LIBERALISATION, GROWTH AND COMPETITIVENESS OF FIRMS: A STUDY OF INDIAN AUTOMOBILE INDUSTRY

A thesis submitted during 2011 to the University of Hyderabad in partial fulfillment of the award of a Ph.D. degree in Economics

BY

TOPHAN PATRA

Department of Economics
School of Social Sciences
University of Hyderabad
(P.O) Central University, Gachibowli
Hyderabad – 500 046
Andhra Pradesh
India

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CERTIFICATE

This is to certify that the thesis entitled "**LIBERALISATION, GROWTH AND COMPETITIVENESS OF FIRMS: A STUDY OF INDIAN AUTOMOBILE INDUSTRY**" submitted by Mr. Tophan Patra bearing Regd. No. 05SEPH05 in partial fulfillment of the requirements for the award of Doctor of Philosophy in Economics is a bonafide work carried out by him under my supervision and guidance.

The thesis has not been submitted previously in part or in full to this or any other University or Institution for the award of any degree or diploma.

(Prof. J. Manohar Rao)
Research Supervisor

(Prof. A. V. Raja)
Head
Department of Economics

(Prof. G. Nancharaiah)
Dean
School of Social Sciences

DECLARATION

I Tophan Patra hereby declare that this thesis entitled "**LIBERALISATION, GROWTH AND COMPETITIVENESS OF FIRMS: A STUDY OF INDIAN AUTOMOBILE INDUSTRY**" submitted by me under the guidance and supervision of Prof. J. Manohar Rao is a bonafide research work. I also declare that it has not been submitted previously in part or in full to this University or any other University or Institution for the award of any degree or diploma.

Date:

Name: Tophan Patra

Signature of the Candidate

Regd. No. 05SEPH05

Dedicated to……..

My
Parents

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Contents

List of Tables and Figures

Tables

List of Figures

Abbreviation

ACMA	Automotive Component Manufacturers Association
ADB	Asian Development Bank
AFTA	ASEAN Free Trade Area
AIAM	Association of Indian Automobile Manufacturers
ALL	Ashok Leyland Limited
AMP	Automotive Mission Plan
APEC	Asia Pacific Economic Cooperation
ARAI	Automotive Research Association of India
ARTNeT	Asia-Pacific Research and Training Network on Trade
ASEAN	Association of South East Asian Nations
ASI	Annual Survey of Industry
BIFR	Board of Industrial and Financial Reconstruction
BIS	Bureau of Indian Standards
BRIC	Brazil, Russia, India, and China
BTL	Bajaj Tempo Limited
C&RM	Components and Raw Materials
CAGR	Compound Avarage Growth Rate
CARE	Credit Analysis and Research Limited
CBU	Completely Build Up
CI	Capital Intensity
CII	Confederation of Indian Industries
CKD	Completely Knocked Down
CKD/SKD	Completely Knocked Down/Semi Knocked Down
CMIE	Centre for Monitoring the Indian Economy
CRISIL	Credit Rating and Information Services of India Limited
CVDP	Commercial Vehicle Development Program
CVs	Commercial Vehicles
DGFT	Directorate General of Foreign Trade
DMI	Daewoo Motors India Limited
ECE	Economic Commission of Europe
EEC	European Economic Community
EIU	Economist Intelligence Unit

EML	Eicher Motors Limited
EOI	Export Oriented Industrialisation
EU	European Union
EV	Electric Vehicle
FBU	Fully Built Up
FDI	Foreign Direct Investment
FERA	Foreign Exchange Regulation Act
FICCI	Federation of Indian Chambers of Commerce and Industry
FIE	Foreign Invested Enterprise
FIPL	Ford India Private Limited
FML	Force Motors Limited
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GFA	Gross Fixed Asset
GM	General Motors
GMI	General Motors India Private Limited
GPN	Global Production Network
GTW	Gross Trailer Weight
GVC	Global Value Chain
HEV	Hybrid Electric Vehicle
HMC	Hyundai Motor Corporation
HMIL	Hyundai Motor India Ltd.
HML	Hindustan Motors Limited
HSCIL	Honda Siel Cars India Limited
IBEF	Indian Brand Equity Foundation
ICRIER	Indian Council for Research on International Economic Relations
IDS	Institute of Development Studies, University of Sussex, UK
IIP	Index of Industrial Production
IMCAP	Imported Capital
IMF	International Monetary Fund
IMVP	International Motor Vehicle Program, MIT, US
ISI	Import Substitution Industrialisation
ITR	Inventory Turn Ratio
JAMA	Japan Automobile Manufacturers Association

JV	Joint Venture
LCV	Light Commercial Vehicles
LEV	Low Emission Vehicle
M&A	Mergers and Acquisitions
M&M	Mahindra and Mahindra Limited
M/HCVs	Medium and Heavy Commercial Vehicles
MCI	Ministry of Commerce and Industry
MFN	Most Favoured Nation
MHIPE	Ministry of Heavy Industries and Public Enterprises
MNC	Multinational Corporation
MoU	Memorandum of Understanding
MPV	Multipurpose Vehicle
MRTP	Monopolies and Restrictive Trade Practices Act
MSI	Maruti Suzuki India Limited
MSPI	Ministry of Statistics and Programme Implementation
MUL	Maruti Udyog Limitd
MUVs	Multi Utility Vehicles
NAFTA	North American Free Trade Agreement
NATRIP	National Automotive Testing and R&D Infrastructure Project
NBER	National Bureau of Economic Research
NCAER	National Council for Applied Economic Research
NCP	National Car Project
NEP	New Economic Policy
NIC	National Industrial Classification
NIC	Newly Industrialising Country
NIE	Newly Industrialising Economy
OECD	Organisation for Economic Cooperation and Development
OEM	Original Equipment Manufacturer
OES	Original Equipment Supplier
OGL	Open General License
OICA	Organisation Internationale des Constructeurs d'Automobiles
OPEC	Organisation of Petroleum Exporting Countries
PCM	Price Cost Margin
PECC	Pacific Economic Cooperation Council

PVs	Passenger Vehicles
R&D	Research and Development
R&N	Renault Nissan Group
SIAM	Society of Indian Automobile Manufacturers
SIDC	State Industrial Development Corporation
SML	Swaraj Mazda Limited
SOE	State Owned Enterprise
STS	Second-Tier Supplier
SUV	Sports Utility Vehicle
TELCO	Tata Engineering and Locomotive Company
TFP	Total Factor Productivity
TFPG	Total Factor Productivity Growth
TII	Technology Improvement Institute
TNC	Transnational Corporations
TPM	Total Productive Maintenance
TQC	Total Quality Control
TQM	Total Quality Management
TRIMs	Trade Related Aspects of Investment Measures
TTS	Third Tier Supplier
UAW	United Auto Workers Union
ULEV	Ultra Low Emissions Vehicle
UNCTAD	United National Conference on Trade and Development
UNCTC	United Nations Centre for Transnational Corporation
UNIDO	United Nations Industrial Development Organisation
UVs	Utility Vehicles
VA	Value Added
VI	Vertical Integration
WPI	Wholesale Price Index
WTO	World Trade Organisation

Chapter I

Introduction, Objectives and Scope of the Study

Chapter I

Introduction, Objectives and Scope of the Study

1.1. Introduction

The Indian automobile industry, one of the core sectors, has undergone changes with the advent of new business and manufacturing practises in the light of liberalisation and globalisation. The two waves of liberalisation in the 1980s and after 1991 have been associated with significant structural changes (Kaplinsky, R. 1997)[1]. The industry has been evolving over the years, meeting up with challenges as diverse as transitions, consolidations and restructuring, and thereby adapting to the new market conditions.[2] The attention and importance to the automotive industry in the economic development and planning policies of government and its agencies has also witnessed significant uprise. With the introduction of economic reforms in 1991, Indian industries have witnessed profound changes in the basic parameters governing their structure and functioning.

