable long-run equilibrium relationship with real exchange rate. The results support the B-L hypothesis in the framework of India. Drawback of the study is they are not included many traded goods in the traded sector for the analysis.

MacDonald and Ricci (2001) also use the OECD sectoral data base to build productivity measures which are then used in panel regressions of the CPI-based real exchange rate. They find that when the difference between productivity in the traded and non-traded sector is entered as a differential it is correctly signed, strongly significant and has a plausible magnitude, in particular, they find a point estimate on relative productivity of around 0.8, which is consistent with its interpretation as the share of expenditure on non-traded goods. MacDonald and Ricci however, demonstrate that the Balassa–Samuelson prediction that the coefficients on productivity in the traded and non-traded sectors are equal and opposite and strongly rejected. Furthermore, when the wage is come into the panel regressions the coefficient on productivity on the traded sector becomes significantly negative.

In the absence of the Harrod-Balassa-Samuelson effect on real exchange rate, the Flek, Markova and Podpiera (2002) study predicts the real exchange rate of converging economies to depreciate rather than the appreciate. However, their hypothesis explaining real exchange rate appreciation based on exogenous productivity differential seems to be empirically defective. Taylor and Taylor (2004), the probability of time varying Harrod-Balassa-Samuelson effect has been verified by allowing for linear and non-linear deterministic trends. There may be a tendency that over a period of time, the real equilibrium exchange to shift because of inter-temporal variations in relative

[1] They take manufacturing goods were consider as traded goods and non-manufacturing goods are treated as non-traded goods

productivity differentials. The inclusion of linear or non-linear deterministic trends offer substantial support in resolving the puzzles about how fast the exchange rate reverts to its mean level.

As far as research in India is concerned, Kohli (2002) has carried a time series analysis of real exchange rate of India during the recent float period to test for mean reversion property. This study applies unit root tests and variance ratio tests. She finds evidence of mean reversion in real exchange rate series constructed with the consumer price index as deflator, as well as for a series constructed using the ratio of wholesale and consumer price indexes to proxy for shares of tradable and non-tradable goods. Earlier time series analysis of exchange rate for India are inadequate as these studies have not considered possible sources of misspecification like structural breaks in the conditional mean and then testing predictability and nonlinear dependence in the model with appropriately specified conditional mean and variance.

For emerging and developing countries, Chinn (2000) estimates a productivity-based model of relative prices and real exchange rates for nine East Asian economies and finds conflicting results. The hypothesis of productivity-driven real exchange rate appreciation is supported for Japan, Malaysia, and Philippines but not for fast growing countries like China and Thailand in the time-series samples; the panel estimates support the productivity effect with government spending and terms of trade emerging as insignificant factors.

Benigno and Thoenissen (2002) used a dynamic model that includes home bias for the UK economy to find that productivity improvement leads to depreciation of the real exchange rate. From both static and dynamic models, it appears that productivity improvement will lower the price of home goods, and that this terms-of-trade effect will translate into real depreciation of real exchange rate based on tradables. (Lee and Tang, 2007)

Jeanneney and Hua (2003), investigate the impact of the appreciation of real exchange rate in China on total factor productivity growth. They used DEA Malmquist indices to calculate total factor productivity growth and run a panel estimation of productivity growth. Their results show that the appreciation of the real exchange rate had an unfavourable effect on technical progress but a favourable effect on efficiency growth and these two effects offset each other partially to give a lesser negative effect on productivity growth.

Choudhri and Khan (2004), focus solely upon developing countries. In a panel sample of 16 countries investigate the applicability of the Balassa- Samuelson effect on the long-run behavior of real exchange rates. They find that the traded-nontraded sector productivity growth differential to be a significant determinant of the relative price of nontraded goods, consequently exerting a significant influence upon the real exchange rate thereby providing a robust verification of Balassa-Samuelson effects for developing countries.

The performance of the manufacturing sector in recent times, particularly in the post 1991 reform period has been controversial and has attracted the attention of several researchers. The study by Kaliappa (2004) reveals that growth of output in the manufacturing sector in the post-reform period is “input driven” rather than efficiency driven. Manufacturing has been an engine of growth in India in the seventies and eighties. After the 1991 economic reform, it appears that the speed of the engine has slowed down. The analysis indicates that on an average about 15 per cent output growth can be achieved by improving firms’ efficiency without having to increase any inputs.

