CONCLUSION

7.1 Structure and Performance of Electronics Industry

In this chapter, the analysis focused on the electronics industry's market behaviour through structure-conduct-performance paradigm, during pre- and post-reform period. Further, analysis continues importance of structure (Herfindahl index) variable at aggregate and disaggregate level. Disaggregate level consists of consumer electronics, industrial electronics, computer electronics, communication electronics and component electronics industry. Finally, the analysis continued to look at the relation among price-cost margin, wage share and central excise duty.

Study of S-C-P paradigm or determinants of price-cost margin has been carried out by estimating panel data regression equation, Random Effect, and GLS method. The analysis shows that structure, capital intensity, export intensity, import technology, liberalisation dummy and foreign dummy are positively significant. Central excise duty is negatively significant. These results implies that the economic reforms leads to increase in capital stock, import of technology, foreign participation and export. Liberalisation of economy helps in the transfer of knowledge and technology diffusion in the economy. It allows import of capital and technology from developed countries and facilitates the filling of the technological gap. Joint ventures with MNCs facilitate obtaining of capital, technology, skill, business strategy etc. MNEs’ market access and brand image improves demand for the products. The structure (concentration ratio) is also found to be positively associated with profit. These factors resulted in profit gain during the reform period. Some of the other variables, viz. age, advertisement intensity are negatively related and firm size and R&D are positively associated but insignificant.

The Herfindahl index shows that the concentration of electronics industry has been decreasing gradually due to the economic reforms. Immediate after the reform period the Indian private sector entered the electronics industry, reducing the power of some of the large scale firms. Concentration ratio has recorded a slight decline thereafter except during the years 2001 and 2002. Further liberalization of economy has encouraged MNEs and their entry or establishment of firms resulting in the further reduction of the concentration ratio.

The decline in the concentration in the communication electronics is much more than the other electronics industry. Decline in the concentration of communication electronics is followed by the component, computer and the industrial electronics.
The consumer electronics industry is the only industry which, comparatively, remained constant; there is a slight decrease during 1990s and an increase thereafter at same rate.

Analysis of price-cost margin of the electronics industry at the aggregate level reveals that there is a rise in the price-cost margin after economic reforms. The income share of labour in value added is also rising. On the other hand, the central excise duty has been continuously decreasing. This suggests that the fall in the central excise duty has resulted in the rise not only of the price cost margin but also the wage share of the labour. The trend shows the price-cost margin and the wage share together decreasing till 1992, but from 1992 to 2005 both increase; later both started decreasing. The wage share remains higher than the profit during the pre-reform period whereas profit is higher than wage share during the post-reform period and it continues till 2003. During the post-reform period till 2003 the profit and wage share are inversely related; may be the labour power in terms of bargaining power was lower than the pre-liberalization period. The Multinational Enterprises’ entry may have led to the rise again the share of the labour wages; they kept their profit margin low to compete in the Indian market.

During the reform period the consumer electronics industry has been experiencing an inverse relation between its profit and wage share. Industrial Electronics-in contrast to the consumer electronics industry, decline in the Central excise duty resulted in the increase in wage share. Computer Electronics-as the central excise duty decreases the Profit and the wage share increases. During the pre-reform period, the wage share remains high, whereas in the post-reform period the profit share remains higher than the labour share. Later the differences get reduced and convergence takes place. It reveals that since computer is a highly competitive product and there is large domestic demand for the computers, there is an understanding between the labours and the entrepreneur.

Communication Electronics - There is slight decrease in the central excise duty. Pre-liberalization period profit is higher than the wage share, and during the post-liberalization period the wage share remained high. This reveals that the Profit and the wage share are almost inversely related. The increase in profit is very less compared to increase in wage share. It reveals that the major share of profit is taken away as the share of the labour. It also explains that to be competitive in global level, profit has to be kept at minimum level and skilled labour maintained by paying high wage.
7.2 Electronics industry and liberalization: productivity analysis