The 1990's brought about significant changes in the Indian automobile industry with respect to quality standards, degree of competition, and degree of product differentiation as a result of relaxed trade restrictions. It assigned central role to the market forces for organising economic activities and adopted a more liberal stance towards foreign trade and investment. These policy changes, collectively known as 'liberalisation of the Indian economy', had far-reaching implications. The transformation of the automotive industry in the post-liberalisation years is nothing short of dramatic. This transformation is discussed using different parameters, and some critical issues that face the industry in India are conjectured. Liberalisation transforms market structures through the responses of incumbent firms and entrants to freedom of choice. This historical analysis suggests the current need for reorientations in national structural policies to deal effectively with internationalised markets, firms, and competition in the automobile and other industries today[3].

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[1] Kaplinsky Raphael (1997), "India's Industrial Development: An Interpretative Survey", *World Development,* Vol. 5, No. 5, pp. 681-694.

[2] EXIM Bank of India (2008), "Indian Automotive Industry: At the Crossroads", Occasional Paper No. 129.

[3] George R. Heaton Jr. (1983), "Government Structural Policies and the Automobile Industry", *Review of Policy Research,* Vol. 2, No. 4, pp. 762-781.

The Indian automotive industry after de-licensing in July 1991 has grown at a spectacular rate for last few years. The Indian automotive industry embarked a new journey in 1991 with de-licensing of the sector and subsequent opening up for foreign direct investment (FDI). Since then almost all global majors have set up their facilities in India taking the level of production in recent years. Interestingly, the level of trade exports in this sector in India has been medium and imports have been low. However, this is rapidly changing and both exports and imports are increasing. The demand determinants of the industry are factors like affordability, product innovation, infrastructure and price of fuel.

With a high cost of developing production facilities, limited accessibility to new technology and soaring competition, the barriers to enter the Indian automotive sector are high. The cost structure of the industry is fairly traditional, but the profitability of motor vehicle manufacturers has been rising over the past few years. The level of technology change in the motor vehicle industry has been high but the rate of change in technology has been medium. Investment in the technology by the producers has been high. System suppliers of integrated components and sub-systems have become the order of the day. However, further investment in new technologies will help the industry become more competitive. Over the past few years, the industry has been volatile. Currently, India's increasing per capita disposable income and growth in exports is playing a major role in the rise and competitiveness of the industry.

Like in all industries, consumers are very important of the survival of the motor vehicle manufacturing industry also in 2008-09, customer sentiment dropped, which burned on the augmentation in demand of cars. The success in the industry also depends on improvement of improve labour productivity; labour flexibility, and capital efficiency are among others. Having quality manpower, infrastructure improvements, and raw material availability also play a major role. Access to latest and most efficient technology and techniques will bring competitive advantage to the major players. Utilising manufacturing plants to optimum level and understanding implications from the government policies are the essentials in the automotive industry of India.

The Automobile manufacturing sector is characterised by a high cyclical growth patterns, high fixed cost and break-even point levels, and an excessive number of participants. Barriers to entry into automobile manufacturing activity are formidable. The relative large

size of domestic market, together with high competition, has already seen significant rationalisation of this industry. After globalisation the new automobile policy has focused on import of foreign technology and capital for sustainable competition in the domestic and as well as international markets. Liberalisation has also stipulated to elevate the level of foreign equity in the Indian automobile industry. This gave push up and easier access to foreign collaborations. With this new policy, investors from all over the globe looked India as a potential platform for foreign investments. Since then, India's trade has boomed and there has been sustained investment into industry by foreign players, bringing in not only foreign capital, but also international technology and know-how. There have also been indirect consequences of development, employment, efficiency and rising per capita incomes. The emphasis of reform has switched to institutions that will allow the market to perform more efficiently. The liberalisation policies of Indian government have been one of the biggest favourable factors behind the Industry's rapid growth. Supportive policy measures in many aspects like relaxation in foreign exchange and equity regulations, reduction in tariffs on imports, and banking liberalisation in India is leading to a boom in financing driven purchases and convenient pay back have contributed highly to the present success of the Indian automobile industry.

The most prominent policy is 'Auto Policy' adopted in 2002. The Automotive Mission Plan 2006-2016 was released in 2007. The government permits 100% direct foreign investment in the sector aimed at creating a more conducive environment for the foreign investors. Thus, during this phase, the increasingly investor friendly as well as liberal trade measures adopted by the government led to a momentous increase in the number of foreign players active in the country. Both, industry and Indian government are obligated to intervene the Indian automotive industry. The Indian government should facilitate infrastructure creation, create favourable and predictable business environment, attract investment and promote research and development. The role of industry will primarily be in designing and manufacturing products of world class quality establishing cost competitiveness and improving productivity in labour and in capital, achieving scale and R&D enhancing capability and showcasing India's products in potential markets. Automobile sector in India is growing fast and the growth pattern seems to have a clear correlation with the reforms related policies those influenced both domestic demand

pattern as well as trade. Given the fact that the growth of the automobile industry depends upon the domestic demand pattern that evolve through the growth process of the economy at large the response firms to this demand draws in issues related to innovation and liberalisation. Market shares tend to turn more volatile, and the agility and competitiveness of small, as against large, firms determine whether markets grow more concentrated, or less.

1.2. The Importance and Relevance of the Automobile Industry

The Automotive sector is also seen as a multiplier of industrial growth. Automotive Industry, globally, as well in India, is one of the key sectors of the economy. Due to its deep forward and backward linkages with several key segments of the economy, automotive industry has a strong multiplier effect and acts as one of the drivers of economic growth. It contributes about 4 per cent in India's Gross Domestic Product (GDP) and 5 per cent in India's industrial production. Further, by the end of decade, the automotive sector is likely to double its contribution to the country's GDP from current levels of 5% to 10%. The economic contribution of this sector is immense, with significant linkages to the manufacturing and services sectors. [4]

This industry is one of the most interesting ones because of its visibility and the attention it has recently received by the government. One of the striking features of domestic consumption is the appearance of new automobiles on Indian streets since the 1990s, which has accelerated in the new millennium. For most of its existence the automobile industry has been a model of industrial and social discipline and control. It is not that the auto sector offers a 'pillar' of industrial development, it also offers something else. The automotive sector is important and complex one. Apart from vehicles, the roads and fuel needed, the business is intricately tied to the manufacture of a wide-range of components and the extraction of precious raw materials. In many ways, the automotive sector offers an almost endless stream of social, political and economic inter-connections which affect us all in several ways. For much of the developed world and increasingly for the developing world, it is a pillar industry and a flag of economic progress.[5]

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[4] Ministry of Heavy Industries & Public Enterprises, Department of Heavy Industry, (2006), "*Report of Working Group on Automotive Industry: Eleventh Five Year Plan (2007-2012)*"

[5] Graeme P. Maxton and John Wormald (2004), "*Time for a Model Change: Re-engineering the Global Automotive Industry*", Cambridge University Press, New York.

The automobile industry is considered the single largest manufacturing sector in the world. More than 10 percent of the Japanese and American output and employment are derived from this industry (Smitka, 1991). The automobile production of European Union's 12 member countries as a whole accounted for 10 percent of the total manufacturing output; in Germany alone, the sector contributed about 20 percent to its Gross Domestic Product. The automobile industry is income-elastic where the automobile stock is expected to augment faster than the increase in income level. More importantly, it directly or indirectly links to a wide range of other sectors from primary to secondary and services sector. It also links many types of producing firms, from material producers to intermediate and capital manufacturers and final assemblers.