Christain (2004) in his study using a “New Open Economy Macroeconomic” (NOEM) model to study the effect of a productivity shock on exchange rate dynamics. He extending a standard NOEM model to incorporate imperfect bond market integration and a specification for households’ preferences that features a “catching up with the Joneses” effect can give rise to a delayed exchange-rate overshooting in the aftermath of a productivity shock.

Many studies have concluded that productivity shocks have negligible effects on real exchange rate fluctuations. But Annika (2005) in her study, explore the long run equilibrium relationship between real exchange rate level and relative productivity shocks using VAR model. She empirically shows the relative productivity shocks are found to be the dominating source of long run movements in real exchange rates. For five of the six real exchange rates, 60–90% of the permanent movements are due to productivity shocks.

Most empirical studies which include the Balassa-Samuelson effect either focus on aggregate measures of productivity or productivity in the tradable sector or the aggregate Balassa-Samuelson term. MacDonald and Ricci (2005) used tradable sector productivity and non-tradable sector productivity separately in the model. They explores the influence of the distribution sector on the real exchange rate and other macro variables as well as controlling for the Balassa-Samuelson effect. They used ten countries data for the period of 1970 to 1991 estimate long run coefficients using a panel dynamic OLS estimator. Empirical evidence suggests that with increase in the productivity and competition in the product market of the distribution sector with respect to foreign countries leads to an appreciation of the real exchange rate.

Whether the real exchange rate is undervalued or overvalued in relation to its long-run equilibrium path is of potential interest to policy makers responsible for the exchange rate management policy of any country. Joshi (2006) attempts an estimation of the real equilibrium exchange rate for India for the period of 1996 to 2005 was collected from IMF's International Financial Statistics (IFS) database. He used Blanchard and Quah (1989) methodology and Vector Autoregressive model with appropriate restrictions consistent with open economy assumptions. The model identifies the permanent impact of three fundamental structural shocks, viz., real nominal, demand and supply shocks and evaluates their relative significance to the forecast error variance in real exchange rate. The empirical outcomes support the finding that the variability in the real exchange rate in India is explained predominantly by permanent real demand shocks followed by nominal and supply shocks.

In the literature, there are two papers that study the relationship between exchange rate volatility and productivity growth: Aghion et al. (2006) and Benhima (2010). Aghion et al. (2006) use a panel of 83 countries from 1960 to 2000. They find that volatility in real exchange rate can have a non-negligible effect on growth rate of productivity, and the impact is function of the level of the financial development of the countries. Volatility in exchange rate acts negatively on productivity growth in countries with low levels of financial development while it has no effect on countries with high levels of financial expansion. Benhima (2010) argues that the effect of exchange rate flexibility on productivity can also depend on liability dollarization. Panel data of 76 countries going from 1995 to 2004, he observed that the impact of exchange rate flexibility on productivity is negative and more pronounced in countries with high degree of dollarization.

Lothian and Taylor (2008) look at the Balassa-Samuelson effect for the sterling/dollar real exchange rate for even larger time horizons. They employ a long span of historical data for three countries, France, the United Kingdom and the United States, over a sample period that spans nearly two centuries. They estimated exponential smooth transition autoregressive models for real sterling-dollar and real sterling-franc exchange rates. Their research contributes in favor of the view that the BS model is not very successful in explaining the real exchange rate movements except in the very long run. The authors find that 40 percent of the movements in the real exchange rate are accounted for by the BS effect in a sample of 180 years. The rest is argued to be caused by the nominal factors. However, when the BS effect is examined within shorter time horizons ranging from one year to ten years, its impact is much smaller. According to the paper, the BS effect explains only as little as 0.1 percent of the real exchange rate movements in a one year horizon, and reaches its maximum at 9 percent in a seven year horizon.