The Productivity (Partial and Total factor productivity) study of Indian electronics industry has been done both at industry level and unit level. For Industry level study ASI three digit and for Firm level study ASI unit level data has been used. ASI unit level data has Permanent Serial Number (PSL) till the year 1998-99 and PSL-State combination is unique to every firm. So there is no difficulty in identifying firms to make a panel. From the year 1998-99 onwards ASI suppresses firm identity. Here firms are identified and panel has made by concatenating NIC code, State code, and Year of Establishment. Initially attempts are made to identify firms through opening and closing capital stock, i.e. Closing value of capital stock on 31 March of one financial year and Opening value of Capital stock on 1 April of the immediately next financial year. Since firms obtained are very less, this method was dropped and the above mentioned method is the one used. At firm level regression function has been estimated for the panel data. The study uses both parametric and non-parametric techniques to estimate production function. The main findings of the study are summarized below:

Labour productivity of the electronics industry has been increasing and capital productivity has been decreasing during the post-reform period compared to the pre-reform period. The same trend continues during the second phase of the reform period as compared to the first phase, except for component, medical and photographic electronics industry.

Capital productivity was low during the post-reform period (1991-03) compared to the pre-reform period (1981-90). However, some of the electronics industries have experienced an increasing trend during the second phase of the reform period compared to the first phase of the reform period, viz. component, medical and photographic electronics.

Industry-level analysis, translog index method, reveals that the Total Factor Productivity growth of the electronics industry has increased from that of the pre-reform period to that of the post-reform period. During the 1980s, four out of five electronics industries have experienced negative growth. During the post-reform period (1991-04), five out of six electronics industries have experienced positive tfpg; the computer, component, broadcasting and photographic electronics recorded 2 per cent, 4.3 per cent, 1.8 per cent, 3.5 per cent, and 3.3 per cent respectively. Communication electronics has shown negative tfpg (-3.5 per cent).
Cob-douglas production function method shows that the TFPG for the period 1981-82 to 2003-04 has been increasing continuously. The average TFPG has been recorded at 2.61 per cent during the 1980s, and it increased to 4.40 per cent and 4.53 per cent during the 1990s and the 2000s respectively. The Total factor productivity recorded 1.06, 1.007, 1.14, and 1.039 during the 1980s, 1990s, 2000s and the post-reform period (1991-03) respectively.

The ASI unit level data has been used to study the Cob Douglas production function and Multilateral production function. The Panel data (1993-94 to 1998-99 and 1999-00 to 2004-05) analysis has been done in Cobb-Douglas production function. Cross section-time series (Pooled) data has used to study multilateral production function. Here the Output has been regressed on labour, capital, energy and material. During the first phase (1993-94 to 1998-99) of the reform period the Output elasticities of capital, labour, energy and material were recorded at 0.139, 0.316, 0.188 and 0.48 respectively. The ‘t’ time (technical change) value is negative (-.122); in other words the TFP has been recorded negative.

During the second phase (1999-00 to 2004-05) of the reform period the ‘t’ time value with output is 0.026. Hence, during the second phase of the reform period the technical change has turned to be positive. During the 2000s, the Output elasticities have been determined by material (0.621), labour (0.242), capital (0.141) and energy (0.066). Hence, the Output growth during the second phase in comparison to the first phase has been mainly contributed by material, capital and technical change.

The Total factor productivity growth during the 1990s has been negative except for 1994-95. TFPG has been positive during the 2000s except for 2001-02. The TPFG increased during the second phase of the reform period as compared to the first phase of the reform period. The TFPG has been recorded at 1.78 per cent during the year 1994-95, and it has drastically declined to 1.64 per cent in the year 1997-98. During 1998-99 to 1999-2000 the TFPG has improved but has remained negative. On the other hand, in the following period (2000-01 to 2004-05), it has experienced positive growth except for the year 2001-02. It recorded 2.52 per cent during the year 2000-01, and it decreased and recorded -0.63 during the year 2001-02. The Total factor productivity growth (Multilateral production function) for the period 1984-85 through 2004-05 has been either sluggish, if positive, or negative over the period. A comparison over the time period shows that during the pre-reform period the TFPG was positive, it turned negative during the first phase of the reform period and became positive during the second phase of the reform period. The highest growth
rate (2.74 per cent) has been recorded during the year 1989-90 and the lowest growth rate (-2.003) during the year 1996-97. During the initial phase of the reform period the TFPG has been negative except for the year 1994-95. During the second phase of the reform period the TFPG has been positive except for the year 2002-03. During the post-reform period, the overall sign of TFPG of Cobb-Douglas and Multilateral production function remains the same except for the years 2001-02 and 2002-03.