Efforts to develop the automobile industry would have a significant impact on resource-based industries and on as well as non resource based industries. Of significance, the automobile industry requires a set of production systems linking a wide range of industrial liberalisations and technologies with great variations in size and sophistication. Such huge backward and forward inter-linkages justify one's arguments the industry is the back bone of the economy. This cross sector link is thus crucial in the development policy of developing countries for further growth.[6] The automobile industry is experiencing a period of massive change. This involves considerable micro- and macro-economic effects, reflecting the structure and behaviour of the industry and its scale of operations within an economy.[7] In many car-producing countries a large share of output is exported. Economic activity in the automobile industry usually moves in line with the overall business cycle, the relationship being particularly stronger in countries such as the United States, Japan and Germany. The link may even have strengthened in the recent period. A high correlation is also found between car sales and private consumption, which in turn accounts for a large part of total output. The correlation coefficient has increased significantly in the past decade in the United States, Germany and Canada. There can hardly be any doubt about the important role of this sector as an engine for growth. Indian automobile industry today is one of the most modern, growing and vibrant automobile markets on the global map. No wonder, it has become a centre of attraction for most of the

[6] Mohd. Rosli (2006), "The Automobile Industry and Performance of Malaysian Auto Production", *Journal of Economic Co-operation*, Vol. 27, No. 1, pp. 89-114.
[7] Garel Rhys (2001), "The Modern Motor Industry", *World Economics*, pp. 9- 29.

global automobile players. Due to its performance, the automobile industry is often viewed as the representative of modern industry.

1.3. Problem-Setting for the Study

The research problem is to investigate into those factors that are responsible for the influence of Industry's growth. The national environment, which is explained by the country's characteristic demand, basic and advanced factors of production, industry structure and related and supporting industries, could be influenced both positively as well as negatively by various government decisions. Various government interventions in the form of policies, existing at various points of time, have influenced the development of India's automotive industry. With regard to the identification of relevant policies, one experiences complexity with the vast array of government policies that potentially influence the development of the automotive industry. The reason behind generation of such an overwhelming list of policies is the complex functioning of the automotive industry influenced by several policy areas. Additionally, the complexity is compounded by the fact that policies change over time owing to changing government agendas, and that an understanding of the impact of a certain policy over the development period of India's automotive industry would necessitate an understanding of each version of that policy

With the gradual liberalisation of the automobile sector, since 1991, the number of manufacturing facilities in India has grown progressively. The norms for foreign investment and import of technology have also been progressively liberalised over the years for manufacturing of vehicles including passenger cars in order to make this sector globally competitive. In general, liberalisation and the accompanying entry of foreign firms have raised the technological competence level of India's automotive industry. Entry of firms, mostly with foreign capital and technology, threatened the market share and the rate of progress of most of the veterans in the Indian automobile industry. Foreign direct investment, resulting in transfer of latest technological configurations to produce/assemble vehicles involving technological up-gradation, raised serious questions about sustainability of growth and competitiveness in the already existing firms. As the players continue to introduce new models and variants, the competition may intensify further. The ability of the players to contain costs and focus on exports will be critical for the performance of their respective companies. The sustained competitiveness in the automotive industry

comes through improvement in productivity, which calls for continuous innovation by the players. Nevertheless, the domestic automotive firms still spend a relatively low amount on R&D as percentage of sales as compared to that of the global auto majors (Knowledge and Wharton 2005).[8]

Following the global financial meltdown and recessionary trends in world economy, there has been a slowdown in demand and supply of vehicles due to liquidity crunch, both at producer level and at consumer level. Cost escalation in input prices has impacted the growth of the Indian automotive industry. The effects of volatility in fuel prices are multipronged. The oil price has an impact on inflation, affecting the saving and disposable income of the consumers, thereby affecting the demand for automobiles. Movement in oil prices also has an impact on demand for large cars in India. During the periods of high fuel cost as experienced in 2007 and first-half of 2008, demand for large cars declined in favour of smaller, more fuel efficient vehicles. Thus, the volatility in oil prices affects the prospects of the industry.

Economic downturns and other events can affect the expenditure decision of households. When customers are not happy or optimistic about the future of the economy, they will tend to postpone expenditure until times are better. In 2008-09, customer sentiment is expected to fall, which will have a brunt on the augmentation in demand of cars. Over the past few years, the motor vehicle industry has become more volatile. This has been the result of fluctuations in metal prices and fuel prices, as well as changes in legislation and assistance packages. The risk of an increase in the interest rates, the impact of delayed monsoons on rural demand, and increase in the costs of inputs such as steel are the key concerns for the players in the industry. Reduced availability of credit and high cost of finance remain the main reasons for the current scenario in market, while falling industrial growth rate added to its woes

1.4. Scope and Objectives of the Study

The current structure of the industry is the result of a long process of structural change. In consideration to the complexities expressed so far, this study has discussed the influence of government policies while maintaining the scope of discussion within modest levels. On

[8] Knowledge and Wharton (2005): "*How R&D is Changing Indian Pharma and Auto Companies*", Wharton School of the University of Pennsylvania.

the canvas of the Indian economy, automotive industry occupies a prominent place. A sound transportation system plays a pivotal role in the country's rapid economic and industrial development. The Indian automobile industry is going through a phase of high growth and rapid changes. The future of the automotive market is far from being saturated. It has wonderful scope for volume growth. Markets are close to saturation in many advanced economics and therefore future developments are likely to be driven by a slow increase in vehicles per capita. Automobile sales are increasing at a rapid pace in China and India. It is a well known fact that automobile industry is the cornerstone of some of the most influential economies in the world. Indian automobile industry is all set to play the same role in Indian economy.

The automotive industry has been a core industry and a unique economic phenomenon. The automobile has become an important ingredient of nearly every aspect of economic and social life. Its impact on everyday life and human perceptions is so large that it has come to be regarded as something like a symbol of progress and development. This has significantly increased automotive industry’s contribution to overall industrial growth in the country. The country’s active economic growth has paved a solid road to the further expansion of its domestic automobile market. One can say that the automobile industry in the country has occupied a solid space in the platform of Indian economy.

The future prospect of this industry both the domestic and international market would be growing at a rapid pace in terms of its products and services. Future prospect of Indian automobile sector is looking bright. India holds huge potential in the automobile sector owing to its technological, cost and manpower advantage. Further, India has a well-developed, globally competitive auto-ancillary industry and established automobile testing and R&D centres. Indian Automobile today is one of the most modern, growing and vibrant automobile markets on the global map. No wonder, it has become a centre of attraction for most of the global automobile players. India’s ranking in the world motor vehicle production is not unimpressive. Additionally, supporting policy measures of the Indian government such as export-linked fiscal incentives, establishment of export-processing zones, bilateral or multilateral trade agreements with other countries, etc., have furthered this growth. As a result, the Indian government has paid special attention to the investment and growth within the industry.

Favourable investment conditions and the changing scenario of global competition have attracted world's major auto manufacturers into India. Be it market-seeking or low-cost sourcing, India has emerged as an attractive automotive location to offer global automotive sector firms strategic advantages. This study aims at discussing the influences various government policies had on the development of India's automotive industry. Such a discussion, in its true semantic sense, would necessitate identification of all the policies that have influenced the development of India's automotive industry and an understanding of their impact on the industry's development. Having mentioned that, it is important to discuss the complexities involved in such an attempt, and thereby the need for rationalising the scope of the discussion. The specific objectives of the present study are listed as below:

- This study examines the factors that are most likely to influence the Indian automobile demand.
- It attempts to analyse the determinants of growth of Indian automobile firms during two different policy regimes, namely liberalisation (1991-92 to 2000-2001) and auto policy (2001-2002 to 2008-2009)
- It analyses the determinants of competitiveness of firms in the Indian automobile industry during the same period.
- It seeks to examine the productivity performance in terms of partial factor productivity and total factor productivity growth.