Engels, Konstantinou and Sondergaard (2007), provides empirical evidence in support of a stable long-run relationship between productivity levels and the real exchange rate. They argue that a positive productivity shock is consistent with a decrease in the relative price of traded goods and thus a real depreciation in exchange rate. They found, a 1% increase in UK productivity is compatible with a 3.5% depreciation in the sterling real exchange rate vis-à-vis the euro. Likewise, an increase by 1% in euro area productivity corresponds to a 5.16% appreciation of the sterling real exchange rate. Hence, the sterling real exchange rate responds less to a 1% UK productivity shock than to a foreign shock of similar magnitude.

Lakshmanan et al. (2007) provides an analytical framework of manufacturing competitiveness of the Indian economy. They estimate a relationship among manufacturing exports, world GDP and REER for the period 1980- 81 to 2003-04 through a regression analysis using ordinary least squares. India's manufacturing exports have risen impressively after liberalization and found to be directly linked to the world GDP and inversely related to real effective exchange rate. Further, a high correlation is found at 0.66 between the manufacturing exports and inverted REER. This indicates that change in REER significantly affects the manufactured exports. During 1999-2000 to 2004-05, correlation between the global GDP growth and India's manufacturing sector exports is found to be high at 0.56. Indian manufacturing industries exhibit certain inherent strengths and advantages in having a relatively adequate, inexpensive and skilled labour force, competitive prices and cost-effective goods production, large manufacturing base and closeness to fast growing Asian markets.

Lee and Tang (2007) found that, whether productivity growth leads to appreciation or depreciation of the real exchange rate depends on the measure of productivity used. When labor productivity is used to measure productivity, the classical positive association between productivity and the real exchange rate shows up in the data and higher total factor productivity is found to often depreciate the real exchange rate. In this paper, at least for the group of countries with comparable levels of productivity, strategic pricing decisions appear to loom large in the dynamics of the aggregate real exchange rate, microeconomic evidence uncovered in the existing literature on pricing to market.

A study done by Miller (2008), utilizes a large country open economy intertemporal model to obtain the effects of productivity shocks on the real exchange rate. He theoretically concludes that the effect of a productivity shock on the real exchange rate may change signs, depending on whether the shock applies to the productivity of new capital or old capital. The model seems consistent with the unexpected switch from negative to positive around 2002 in the correlation between the real value of the euro vis-a-vis the dollar and the US minus EU productivity growth differential.

Rodrik (2008) is one of the recent studies on RER misalignment and growth, with estimation results for a set of 184 countries and time series data from 1950 to 2004. The author develops an index to measure the degree of RER undervaluation adjusted for the Balassa-Samuelson effect using real per capita GDP data. The main empirical result is that overvaluation adversely affects growth, undervaluation promotes it. For most countries, high growth periods are associated with undervalued currencies. In fact, there is a little evidence of non-linearity in the relationship between a country’s RER and its economic growth. An increase in undervaluation simulates economic growth just as well as a decrease in overvaluation. The magnitude and statistical significance of the estimated coefficient for RER undervaluation is higher for developing countries due to the fact that such countries are often characterized by institutional fragility and market failures.

Peltonen and Sager (2009) examine the relationship between equilibrium real exchange rates and productivity using a panel estimation framework for the period of 1990 to 2001 that incorporates 18 advance countries and 24 emerging market economies and a dataset that allows explicit consideration of the role of traded as well as non-traded. They find evidence of significant correlation between productivity differentials and real exchange rates in both sectors. They find a significant role for the non-traded sector in exchange rate determination, and of a relatively high correlation between exchange rates and productivity shocks. They find reverse evidence of Balassa-Samuelson effect for emerging market economies fixed exchange rates, indicating that relatively higher productivity growth in the domestic traded sector is correlated with a real depreciation of the exchange rate.

Schnabel (2010) developed a simple model of cross-border competition with the aim of explaining the impact of macroeconomic productivity improvements on an individual firm's competitive advantage. He found that improvements in Australian macroeconomic net productivity caused the dollar to appreciate whereas improvements in Korean macroeconomic net productivity caused the dollar to depreciate.

Choudhri and Schembri (2010) examines whether the mixed results on the Balassa–Samuelson hypothesis can be explained by a variation of the model that introduces differentiation between home and foreign traded goods. A basic modern version of the Balassa–Samuelson model is developed, in which differentiated traded and non-traded goods are produced under monopolistic competition using only one factor, labour. The real exchange rate appreciates in response to an increase in both the relative price and the terms of trade. Improvement in productivity leads to lower terms of trade, appreciate or depreciate in the real exchange rate can depending on whether the relative price effect offsets the terms-of-trade effect or not.