A comparison of Total factor productivity growth of the 1990s with that of the 2000s shows that it has increased across various states. A large number of states have experienced negative TFPG during the 1990s, and almost the same number of states have turned positive during the 2000s. Five out of sixteen states has record negative TFPG over the period (1993-94 to 2004-05). During the 1990s, the TFPG has been positive in the states of Delhi, Gujarat, Karnataka, Maharashtra and Pondicherry recording 5.98, 4.53, 3.05, 4.79 and 0.52 per cent respectively. However, during the 2000s the TFPG has been positive in the states of Goa (4.73 per cent), Himachal Pradesh (7.18 per cent), Kerala (7.31 per cent), Madhya Pradesh (9.22 per cent), Pondicherry (5.6 per cent), Punjab (8.95 per cent), Rajasthan (13.43 per cent), Tamil Nadu (10.4 per cent) and Uttar Pradesh (17.86 per cent). Andhra Pradesh, Haryana and West Bengal have recorded negative TFPG but have improved during the second phase of the reform period as compared to the first phase of the reform period.

7.3 Determinants and Structure of Employment in Electronics Industry

The main findings of the study are: Labour-Capital ratio of all sectors of the electronics industry has been declining over the period. Similarly, labour-output ratio also gradually declined over the period. A decline in the labour-capital ratio shows that capital is replacing labour.

The relationship between the employment growth and the real value added growth during the pre-reform and post-reform periods explains that the Component and Medical electronics are positively associated. The remaining industries, namely, Computer, Broadcasting and Photographic electronics show inverse relation between output growth and employment growth.

The Employment behaviour at industry level shows that, during the pre-reform period, the coefficients of the real wages and output variables are statistically significant at 5 per cent level. The coefficient of the man-days is found to be statistically insignificant. It explains the fact that during the pre-reform period the growth of real wage and output resulted in an increase of employment growth.
During the post-reform period, the coefficients of real wage and output are statistically significant at 10 per cent level. The growth of wage during the 1990s is negatively related to the employment growth. The growth of output is positively related to the employment. The coefficient of man-days and is found to be statistically insignificant. It shows that an increase in the growth of employment is the result of a decrease in the growth of real wage rate on the one hand, and the increase in the growth of the output on the other.

To study employment behaviour at the firm-level, a panel data using GLS Random Effect and a pooled cross-section data using OLS have been taken. All the variables in the GLS estimation are significant. During the second phase of reform period all the variables are significant both in the GLS and OLS estimation. Except Output all other variables are negatively significant at one per cent level in both GLS and OLS estimation. Capital intensity is negatively significant at five per cent in the GLS estimation and is positively significant at one per cent in the OLS estimation.

The result proves that employment is positively associated with output, but employment growth is not at par with output growth. The electronics industry being capital intensive, there is always the possibility of attrition of labour force rather than fresh employment. Labour reform is more effective in the private sector where the management is more powerful than the labour union. Employers prefer to replace labour with capital and skilled labour, since as the labour productivity increases the output also increases.

Total Factor Productivity is negatively associated with labour both during the first half and the second half of the reform period. As newer technology is incorporated into the production process the employment level declines. This is the major factor for the employment not growing at par with the output growth. The overall growth of the employment declines as output increases.

During the beginning of the economic reforms, import intensity is positively associated with employment. Increase in imports resulted in increased employment initially. During the latter period of economic reform, it is negatively significant proving that increase in imports actually caused decrease in employment growth in this period in a complete opposite scenario from the previous period. Thus, during a period of restructuring, because of the liberalization policies, the Indian electronics industry had to depend on imports for expansion of production and hence the growing labour force. During the 2000s import intensity is not conducive for employment growth. The reason may be that the electronics hardware sector requires
a longer gestation period and during 2000s many of the electronics firms that have been already established in India could supply the required material for the industry. So, the import of additional electronics material/component could affect the employment growth negatively.

During the beginning of the reform period as well as later on, private ownership is negatively associated with employment. The private sector emphasise more on imported capital than the domestic research and development. The capital embodied technology can be handled by a skilled labour force, so the unskilled labour will be removed from the job.