1.5. Overview of Literature and Research Gaps

The process of liberalisation is linked to the growth and productivity performance of firms. A brief review of few major studies on liberalisation and growth performance and few on productivity growth of industries are carried out making use of both time series and cross section data led to find out the research gaps for the purposes of this study. There are many other studies as in the major comprehensive review in Chapter 2. It provides similar or divergent relationships leading to a few hypotheses for further empirical testing. It is also intended to trace research gaps as to fetch requisite hypotheses and research questions. Siddharthan, N.S. and K. Lal (2004)[9] show that not all firms have benefited from the liberalisation measures. There have been both gainers and losers. The impact of the

[9] N.S. Siddharthan and K. Lal (2004), "Liberalisation, MNE and Productivity of Indian Enterprises", *Economic and Political Weekly*, Vol.39, No.4. pp. 448-452.

determinants on growth has not remained constant over the years but has changed during the process of liberalisation. Narayanan, K. (2004)[10] finds that vertical integration is detrimental for growth in a liberalised regime as it potentially limits diversification. In a liberal regime, growth is positively influenced by the intra-firm technology transfer. Agarwal, R. N. (1991)[11] finds that profitability has mainly increased through experience of the older firms. The older firms need to be encouraged to diversify into other product lines and to internalise production process through vertical integration to improve profitability and growth of the firms in the industry. Narayanan, K. (1998)[12] in his study found that competitiveness in a de-regulated regime would, however, depend upon the ability of the firm to bring about technological paradigm shifts. New firms who depended on intra-firm transfer of technology and firms with in-house R&D efforts, to accomplish paradigm shifts, appear more successful. Further, in a liberal regime, advantages of vertical integration over sub-contracting also appear to be important in the determination of competitiveness.

Ranawat, M. and Rajnish Tiwari (2009)[13] attempted at identifying policies relevant to the development of India's automotive industry and at studying their impact on the industry's development. With every major shift in policies made by the Indian government, the automotive industry has come out stronger and better.

There are large literatures regarding the productivity of firms or industries in India. Among them, the determinants of productivity are investigated in many studies. The issue that attracts most attention is the effect of the economic deregulations since 1991. Turning to the trends in productivity in the post-reform period, the evidence from empirical studies by researchers was ambiguous, though subjective evidence, especially of trends of recent years shows significant increases in productivity growth. Balakrishnan et.al. (2000)[14]

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[10] K. Narayanan (2004), "Technology Acquisition and Growth of Firms: Indian Automobile Sector under Changing Policy Regimes", *Economic and Political Weekly*, 39(6), pp. 461-470.

[11] R.N. Agarwal (1991), "Profitability and Growth in Indian Automobile Manufacturing Industry", *Indian Economic Review*, Vol. No. 1, XXVI, PP. 81-97.

[12] K. Narayanan, (1998), "Technology Acquisition, De-regulation and Competitiveness: A Study of Indian Automobile Industry", *Research Policy*, Vol.27, No.2, pp. 217-230.

[13] Mahipat Ranawat and Rajnish Tiwari (2009) "*Influence of Government Policies on Industry Development: The Case of India's Automotive Industry*" Hamburg University of Technology, Institute of Technology and Innovation Management, WP. No. 57, PP. 1-60.

[14] P. Balakrishnan and K. Pushpangadan (1994), "Total Factor Productivity Growth in Manufacturing Industry: A Fresh Look", *Economic Political Weekly*, Vol. 29, No. 31, pp. 2028-2211.

report a significant decline in the growth rate of total factor productivity since 1991-92 in five manufacturing industries in India and they failed to find a link between trade reform and total factor productivity growth (TFPG) growth in the 90s. Pradhan and Barik (1999)[15] captured the TFPG during the period 1963-1993 for aggregate manufacturing sector and eight selected industries by estimating the translog cost function. On the whole, a decline trend of TFPG in Indian manufacturing sector–both at aggregate and disaggregate levels has been noticed. They observed that a decline in both scale economies and technical change seems to have produced the present character of TFPG, although decline in the latter does not appear to be as sharp as the former. Grossman and Helpman (1991)[16] argue that technological change can be influenced by a country's openness to trade. Openness to trade provides access to imported inputs which embody new technology and increases the size of the markets facing producers which in turn raises return to innovation and affects a countries research intensive production. Thus, a countries openness leads to improvement in domestic technology helping the production process and becomes more efficient, improves productivity growth.

Srivastava (2000), using firm level data, shows that there is a strong evidence of a decline in productivity growth rates in the 1990s. Balakrishna, Pushpangadan and Basu (2000) show some evidence of a decline in the growth rate of total factor productivity after 1991-1992. Das (2003) also confirms that many three digit industries record lower productivity growth rates in the 1990s compared to the 1980s. Conversely, Unel (2003) and Tata Services Limited (2003) claim that productivity growth accelerated after the economic deregulation in 1991. However, Goldar (2004) has pointed out the shortcomings in their methodologies and, after correcting the faults, obtained the result that there was a slowdown in productivity growth rates after 1991.

Despite ambiguity regarding acceleration in TFPG, evidence suggests that trade liberalisation since 1991 had a positive impact on the TFPG in India (Krishna and Mitra, 1998; Chand and Sen, 2002; Das, 2003; Topalova, 2004; Kathuria, 2002)[17] finds that

[15] G. Paradhan and K. Barik (1999), "Total Factor Productivity Growth in Developing Economics: A Study of Selected Industries in India", *Economic and Political Weekly*, pp. M92-M97.

[16] G. Grossman and E. Helpman (1991), "*Innovation and Growth in the Global Economy*", Cambridge, MIT Press.

[17] Vinish Kathuria (2002), "Liberalisation, FDI and Productivity Spillovers-An Analysis of Indian Manufacturing Firms." *Oxford Economic Papers*, 54 (4): 688-718.

productivity of foreign owned firms improved in the post-reform period and Indian owned firms which invested in R& D gained from productivity growth. Given this ambiguity, the effect of trade reforms on total factor productivity growth is an empirical issue. These varied empirical results initiate us to investigate further into the links between liberalisation and productivity growth of Indian automobile industry. An investigation of the issue on analytical front may broaden to our knowledge of the issue and elucidate the distinct set of results produced by the existing studies.

1.6. Hypotheses of the Study

On the basis of these possible effects of liberalisation on the behaviour of firms and drawing upon the empirical knowledge, this study formulates hypotheses concerning the nature of differences in the behaviour of firms across the two policy regimes. The key policy decisions highlighted during 1991-92 to 2000-01 are grouped together as 'liberalisation policy' and the ones on the right as 'Auto Policy-2002'. Details of the policy environment in which the firms have been operating under the two different policy periods effects are explained here. The risk of an increase in the interest rates, the impact on automobile demand, and increase in the costs of inputs are the key concerns for the players in the industry. Based on these effects this study hypothesises the role of factors that are most likely to influence the automobile demand. In order to examine the correlation between the hike in fuel prices, interest rate, and GDP per capita with India's automobile sales, macro level time series analysis is used here.

The Indian automobile industry is going through a phase of rapid change and high growth. The parameters to capture the behaviour of firms have been classified into technology acquisition, product improvements through imports of components, vertical integration, product differentiation and performance. This study hypothesises differences in the nature and direction of the effect of technology variables (imports and domestic efforts) in determining growth across the two different policy regimes. The study examines the role of firm size, profits, age, vertical integration, capacity utilisation, etc., and highlights the importance of all these variables in determining growth and profitability of firms during these policy regimes.