Soubarna (2011) examined the effects of productivity differential on bilateral real exchange rate i.e. Harrod Balassa Samuelson effect between India and US, in the context of a non-linear adjustment of real exchange rates to their long run equilibria. Evidence of Harrod Balassa Samuelson effect is observed using annual data for the period 1959-2001. The impulse response functions for shocks of various magnitudes to the real exchange rates suggest that the half-lives for large shocks of twenty per cent or ten percent are only one year. For small shocks like three per cent and five percent they are two years.

Theoretical and empirical works assert that exchange rates depend upon a country's productivity growth and this effect is dubbed the Balassa-Samuelson. Yan and Kakkar (2010) inspects the evidence for a Balassa-Samuelson based explanation for the real exchange rate movements of China vis-a-vis U.S. dollar. They calculate sectoral total factor productivities for the tradable and nontradable sectors using disaggregated industry data over the period of 1980-2003. Finding of the study confirm the existence of a strong B-S effect in China. They find the relative price of nontradables in China is driven by the TFP differential between the tradable & nontradables sectors and different trends in sectoral TFPs in the China and U.S. can successfully account for the long run changes in the U.S. - China bilateral real exchange rate.

The study done by Bodel (2011), focuses on the impact of productivity and real effective exchange rate on the competitiveness of manufacturing exports for the period of 1993 to 2008. He used Cobb-Douglas production function and export function in order to estimate the total factor productivity in each industry and to measure the effect of productivity and real effective exchange rate on manufacturing exports. Export function is taken as an estimate for the branches of manufacturing industry. Bodel found that the total factor productivity has a positive and significant effect at 5%; an increase of one percent of the total factor productivity all things being equal results in an increase in manufacturing exports by 3.5% and the real effective exchange rate is negative and significant at 10%.

In the McLeod and Mileva (2011) study, estimates country fixed effects panel model of TFP growth on the real effective exchange rate and several standard control variables for 58 developing countries for the period 1975 - 2004. According to the country fixed effects panel data estimates, 10% depreciation of the real exchange is associated with a 0.2% increase in the average annual TFP growth rate. A one-percent increase in the share of manufactures exports is associated with a 0.11% increase in the average. Their result seems to suggest that the RER affects TFP growth through the change in manufactures exports.

Ray (2012), in her study assesses the impact of various determinants that affect total factor productivity growth in seventeen manufacturing industries during the period of 1980-81 to 2001-02. In her analysis, she found trade variables as well as macro-economic variables have relevant significant impact on TFPG of those industries. The regression result of individual sector reveals that export is a negative determinant of total factor productivity growth in most of the energy intensive industries in India. But, many earlier studies on the trade-growth nexus imply that exports enhance productivity growth because firms exposed to international competition tend to absorb best-practice technology. The analysis also reveals that in most of the industries, real effective exchange rate has a significant negative impact on productivity growth as is expected. It indicates that decrease in real effective exchange rate should increase the demand for traded industries' output by stimulating export vis-à-vis enhances TFP growth.

Ghose and Biswas (2012) examine the impacts of real effective exchange rate along with other trade related variables and some technological-socio-economic variables on total -factor-productivity-growth of Indian Manufacturing sector. Productivity growth is measured by Malmquist-Productivity-Index, using non-parametric Data-Envelopment-Analysis. They found from the period of 1980-81 to 2001-2002, considering 17 industry groups, the average TFPG is reported as 3.90% per annum. The coefficient of Real Effective Exchange Rate (REER) is expected to be positive throughout the regressions and it happens so for four industries - Food Products Industry; Paper, Paper Products Industry; Non -electrical Machinery Industry whereas; the significance level is low for Wood, Wood Products Industry. Notably, with change in each of these variables the magnitude and responsiveness of TFPG vary across industries. Effective rate of protection as a proxy of measure of import liberalization and negative coefficient of ERP implies lowering of ERP has favorable effect on TFPG as shown by two industry groups - Metal Products Industry and Transport Industry.