Electronics industry shows an inverse relation between ratio of emolument to output and contract labour per unit of employees and contract labour per unit of worker. The labour reforms made the trade unions weaker in terms of their bargaining power. The presence of a huge reserve army of labour and escalating labour costs are the reasons for the increased use of contract workers. A gradual decline in the number of strikes depicts the gradual decline of power of the labour union. The number of lockouts during the 90s gradually increased and man-days lost due to lockouts have also shown an increasing trend over the period. This explains that with the decline of the bargaining power of the trade union, the strength of the employer has increased.

A continuous increase in emolument for engineers has been observed in the states of Karnataka, West Bengal, Rajasthan, Punjab, Haryana etc. Variation in emolument received by degree holders is high in the states of West Bengal, Assam, Orissa etc., whereas the variation is low in the states of Karnataka, Tamil Nadu, Gujarat, Punjab etc. The variation in emoluments receipts by diploma holders is low in the states of Karnataka and Kerala whereas it is high in the states of West Bengal, Andhra Pradesh, Chandigarh etc.

7.4 Ownership Participation: Export Behaviour

This chapter analysed determinants of export on the basis of ownership and compared performance during pre reform and post reform period. After studying export behaviour, following export analysis has been done viz., Export of electronics hardware, Contribution of states/UTs in export and production, Item-wise export, Major destination, Country-wise export, Top exporter of computer hardware etc.

In export behaviour, the coefficient of capital intensity and age of firm are significant in all the groups of electronics industry, viz., Aggregate electronics, Public sector electronics and Private sector electronics industry. Capital intensity is positive and
Age of firm is negatively related to export. Electronics hard-ware products depreciation is high; however, companies which are highly capital intensive can replace products as and when required and use advanced technology. Hence companies with higher capital intensity are able to increase export of electronics industry.

Age of firm is negative and significant in the aggregate electronics, private sector electronics and public sector electronics. Old firms can accumulate capital over the period as well as improve technology and skill of labour. However, in the post-reform period due to liberalization of economy new firms are entering in market. These firms are capital and technology intensive and are dynamic enough to adjust to the economic situations. New firms prefer to import technology rather than invest in domestic research and development. So, the new firms may be more dynamic and thus perform better in export.

Liberalisation had a statistically-significant positive effect on export performance in this sector. The outward-looking policy has made significant changes in trade, technology import, merger and acquisition etc. This has created a competitive environment in the domestic economy.

Foreign participation is positive and significant at 10 per cent level. Foreign participation could have a crowding out effect on the local firms because of its high-tech and skill-intensive goods. However, increase in foreign participation could improve the performance of the industry in terms of production and export. In other words, goods of companies which use high technology and foreign brand name are assumed to be of good quality; it may lead to greater demand in the international market and an increase in export growth.

Import of technology is positive in the aggregate and private electronics industry. The liberalisation policy has relaxed control on import of technology; local firms are thus able to obtain advanced technology from MNEs. This has strengthened the electronics industry in terms of production and export. Research and Development is significant in public sector electronics industry. It shows that the public sector electronics industry, unlike the Private sector, encourages Research and Development activities. Intermediate import intensity is significant and has a positive impact on export intensity in public sector electronics industry.

Excise duty is a statistically-significant negative effect on export performance. Higher excise duty will have a regressive effect on export performance of the firm.
Higher excise duty discourages both producers and exporters, and results in underutilization of available resources. Impact of advertisement is statistically-significant; it has a negative impact on export performance in public sector electronics industry.

7.5 Ownership Participation: Research and Development Behaviour

The Capital intensity is positive and significant in Aggregate, Public and Private sector electronics industry. It indicates the importance of capital for research and development activity in all the sectors. Vertical integration is positive and significant in Aggregate, private sector and public sector electronics industry. Vertical integration, like capital intensity, is also helping in bettering the research and development performance in all the groups, viz., aggregate, public and private electronics industry.

The firm size is positive and significant in the public sector electronics industry. It shows that the larger the public sector the greater is the Research and Development activity. Many of the electronics firms that were established immediately after India’s independence were large scale public sector firms. So, the public sector’s medium and large scale firms are involving in research and development activity.

The central excise duty is negative and significant in the Aggregate electronics industry. The excise duty imposed by the central government has negative impact on invention and innovation activities. It is discouraging domestic research and development as well as MNEs’ overseas research and development activities. Since the cost of domestic research and development activity is high, firms resort to technology import.