The study hypothesises the potential link between liberalisation policy measures and shifts in technological paradigm and trajectories. The study examines the role of technology

acquisition, skill intensity, product improvement through import components, product differentiation, firm size, age, vertical integration, capacity utilisation, etc., and highlights the importance of all these variables in determining competitiveness of firms is defined in terms of rate of change in the market share of a firm during these policy regimes. Moreover, as discussed earlier, entry of firms with the latest technology configuration brought about a change in the market share of the existing firms. It is therefore appropriate to use the rate of change in market shares of firms as a measure of competitiveness. This study attempts to examine the factors that brought about this change in the market share.

The significant increase in productivity performance in the 1990s, i.e. the post-reform period, relative to the pre-reform period in the Indian automobile manufacturing industry is hypothesised here. Theoretically, favorable effects of liberalisation on TFPG of industrial productivity are supported. Though, there exists very few quantitative evidence in support of this argument, we would like to take up this issue in our future exercise. The study also hypothesises the role of growth of output, the real effective exchange rate, inflation Terms of trade and investment in fixed machinery (used as proxy of technology acquisition) to the existing fixed capital stock in determining total factor productivity growth. The effect of liberalisation on the productivity growth of Indian automobile industry is an issue. It is an analytical-descriptive account of studies on productivity growth and technical change aspects.

1.7. Sources of Data and Methodology

The analysis explained in this chapter is based on secondary data. The main sources of the data used are from Centre for Monitoring of Indian Economy (CMIE). It provides information on all firms in the industry under study with regard to production, installed capacity, capacity utilisation, equity shares, rates of dividend, balance sheets, profit and loss account, financial ratios and the capital structure. The study includes data on production and sales have been taken by the two automotive associations, namely Society of Indian Automobile Manufacturers (SIAM) and Automotive Component Manufacturers Association (ACMA). The study includes data on world automobile production collected from OICA.[18] The data set contains firm level data for ten automobile manufacturing

[18] OICA, the Liberalisation Internationale des Constructeurs d'Automobiles (OICA) commonly called the International Liberalisational of Motor Vehicle Manufacturers is a federation of automobile manufacturers.

companies for the period 1990–1991 to 2008– 2009. The data relate to firms assembling or producing cars and other four wheeled drives, light commercial vehicles, and the heavy commercial vehicles. The nature of the markets is different for these products.[19] The present study is confined to the both manufacturers of commercial vehicles and passenger vehicles. Two and Three wheelers are not considered because these vehicles have altogether different characteristics, and different markets to which they cater. The Indian automobile manufacturing firms constituting the industry are: Tata Motors Limited, Ashok Leyland Limited, Force Motor Limited, Swaraj Mazda Limited, Hindustan Motor Limited, Mahindra &Mahindra Limited, Maruti Suzki Limited and Premier Automobiles Limited and three joint venture firms are General Motors India, Ford Motor Company Limited and Hyundai Motor India Limited.

Data regarding employment and value added at the aggregate level are provided by the annual survey of industries. All the values involved in this analysis are computed at 1993-94 constant prices. The study has only concentrated on three digit classification which required some important adjustments. Price deflators have been used to derive the trends adjusted for price changes. The wholesale price indices of automobiles and all commodities are collected from Ministry of Statistics and Programme Implementation. The wholesale price indices of Fuel, power, light and lubricants and machinery and equipment are collected from Ministry of Commerce and Industry, Government of India. The price index of durable goods as proxy variable is collected from Central Statistical Organisation, Government of India. The study shows the timeline of key policy decisions and events in the liberalisation phase. The key policy decisions highlighted during 1991-92 to 2000-2001 are grouped together as 'liberalisation policy' and the ones on right as 'Auto Policy 2002'.

This study examines the factors that are most likely to influence the Indian automobile demand. We employ the log linear model to estimate the elasticity of demand for automobiles in this study from 1991-2009. This chapter investigates the correlation between the hike in fuel prices, inflation rate, and GDP per capita with India's automobile sales. This study describes the model of car and commercial vehicle sales growth which has been used to explain the fall in sales in the last quarter of 2008 and the effect of the

[19] For example, while the cars and other four wheeled drives are mainly meant for personal use, the light, medium and heavy commercial vehicles (CVs) are used for commercial purposes.

demand on short-term prospects for sales. For India the equation is specified as an error-correction model. Sales growth depends on GDP per capita (gdppc), fuel price and interest rate.

This study also defines growth in terms of annual sales turnover and examines the role of firm size, age, profits and technological factors in determining the growth of firms during two policy regimes. This study uses the fixed effect model to analyse the determinants of growth function with the pooled data for Indian automobile industry. Growth theory of firm suggests that profits and growth of the firm are interrelated. Profits in turn provide internal funds and incentive for investment and growth. The study has followed Lindenberg and Ross (1981) and Smirlock et al (1984) for estimating q which is defined by the ratio of market value of the firm to the replacement cost of assets. To analyse the determinants of profit, the study has used to estimate the Tobin's q as a measure of profitability. Fixed effect estimation is applied to estimate profitability and the growth equations separately with the pooled data for Indian automobile industry.

Our implicit assumption in relating profitability to competitiveness is that a more profitable firm is more efficient, via lower costs and or better products that ensure higher prices. These, combined with the problems relating to profit measures themselves, imply that our assessment of profitability and competitiveness must be a guarded one. Competitiveness of firms is defined in terms of rate of change in the market share of a firm. This study attempts to examine the factors that brought about this change in the market share. This study has attempted to analyse the effects technology acquisition and competitiveness (defined in terms of market share changes) in the Indian automobile industry. Fixed effect estimation is applied to estimate the determinants of changes in market share.

In the competitive environment described, the most sustainable source of profitability is constant productivity improvement. Increased productivity will directly result in improved profitability for the company that achieves it, but the relationship between productivity and profitability is more complicated over the long term. This study considers the effects of the reform on technical efficiency improvement, as measured by total factor productivity (TFP) growth. It is therefore the proportionate change in output that occurs because of technical progress. This study examines the productivity performance of Indian automobile

industry via growth accounting approach examines the effect of trade liberalisation on the total factor productivity growth of Indian automobile industry. Our study is based on the growth accounting analysis of productivity performance in terms of total factor productivity growth for the entire period, 1974-75 to 2007-2008. Ordinary Least squares regression of log output (value added) on a constant, technical progress and the logarithm of labour and capital produce parameter estimates of a Cobb-Douglas production function.

1.8. Organisation of the Study

The Organisation of this study is as follows. In this introductory chapter to the first part of the thesis, we have broadly drawn the state of relationships in Indian automobile manufacturing industry and its current problems. It presents the introduction to the thesis, objectives, hypotheses, research questions, research gaps, importance and relevance to the study that contributed to knowledge.

The second chapter briefly deals with literature review revealing research gaps traced for the purpose of fulfillment of the study's objectives. It describes the previous evidences on structure of industry, market structure and liberalisation and growth performance of firms in Indian automobile industry. It gives an overview and studies the influence of government policies on industry development. It also studies the determinants dealing with growth and profitability analysis of Indian automobile industry. Further an attempt has also been made to review of empirical studies on productivity analysis. Overall, this study is vital to consider several aspects of industry development such as its size, structure, investment, growth, performance, competition, product variety, product quality, technology base, R&D, imports, exports and international competitiveness.

The third chapter provides basic concepts related to the studies and models dealing with structure of the industry, productivity, market size, growth and profitability. This chapter develops the theoretical model and describes the estimation procedure. It consists of statements about three components: demand, supply and market equilibrium. The demand for automobiles is modeled from a discrete choice framework of consumer. It follows Bresnahan's (1987) hypothesis that supply-side factors must have been responsible for the unusual pattern. It uses Tobin's q measure of profitability which seems to be better measure as compared to the conventional measure of profitability. The Herfindahl index, also known as Herfindahl-Hirschman Index or HHI, is a measure of the size of firms in

relation to the industry and an indicator of the amount of competition among them. Total Factor Productivity (TFP) in this study has been explained by using three different methods of productivity, namely, Kendrick Index, Solow Index and Divisia Index.