There is a link between exchange rate volatility and productivity growth that is either positive or negative. The impact volatility in exchange rate depends on the level of financial development of the countries. Daillo (2012) used panel data instrumental variable regression and threshold effect estimation methods to study the link between total factor productivity growth and real effective exchange rate volatility on a sample of 74 countries (24 developed and 50 developing countries) on six non-overlapping sub-periods starting from 1975 to 2004. For developed nation, a rise in exchange rate volatility by 100% reduces total factor productivity growth just by an amount equivalent to 0.362 percent point. But for developing nation, an increase in exchange rate volatility by 100% reduces total factor productivity growth by an amount equivalent to 2.41 percent points. This suggests that exchange rate volatility is more harmful to developing countries than to developed countries.

Biswas and Ghose (2012) measures technical efficiency using Stochastic-Frontier Production-Function at disaggregated level of West-Bengal's manufacturing sector, employing 3-digit level data during 1980-1981 to 2001-2002. They estimates the technical efficiency value then clubbed into corresponding 2-digit industry groups 14 in number.[2] The information of technical efficiency for 2-digit industries are obtained by taking the average value of technical efficiency corresponding to their 3-digit classification. They observed that trade related variable like real effective exchange rate, effective rate of protection and import coverage ratio play significant role on technical efficiency. Other variables like firm size, real wage rate and capital labour ratio also have a significant impacts on manufacturing sector.

In the fasted growing economies, exchange rate and its management play an important role in high export growth. According to the theoretical literature, it is expected that exchange rate is one of the major determinants of exports and exchange rate depreciation would boost exports. Bhanumurthy and Sharma (2013) study examine the role of exchange rate on exports in three different way. First, using macro level data they test the determinants of exports in India. Second, they examine inter-linkage between exporting and importing at firm-level and third, they attempt

[2] The figures of TE for 2-digit industries are obtained by taking the average value of TE corresponding to their 3-digit counterparts.

to test whether growth in India is export-led or import led at firm-level. They also investigate the relationship between export and import performance using a panel of firms from the Indian manufacturing industries for the period 1994–2006 and to obtained productivity growth rate of manufacturing sector, using Levinsohn and Petrin (2007) method. Results show that at industry level, the impact of imports on exports fluctuates, positive in transport equipment and pharmaceutical industries while in cotton textile, relation is weak and insignificant. This positive effect increases over a period of time. The role of productivity growth on exports is found to be significant at overall industry while mixed at the specific industry level. Impact of real exchange rate found to be insignificant both at the overall industries and also across the industries. They found that imports and exports are inter-linked. Import intensity rather than exchange rate is a major factor in boosting exports as well as productivity.

Berka et al. (2014) investigate the link between sectoral total factor productivity and real exchange rates measures for countries in the Eurozone over the period of 1995-2009. They construct a sticky price dynamic general equilibrium model to generate a cross-section and time series of real exchange rates data which can be directly compared. Assumption of a common currency, for the Eurozone, estimates from simulated regressions are very similar to the empirical estimates. Their findings contrast with previous studies that have found little relationship between productivity levels and the real exchange rate among high-income countries. However, those studies have included country pairs which have a floating nominal exchange rate. They combine the panel of real exchange rates with measures of sectoral total factor productivities for each country and a separate measure of unit labor costs. They conduct panel regressions of real exchange rates to explore the link between the productivity and real exchange rates. Their results indicate that for the Eurozone countries, there is substantial evidence of an amended Balassa-Samuelson effect. Total factor productivity increased in traded goods is associated with a real appreciation and total factor productivity increased in non-traded goods correlates with a real depreciation.

Das (2008) in his study found industry-level evidence regarding the connection between trade policy reforms and labour market indicators within organized manufacturing industries in India. The period of study is from 1980-81 to 1999-2000 in four phases of trade liberalization, 1980-85; 1986-90; 1991-95, and 1996-2000, and the sample covers around 75 industries in the three-digit classification of the Annual Survey of Industries. The study attempts to the connection between trade policy reforms and employment, labour productivity, and real wages growth in the organized manufacturing industries. Trade liberalization is quantified in terms of various trade policy indicators - customs tariff as well as non-tariff measures. Using these quantified trade policy indicators, the paper examines the trends in employment, wages, and productivity in the organized manufacturing industries. The researcher observe that for organized manufacturing, successive phases of trade liberalization bring out a positive relationship between high labour productivity growth and employment growth for a large number of industry groups.