Liberalisation dummy and foreign dummy are negative and significant in the aggregate electronics industry. During the post-reform period, the private sector firms are also experienced negatively significant. It depicts that the trade reform has hindered domestic research and development activity. Foreign firms, which participate either through equity participation or establishing their own firms, import their technology from parent company or other sources. In other words MNEs do not depend on domestic research and development. With India strengthening her patent laws and reducing excise duties, many firms are expected to enter the Indian electronics industry.

The level of technology acquisition activities in Aggregate, Public and Private Companies in India over the period 1989-2007, explains that the R&D has increased
immediately after the reform period (1993-96), slightly decreasing later. However, from 2000 onwards it has experienced an increasing trend. The Capital import intensity drastically increased from 1989-92 to 1997-00. There is a clear indication that the Capital import intensity was higher in the post-reform period than the pre-reform period. The technology import was relatively lower during the pre-reform period than the post-reform period. The foreign equity ratio (Dividend paid in foreign exchange out of total dividends) increased from 1989-92 to 2005-07. Similarly there was an increase in the ratio of dividends paid in foreign exchange to sales.

The public and private sector's electronics industry's technology acquisition explains that the public sector has been emphasizing research and development activity and the private sector has been depending on import of technology. The private sector gave importance to domestic research and development during the initial phase of the reform period. However, finding that import of technology is cheaper, better and quite readily available in the international market it shifted to importing foreign technology rather than depending on domestic research and development. Capital import intensity and intermediate import intensity remained high in the private sector as compared to the public sector. Imported capital is better suited to imported technology rather than domestic research and development. MNEs prefer to participate in the private sector instead of the public sector. Foreign equity share in the private sector has been continuously increasing. Rigidity in rules and regulations, secondary importance given to imported technology, strong labour union etc., in the public sectors are some of the reasons for MNEs' preference for participation in the private sector over the public sector.

As far as the central government enterprises and state government enterprises are concerned, the former dominates in technology acquisition in all the technological activities except intermediate import intensity; the latter dominates in intermediate import intensity. There has been an increasing trend in central government commercial enterprises towards research and development, import of technology and capital import intensity. On contrary to this, the state government's commercial enterprises have experienced a decreasing trend. It shows that foreign participation is taking place in central government enterprises. Foreign firms are participating with their own technology and capital. However, central government enterprises are large scale and emphasise domestic research and development activity. Existing research and development base is one of the reasons for foreign participation in central government enterprises rather than in state government commercial enterprises.
The Research and Development activity of the Indian private sector has been higher than the foreign counterpart. The R&D activity of the foreign private sector remained low; it increased during the initial phase of the reform period, decreased and thereafter maintained the same trend. Import of technology by both Indian private and foreign sector increased continuously; however, the import by foreign private sector is higher than that of the Indian private sector. The Capital import intensity of the foreign private sector is higher than that of the Indian counterpart. The liberalization of the economy has led to the increase of Capital import intensity of the foreign private sector during the initial phase of the reform period; however, it later declined. The Intermediate import intensity of both foreign and Indian private sector also increased immediately after the reform period; then it declined continuously till the year 2001-04 and thereafter increased. The share of dividends paid in foreign exchange out of the total dividends of the foreign private sector has been rising continuously, except during 1997-00. The foreign equity ratio of the Indian private sector’s post-reform period’s ratio remains higher than the pre-reform period.

7.6 Policy Implications

Government of India has influenced electronics industry to be more competitive through policies of trade and investment, patent, tax and subsidy, infrastructure etc. However, Indian electronics industry is not growing at par with Indian software industry and it is lagging behind East and South East Asian countries. Indian government is encouraging more on software sector compared to hardware sector (through Software Technology Parks). It reveals requirement to strengthen electronics hardware sector through further liberalization. Firms should be allowed to behave freely according to international situation. Encouraging firms irrespective of their size would help for optimum utilization of available resources. Competitiveness provides incentives for invention and innovation and produces new products. Export promotion policies specializes firms in production activities and results for global competition. To be competitive at international level government should encourage large size electronic hardware technology parks with high class infrastructure. Merger and acquisition activity increases size of firm and results into economies of scale. Proper implementation of labour reforms leads industry to utilize available skilled and semiskilled labour optimum level. This would produce qualitative goods at lower cost. Raise in demand of electronics goods at international level also increases employment level.