The fourth chapter deals with policies relevant to the development of India's automotive industry and studies their impact on the industry's development. It is made an attempt to review the recent changes in the government policy impact on the growth and profitability of the automobile industry. The study shows the timeline of key policy decisions and events in the liberalisation phase. The key policy decisions highlighted from 1991-1992 to 2000-2001 are grouped together as 'liberalisation policy' and the ones on right as 'Auto Policy 2002' (2002-2009). This chapter deals with analytical framework, methodology of analysis including sources of data, samples and adjustments. This chapter also discusses the various sources of data, definitions of variables and compilation of data on the relevant variables particularly of the wholesale price indices which are used as deflators. In order to show the difference between the different stages of industrial development, the growth performance has been compared with the previous periods by using various kinds of growth rates. The average annual growth rate and the coefficient of variation of sales turnover in current prices of Indian automobile firms are analysed. This chapter shows about the behaviour of Whole Price Index (WPI) of automobiles and all commodities. This study is also concerned with automobile demand and it examines the factors that are most likely to influence. The OLS model is also applied to estimate the demand equation in order to develop the model for automobile demand in India. This study describes the model of PVs and CVs sales growth which has been used to explain the fall in car and commercial vehicles sales in the year of 2008 and the effect of the high interest rates and the recovery in demand on short-term prospects for both sectors sales. The equation is estimated by error correction model. In particular, this chapter analyses the determinants of the growth of firms in the Indian automobile industry during the period 1990-91 to 2008-2009. It estimates the Tobin's q as measure of profitability. This chapter attempts to analyse the differences in the technological strategies adopted by the firms, and how the difference in the firm characteristics determines the technological behavior of firms drawn from the Indian automobile industry. In particular, this chapter uses fixed effect estimation to analyse the determinants of growth and profitability of Indian automobile firms.

The fifth chapter is a discussion on the role ought to be played by the government in different stages of industry's competitive development. It examines the impact of liberalisation policy started in India since 1991 and competitiveness of Indian automobile firms. In particular, this chapter analyses the determinants of rate of change in market share. In this chapter, we analyses various aspects of the domestic-market competitiveness of the chosen firms. This includes an analysis of market shares, profitability and productivity ratios. The worldwide production of cars and commercial vehicles in India is explained in this chapter. The SCP approach indicates that market performance is determined by market conduct which in turn depends on market structure. HHI is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them**.** The study uses fixed effect estimation to analyse the determinants of inter-firm differences in the dependent variable, namely, the rate of change in market share. Coefficient of variation is used to measure the different profitability and productivity measures of chosen firms.

Sixth chapter seeks to measure productivity performance of the Indian automobile industry in terms of partial factor productivity and total factor productivity growth for the entire period, 1975 to 2009. This is done by examining different productivity indicators like labour productivity, capital productivity and total factor productivity. Divisia Tornquist approximation has been used to arrive at productivity estimates of total factor productivity index in this industry over the study period. This chapter also discusses an analytical framework and tests empirically whether liberalisation reforms since 1991-2009 improve productivity growth in Indian automobile industry. Major findings and policy implications are provided in the final section of the thesis. This industry remains a very great one. It deserves well-informed analysis, commentary and debate. Our motivation, at the very least, is to have contributed to that. It discusses about the theoretical framework and reviews the relevant literature for major studies of liberalisation impact on growth, profitability and productivity performance of industries are in the major comprehensive review in chapter 2.

Chapter II

Review of Literature

Chapter II

Review of Literature

2.1. Introduction

This chapter reviews the past studies dealing with the brief history and structure of Indian and world automobile industry in the light of its current status. It provides similar or divergent relationships leading to a few hypotheses for further empirical testing. It traces research gaps to fetch requisite hypotheses, or research questions. In this chapter, we review many different facets of the world's auto industry, looking at the sector not as a business but as an economic phenomenon. Most of the studies on automobile industry cover the U.S. and Japanese automobile industries. These studies reflect activities and events of a particular time. It deals with an early history of Indian automobile industry that grew under a highly regulated and protected economic environment. Although this section focuses on studies conducted since the 1980s, we would like to start with studies by Agarwal (1991), Kathuria (1996), Narayana (1998, 2004), Ranawat and Tiwari (2009) and OECD Economic Outlook (2009). Our study draws the fact the relaxations of quantitative restrictions, technology acquisition, internal funds, availability of credit, business models and the influence of important government policies, and the role of oil prices and material costs were the main tools used to analyse growth and competitiveness of firms in the automobile market.

In the new manufacturing environment, time is considered as one of the primary motives for operating business these days. Given the happenings worldwide, this study outlines the impact on the growth of market for the automobile industry in India. The impact is all the more relevant in light of the liberalisation policies followed the Indian government in the sector. This chapter is about literature review in which core competitive issues are reviewed. The identification of gaps in the literature help to identify shortcomings in existing literature and then address issues like low cost, quality improvement and rapid product development in a more coherent and systematic manner. It is concerned with the firm level multidimensional concept of competitiveness in the domestic market. The study identifies the determinants of competitiveness of enterprises as their strategy, structure and

rivalry, the demand conditions they face, the factor supply conditions they encounter, and the conditions of related industries.

In this section, we will look at some recent empirical studies of industries with market power. In order to explain the issues related to the market, we look at the structure of the industry. Here, the international studies are brought with emphasis on the production of world motor vehicle. The world motor vehicle market for demand, patterns of foreign investment and trade, interrelationship between trade and investment policies, joint ventures between multinational and local firms and international mergers and acquisitions and other equity operations have been the most effective to these markets for future growth. Turning to the trends in productivity in the post-reform period, the evidence from empirical studies by researchers has been ambiguous, though subjective evidence, especially of trends of recent years, shows significant increases in productivity growth. Previous findings for the contribution of total factor productivity growth to total output growth yielded contradictory result. Many developing countries grew via factor accumulation instead of improved technological changes via total factor productivity growth and therefore attempts have also been made to investigate into whether output growth is input-driven or productivity-driven and to investigate factors influencing TFPG.

2.2. The Indian Automobile Industry: An Early History

The evolution of India's automotive industry is identified to have occurred in four phases. In the first (1947-1965) and second phase (1966-1979), the important policies identified were related to protection, indigenisation and regulation of the industry. On the one hand, these policies helped India to build an indigenous automotive industry, while on the other it led to unsatisfactory industry performance. In the third phase (1980-1990), the single most important policy identified was the one with regard to relaxation in the means of technology acquisition. The foreign competition inducted into the industry transformed its dynamics. Lastly, in the fourth phase (1991 onwards) the liberalisation with regard to foreign investment has a significant influence on the Indian automotive industry as we see it today.

The growth of the Indian automobile industry till mid-1980s could be termed as protection for the Indian automotive industry. The Automobile industry in India grew under a highly regulated and protected economic environment over the period 1950 to 1985. There were

quantitative restrictions on imports of raw materials, components and equipments through licensing and a tariff structure designed to restrict the market. Also there were restrictions on FDI, and imposition of indigenization of components production protected the domestic market. The initial changes, introduced in 1985, eased the licensing requirements, broad-based the classification of vehicles for issue of licenses, allowed selective expansion of capacity and partially relaxed controls with regard to foreign collaborations, imports of capital goods, raw materials and spares. Though these measures represented a 'domestic liberalisation', the policy environment continued being geared towards imposing trade and investment regulations, constraining the growth of big business houses and regulating exchange rates (Narayanan, K 2001).[1] There were restrictions on the manufacturing and import of automobiles, and the Indian automobile market was a seller's market. This net of controls on the economy in the 70s caused several firms to operate below the minimum scale of efficiency (MSE), under-utilise capacity and use outdated technology. Use of outdated technology resulted from the restrictions placed on import of technology through the provisions of FERA. Recognition of the deleterious effects of these policies led to the initiation of reforms in 1975 which took on a more pronounced shape and acquired wider scope under the New Economic Policy (NEP) in 1985.