Khundrakpam (2008) examines the behaviour of exchange rate pass-through to domestic prices in India after the reforms initiated in the early 1990s. He finds a rise in exchange rate pass-through to domestic prices until recent years. Apart from economic factors that are usually associated with economic liberalization, a persistent higher inflation is a critical factor for the rise in pass-through.

Diallo (2010) used panel data and empirically investigate the relationship between real exchange rate and total factor productivity on a sample of 68 developed and developing countries for the period 1960-1999. The study puts forward argument to explain how productivity, technical efficacy and technological progress are affected by real exchange rate. He obtained productivity by using a Solow residual of an estimation of a Cobb-Douglas stochastic production function frontier. He empirically proved that an exchange rate appreciation causes an increase of total factor productivity and the relationship between real exchange rate and productivity is nonlinear. Total factor productivity rises by 4% due to 35% change in the real effective exchange rate. While the real exchange rate affects productivity negatively below the threshold the same affects productivity positively above the threshold.

A study done by Ben (2010) develops a dynamic structural model that captures the effect of plant level productivity and real exchange rate fluctuations on plant entry and exit decisions in the Canadian agricultural implements industry and finally it affects aggregate productivity. He used second stage simulation model to investigate the effects of shocks to the exchange rate process on aggregate industry productivity. The estimates of the study show that large real exchange rate shocks can have an immediate impact on aggregate productivity through plant turnover and little effect in the long run.

McMillan and Rodrik (2011) argue that applying the developed countries inter-sectoral distribution of production to developing countries (holding unchanged their sectoral productivity levels) would entail productivity gains ranging from 100% for India to 1000% for Senegal.

Mustafa and Firat (2011) empirically examine the impact of the level and the volatility of the real exchange rate on firm level productivity growth, conditional on firms' access to domestic and foreign equity markets, and to debt finance. They used a unique panel of the top 1,000 private manufacturing sector firms from a major emerging market, Turkey, covering the 1993-2005 period. The study finds that firm productivity is negatively affected by exchange rate appreciation and the effect is significant economically and statistically. Further, the negative productivity growth impacts of exchange rate shocks is not reduced either by availability of external credit or access to foreign or domestic equity market. The study also concludes that productivity growth of export-oriented firms significantly hurts more severely than inward oriented firms by exchange rate uncertainty.

The above study is close to a recent paper by Mcloed and Mileva (2011). Using simulations of a two-sector open economy growth model based on Matsuyama (1992) and panel estimates for 58 countries, they conclude that a weaker real exchange rate can lead to a growth surge, as workers transfer from non-traded goods sectors with slower productivity growth to traded good industries characterized by more learning by doing. However, the approach of the letter study differs conceptually from the former study. While the McMillan and Rodrik Study tested whether the growth impact of real exchange rate undervaluation operates through an economy-wide productivity improvement, the Mcloed and Mileva study focuses on the level of the exchange rate rather than its misalign. They exclusively discussed the appreciation and depreciation phases without commenting on the equilibrium real exchange rate. Their approach seems preferable since it takes into account the probable evolution of the equilibrium real exchange rate over time.

There is a link between exchange rate volatility and growth in general and between exchange rate volatility and productivity in particular. Daillo (2012) study the relationship between total factor productivity growth and real effective exchange rate volatility on a sample of 74 countries (50 developing and 24 developed countries) over the period of 1975 to 2004. He employed data instrumental variables as well as threshold effects estimation methods. He found that REER volatility negativity affects the growth rate of total factor productivity and the impact of REER volatility depends on the level of financial development of the countries.

Kakkar and Yan (2012) focus on relatively rapidly growing Asia-Pacific economies. They examine a productivity based explanation of the long-run real exchange rate movements of six Asian economies. Using industry level data, they construct total factor productivities for the tradable and nontradable sectors. The main finding of their study is that sectoral total factor productivity differentials play an important role in explaining the long-term trends in both the relative prices of nontrabables and the real exchange rates of these Asian countries. Further, their result suggest that productivity differentials may be an important factor in explaining the persistent departures of nominal exchange rates of these Asian countries from their purchasing power parity.