As part of these reforms, several groups of industries were delicensed and broadbanding[2] was permitted in select industries. Controls over capacity expansion were relaxed through the specification of the MES of production for several industries. Foreign investment was allowed in select industries and norms under the MRTP Act were relaxed. The firms were given greater flexibility in their operations through policies such as broad-banding, exemption from monopolies commission references, minimum economies of scale and a generous degree of capacity expansion. These changes induced a certain amount of competition and technical changes in the automobile industry through induction of new

[1] Narayanan, K. (2001), "Liberalisation and the Differential Conduct and Performance of Firms: A Study of the Indian Automobile Sector, Discussion Paper Series No. 414, The Institute of Economic Research, Hitotsubashi University and United Nations University Institute of Advanced Studies, Japan.

[2] Delicensed industries meant that firms no longer required licenses from the State to enter the industry or expand their plants. Broadbanding meant that a firm could manufacture products related to the ones they were currently making without the need for a separate license. The broad banding introduced in 1984 has helped producers to optimize installed capacity and adjust the product mix to market demand. This in turn helped in obtaining economies of scale for larger players like Telco and M & M.

technology. Thus the Industrial Policy in India moved from the position of regulation and tight control in the 60s and 70s, to a more liberalised one in the 80s and 90s.

The post 1991 could be termed as a phase of liberalisation as the Indian automotive market was the beneficiary of the opening up of India's economy. This phase was marked by the entry of foreign automobile players and increase in the availability of automotive financing. The Indian automotive market became a buyer's market during this phase. Coinciding with the second wave of liberalisation, the growth of automobile industry from early 2000 till date could be termed as a phase of globalisation of the Indian automotive industry. This phase has been marked by the removal of most import controls, entry of many more foreign players in the Indian automotive market. Therefore, Indian companies gaining a global identity and acquiring foreign companies. The period 1970-1980 saw state controls, through the use of the licensing system and certain regulatory acts over the economy at their peak. During 1981-1990 significant reforms were introduced in the country. The final time-period covers the period 1991-1999 during which the reform process encompassed several areas like finance, trade, tax, industrial policy etc.

In the last few years, the Indian automotive industry has grown at a healthy rate by reducing costs and improving efficiency. The Indian automotive market with a healthy growth rate of 13% in the last 7 years was a source of attraction to many foreign automobile companies whose entry in the Indian market not only increased competition, but also raised customer expectations about product quality and reliability. This forced the Indian companies to introduce new and interesting products, and innovation has now become a noteable feature of the Indian automotive industry. The innovation story of the Indian automotive industry would not be complete without mentioning the Nano, which has evoked a worldwide interest, curiosity and confidence in the competency of Indian talent. It has brought both the automobile industry and India into focus. The Nano and other similar products have the potential to change the paradigm of the automotive industry worldwide. The industry has emerged as a key contributor to the Indian economy.[3] Commercial vehicles segment has witnessed the highest growth rate in the automotive industry (IBEF, 2008). In February 2009, Tata registered 35% growth**.**

[3] Indian Brand Equity Foundation (2006), "The India Brand Equity Foundation (IBEF) is a public private partnership between the Ministry of Commerce and Industry, Government of India and the Confederation of Indian Industry.

2.3. Studies on Automobile Demand Structure

The most important structural features of the industry are buyer demand, the nature of the product, number of rival sellers and their relative size (concentration), barriers to new competition, and extent of the economies of scale. Income and price are the major variables determining the demand for automobiles. It is crucial to state that the target of the Indian automobile industry is domestic demand.

Bresnahan (1987) focuses on competition and collusion in the American Automobile Industry during the period of 1955-1957. Bresnahan points out that during 1955, a year of expansion in the U.S. economy, sales of cars increased, yet prices decreased dramatically. Bresnahan model, the industry based on differentiated products. The starting point of the analysis is that if firms compete on price, price will be close to marginal cost, and if we can assume a tacitly collusive market, price-cost margin will not depend on whether close substitute or the product itself is sold. Even when MC is not observable, competitive and collusive mechanism can be identified.

Bresnahan, T. F. and Valeie Ann Ramey (1993)[4] consider the segment shift and capacity utilisation relationship in the U.S. automotive industry and show that domestic firms reacted very quickly to oil shocks throughout 1970s and 1980s. This study shows that the automobile industry avoids capacity misallocation significantly by switching among class sizes. Finally, there are two notable studies on this issue by Goldberg (1995)[5] and Berry et al. (1995)[6]. Goldberg develops and estimates a complete model of demand and supply for the automobile industry. In this model, the U.S. automobile market is treated as an oligopoly with differentiated products. By using the estimated results, simulation is conducted to investigate the effects of VER and exchange rate pass through. Berry et al. (1995), on the other hand, use the same data and estimate cost and demand parameters for all models marketed in the U.S. for over a twenty-year period.

[4] Timothy F. Bresnahan (1993), "Segment Shifts and Capacity Utilisation in the U. S. Automobile Industry", *American Economic Review*, Vol. 83, No. 2, pp. 213-218.

[5] P. Goldberg (1995), "Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry", *Econometrica*, Vol. 63, No. 4, pp. 891–951.

[6] S. Berry, J. Levinsohn and A. Pakes (1995), "Automobile Prices in Market Equilibrium", *Econometrica*, Vol. 63, No. 4, pp. 841–890.

Millner, E. L. and George E. Hoffer (1993)[7] showed that styling changes is a significant demand determinant for automobiles in the U.S. market. Millner and Hoffer consider restyling information between 1978 and 1991 and the impact of restyling is stronger than the restyling itself. Mergers, partial ownerships and acquisitions in the world automobile industry have attracted economists' attention. Economists presented two arguments for these arrangements. The first argument suggests the main reason is risk-sharing behavior. The second reason is rather technology driven. Rosegger (1989, 1991, and 1996) analysed the European Community policies as a supporter of intra-European strategic alliances. Rosegger argues that European firms are beginning to establish technology driven joint ventures and coalitions to secure themselves in what is now a world market.

2.4. Liberalisation and Growth of Automobile Firms

The comprehensive market-oriented reforms pursued in India through the 1990s aimed to rationalize resource allocation, improve productivity and competitiveness in all spheres of economic activity, and move the economy to a sustained rate of higher growth. The reforms ranged from macroeconomic stabilization and fiscal reforms, trade liberalisation, and industrial deregulation, to financial sector reforms, disinvestments, and privatization. The economy did in fact get higher rates of growth in the 1990s, led by services, which is now the largest sector of the economy.[8] The 1990s witnessed further liberalisation of the economy. With the broad ranging liberalisation policy of 1991, the industrial licensing procedure was got rid of. In 1993, the Government completely liberalised the entry of foreign automobile manufacturers. The latter of half of the 1990s saw many entries and set ups of the new joint ventures both from automobile manufacturing and automotive component manufacturing. In early 1980s, a number of other Indo Japanese joint ventures were set up in the private sector two-wheeler and light commercial vehicle manufacturing. Japanese joint ventures in the commercial vehicle manufacturing were not successful.

N.S. Siddharthan and K. Lal (2004)[9] analysed the impact of liberalisation policies introduced by the government since 1991 on the growth of Indian corporate firms. They

[7] Edward L. Miller and George E. Hoffer (1993), "A Re-examination of the Impact of Automotive Styling on Demand", *Applied Economics*, Vol. 25, pp. 101-110.