Samba Mbaye (2012) empirically investigates the effect of exchange rate undervaluation and growth of productivity. He gives strong support to the total factor productivity channel. A 10% increase in undervaluation enhances growth on average by 0.14% via an improvement in productivity. His estimates suggest that this TFP channel conveys the most important part of the growth-enhancing effect of undervaluation.

Hsieh (1982) explain deviations of exchange rates from purchasing power parity with the differences between countries of the comparative growth rates of labor productivity between traded and nontraded sectors. He finds that the price gap between traded and nontraded goods in Japan with an extraordinary productivity growth in the Japanese traded goods sector.

Jack (1999) using the model of panel unit root test and Granger causality test to investigate the relationship between real exchange rate and productivity differential. Granger causality tests and variance decomposition indicate a strong feedback effect from real and nominal exchange rates to traded prices and the relative price of non-tradables. The finding is consistent with sticky prices, leading to nominal and real exchange rate co-movements in the short-run. However in the long-run, goods arbitrage encourages movements in traded prices and the relative price of non-tradables. Granger causality tests and variance decomposition further indicate a strong feedback effect from the relative price of non-tradables to productivity differentials, supporting the hypothesis that productivity adjustments is encourage by international competitiveness.

The most direct mechanism by that labour productivity affects living standards within the long run is through real wages, wages adjusted for changes within the cost of living. Theory contends that at the aggregate level the growth of real wages are determined by labour productivity growth. The Indian manufacturing sector is characterized by decreasing returns to scale because of capital intensive sector. Upender (1996) finds that the elasticity of labour productivity with respect to wage rate is significantly more than unity. This indicates that possibilities of substitution are quite high in favour of labour because labour productivity is found to be an increasing function of wage rate.

TFP growth being an important or a potentially important source of industrial growth in developing countries, analysis of the determinants of TFP growth is relevant for development policy. Goldar (1986) estimate inter-industrial TFP growth of Indian manufacturing using TFP estimates from two earlier studies, namely, Goldar (1981) and Ahluwalia (1985). Using multiple regression equation, a significant positive relationship was found between TFP growth and growth of output, a significantly negative relationship between TFP growth and import substitution and a higher rate of change in the concentration ratio is associated with a higher rate of TFP growth. It seems from the regression results that a 1 per cent higher growth rate in output was associated with about 0.5 per cent higher growth rate in TFP. Further, about 0.6 per cent lower annual growth rate in TFP resulted from a 10 per cent higher contribution of import substitution to change in output.

Tang (2010) finds that there is a positive relationship between competitive pressure and productivity improvement on one hand and market concentration and the intensity of adoption on the other. He empirically analyses 237, 6-digit Canadian manufacturing industries from 1997 to 2006 and finds that labour productivity growth was on average higher after controlling the other variables whereas during the depreciation period between from 1997 to 2006, there is little empirical evidence that labour productivity growth is correlated with exchange rate movements or concentration.

Mallick and Marques (2006), provide a comparative examination of how Indian import and export prices have responded to exchange rate fluctuations, particularly the degree of export price pass-through and subsequently the acceleration of trade openness and the introduction of a flexible exchange rate regime. They find that around 80% of the impact of currency depreciation is borne by domestic firms, while foreign firms bear 20% of the influence. There is a 0.2% dollar price reduction and a 0.8% rupee price increase for 1% currency depreciation and this result holds for both exports and imports.

Mukim (2011) exploring two different effect, first exporting on productivity across the firms and second starting to export on productivity within the firms. She used firm-level data on inputs and output is drawn from Prowess database. She used dataset of 8253 companies for the years 1989 to 2008, yielding a 69,286 total observations. To calculate the productivity of manufacturing sector, she used Olley and Pakes (1996) methodology and then run the ordinary least squares techniques. She finds exporting does lead to a positive and significant effect on the productivity of firms that begin to export and no evidence of continued learning-by-exporting effects, either within-industry or within-firms.

As Bhagwati and Desai (1970) suggests, importance of the effective rates of protection are more than nominal tariffs as guides to the consequences of protection on the allocation of domestic resources and also the relative outputs of various commodities. Besides ERPs, they additionally present estimates of the Import Coverage Ratio (ICR), which measures the proportion of commodities in a particular industrial sector, the importation of which is restricted by a Non-Tariff Barrier. Within the Indian case, owing to wide prevalence of nontariff barriers until 1991, such a measure is particularly significant in evaluating the restrictiveness of trade policy, in conjunction with a tariff-based measure such as the ERP.

Das (2003) measures three important variables related to trade liberalization, namely, import coverage ratio, effective rate of protection and import penetration ratio for 72 three-digit industries divided into three used based classification. The entire period divided into four phases of trade reform, 1980-85, 1985-90, 1990-95 and 1995-00. He find that the effective rate of protection were highest in the second phase of trade reforms and quick decline in the levels of protection based on effective rate of protection. Before 1991, non-tariff barrier level is around 100 percent but it decline to around 25 percent by the end of 1990s. There was no change in import penetration ratio for most industries. There was a marginal improvement in the import coverage ratio during the phases of trade reforms. In the intermediate goods sector, there was some evidence of marginal improvement across the phases of trade reforms. First three periods of trade liberalization show no change in the ratio of imports to domestic availability in case of capital and consumer goods sector. The fourth phase however shows an improvement in import penetration rates across all the use-based sectors.

Pandey (2004) investigate the relationship between changes in trade policy and performance of the Indian manufacturing sector. He concentrated on nominal rate of protection, coverage ratios of non-tariff barriers and effective rates of protection as measures of trade policy. The period of analysis is 1980-81 to 1996-97 which divided into three sub period. For measurement of effective rate of protection he used simple Corden measure of ERP and used coverage ratios of imports to quantify non-tariff barriers. He finds that import coverage ratio as well as effective rate of protection were increased during 1980-81 to 1988-89 but both decrease during the period of 1988-89 to 1996-97. In case of import penetration, results shows that first a decreased and then an increased, although there were differences among the industry groups.

2.2 How Present Study is Different

The present study is significantly different from the earlier studies in many respects. Most of the studies commented on the effect of trade liberalization on productivity of aggregate industrial sector of India. Very few of them estimated productivity growth of industries at disaggregated level. The characteristics of Indian industries suggest that there exists high degree of intra - industrial disparity. Thus it is expected that the factors explaining variations in industrial productivity and also its responsiveness with respect to each factor will vary across different industries. This necessitates the analysis of productivity growth at sector - specific level.

The TFPG estimation in this study follows the methodology developed in Jorgenson et al (1987), Goldar and Kumari (2002), Das (2003), Das, Goldar (2004), Kalita (2009) and Virmani and Hashim (2011) and which ultimately rests on Solow (1957) who showed that under certain conditions the growth rate of TFP could be estimated as the growth rate of output minus the growth rate of total input. This study undertakes four input factors as a determinant of TFPG – labour, capital, material and energy.

Multi-variate regression analysis is performed to explore the impact of trade liberalization on TFPG by taking into account some trade -related variables like, effective rate of protection, import coverage ratio, import penetration ratio, real effective exchange rate along with some other factors arising from industry specific characteristics like, firm size, degree of concentration, level of technology and also economic -socio-political variable like movement of wage rates considering as determinants of TFPG.

The present study can also be considered as a study of intra - industrial variation in TFPG and will definitely be helpful for framing sector –specific policies for boosting up TFPG of different industry groups of India at disaggregate level. This study estimates the effect of trade liberalization on the total factor productivity growth in Indian manufacturing using panel data on 22 industries over 1975-76 to 2011-12.

The present study also explores the link between real exchange rate movement and productivity growth using the Granger Causality test which is unique to the present study.

Limitations of the Study:

A major limitation of the present study is that it does not include the service sector in the analysis. It is possible that the service sector may have contributed to manufacturing sector productivity growth over the long term. However, inclusion of the service sector might have become unmanageable. Future research studies may include the service sector and extend the analysis further. In some cases, due to unavailability of a consistent time series data on wholesale price indices, the present study uses simple average of the aggregate wholesale price indices rather than weighted averages.

Another limitation of the present study is that it covers only organized manufacturing sector in India when estimating total factor productivity growth, regression analysis and basic panel regression model.