[8] Asian Development outlook, ADO, (2003), "Economic Trends and Prospects in Developing Asia"

[9] N.S. Siddharthan and K. Lal (2004), "Liberalisation, MNE and Productivity of Indian Enterprises", *Economic and Political Weekly*, Vol.39, No.4. pp. 448-452.

analyse the inter-firm differences in growth rates over a seven-year period. The basic unit is the firm and the study allows for the entry and exit of firms during the sample period. The results of their study show that during the initial years of liberalisation, firm size MNE affiliation, capital intensity and vertical integration and import of capital goods has a negative impact on growth. However, in recent years the impact of these variables has turned positive and significant, indicating the important changes brought about by the liberalisation policy measures. This study follows the Marris framework and introduces certain important modifications in the Marris model (1964) to analyse the impact of the series of liberalisation measures on the growth of Indian corporate firms. Further, they show that not all firms have benefited from the liberalisation measures. They were gainers and losers. The impact of the determinants on growth has not remained constant over the years but has changed during the process of liberalisation. This is an important feature of the model.

Narayanan, K. (2004)[10] studies the determinants of growth of Indian automobile firms during three different policy regimes, namely licensing (1980-81 to 1984-85), deregulation (1985-86 to 1990-91) and liberalisation (1991-92 to 1995- 96). Narayanan (1998), finds that vertical integration is detrimental for growth in a liberalized regime as it potentially limits diversification. Narayanan (2006) also finds that vertical integration plays a positive role in a regulated regime, while it is not conducive for export competitiveness in a liberal regime. He uses two-way fixed effects estimation of the firm growth as a function of variables capturing technology, such as R&D expenditure as a proportion of sales, foreign equity participation and import of capital goods. The role of technology depends on the technological regime in which the firm operates. In a licensed regime, firms with foreign equity grow faster because of better access to resources and technology. In a deregulated regime, import of capital goods has been the technology-related variable that triggered growth. In a liberal regime, growth is positively influenced by the intra-firm technology transfer.

His study deals with the determinants of the growth of firms in a sector (automobiles) that underwent rapid technological change and saw the entry of new firms in the liberalised era.

[10] K. Narayanan (2004), "Technology Acquisition and Growth of Firms: Indian Automobile Sector under Changing Policy Regimes", *Economic and Political Weekly*, Vol. 39, No. 6, pp. 461-470.

His sample covers the period 1980-96. He identifies two policy changes during the period, namely, partial deregulations introduced in 1985 and liberalisation measures launched since 1991. Consequently, three sets of regressions are presented for the three periods - Licensing 1980-81 to 1984-85, Deregulation 1985-86 to 1990-91 and Liberalisation 1991-92 to 1995-96. Firms in the automobile industry witnessed a change in basic technology configuration of the production process during the sample period. Therefore, he expects the technology factors to play a crucial role in determining the growth of firms. The study uses two-way fixed effect estimation of the growth function. The results of the estimated fixed effect model support the hypothesis that inter-firm differences in growth are determined mainly by variables capturing technology paradigm and trajectory shifts. Thus growth is mainly technology driven.

Biswajit Nag, Saikat Banerjee and Rittwik Chatterjee (2007)[11] examine that the growth patterns change in ownership structures, trade patterns and role of governments of selected Asian countries (viz. China, India, Indonesia and Thailand) in the automobile sector. In India, automobile market is mainly dominated by Japanese and Indian manufacturers. Therefore, some other multinational companies are currently investing in India. The major foreign automobile manufacturers in India are Honda, Toyota, Ford, Fiat, Daimler Chrysler, etc. The major Indian players are Marutyi Udyog, TATA motors, and Hindustan motors. Automobile production in India rose substantially in last five years. 77% of market share is captured by two wheelers. Passenger and commercial vehicles capture around 19% market share (SIAM statistics for 2006-07). On the contrary, in India, government made an attempt to develop automobile sector through domestic private sector before the liberalisation

Kathuria, S. (1987)[12] points out that although Hindustan Motors and Premier Automobiles were established prior to independence, the real history of the Indian automobile industry begins with the Tariff Commission Report of 1953, when firms without a phased manufacturing programme were asked to withdraw from India. By 1965, there were seven

[11] Biswajit Nag, Saikat Banerjee and Rittwik Chatterjee (2007), "Changing Features of the Automobile Industry in Asia: Comparison of Production, Trade and Market Structure in Selected Countries" Asia-Pacific Research and Training Network on Trade, Working Paper Series, No. 37.

[12] S. Kathuria (1987), "Commercial Vehicles Industry in India: A Case History 1928-1987", *Economic and Political Weekly*, Vol. 22, No. 42, pp. 17-24.

firms manufacturing commercial vehicles, four of which also produced passenger cars and jeeps. In 1981, the government approved the entry of four new firms (with Japanese collaborations) into the market for light commercial vehicles. This was followed by further liberalisation in industrial policies, viz, broad-banding, exemption from the provisions of section 21 and 22 of the MRTP Act, and the announcement of minimum economic scales. Since the very beginning, the government has placed more emphasis on commercial rather than private transport vehicles. This is evident in the successive Tariff Commission Reports as well as in the inclusion of commercial (but not private) vehicles. The industry has been protected via quantitative restrictions, a virtual ban on import of built-up vehicles, and high rates of duty. Given its role as a leading sector in economic development, the industry's average growth rate of 4 percent over the period 1950-85 would seem to be inadequate.

2.4.1. Linkage between Trade Liberalisation and Productivity Growth

The principal reforms initiated in the year 1991 included relaxation of import tariffs on most of the goods, removal of quantitative restrictions and liberal terms of entry of foreign players. India's simple average tariff rates were reduced along with reduction of quotas and non-tariff barriers. With the extensive relaxation of control over trade, the pace of reforms got momentum over the period 1991-96. After that, the pace of reforms was slowed down. The uneven structure of tariff rates continues to be a cause of concern along with rapid falling trend in tariff rates in the early 90s. The 1991 reforms were much broader in scope and scale, and initiated a departure from earlier control regime and allowed towards a market oriented regime. The 1985 reforms were piecemeal because it did neither abolish the import license in total, nor did it reduce the level of import tariff. As a result of trade liberalisation since eighties, Indian economy has become more outward looking with the increase in trade intensity and FDI inflow. Liberalisation of foreign investment has increased competition through the entry of foreign firms into the domestic market. The improved performance ended abruptly when the economy slid into a recession in the early 1997 with weak and inefficient firms struggling to cope with increased competition from import and new firms trying to establish themselves in the altered competitive scenario.

Although there exists voluminous empirical research work regarding nexus between trade liberalisation and factor productivity growth, overviews on the link between liberalisation

and TFPG find inadequate evidence on this issue; it is controversial issue and debates are still unsettled. The controversy on the impact of liberalisation on TFPG and diverse conclusions resulting from empirical investigations are probably due to differing interpretations of liberalisation and openness. These varied empirical results initiate us to investigate further into the links between liberalisation and productivity growth of Indian industry.

Rodrick and Subramanian (2004)[13] distinguish the reforms in the 80s and 90 by describing the former as 'pro-business' and the latter as 'pro-market'. The reforms of the '80s' reforms focused on increasing profitability of the existing firms by easing capacity restriction and reducing corporate taxes among other things. The reforms of 90s allowed more competition and paved a way for entry of new domestic firms and MNCs in Indian industries.

Grossman and Helpman (1991)[14] argue that technological change can be influenced by a country's openness to trade. Openness to trade provides access to imported inputs which embody new technology and increases the size of the markets facing producers which in turn raises return to innovation and affects a countries research intensive production. Thus, a country, s openness leads to improvement in domestic technology helping the production process and becomes more efficient, improves productivity growth.

Advocates of trade liberalisation aspire to promote productivity gains with the exposure of industries to severe international competition and facilitating access to the international market. They argue that manufacturing units which face foreign competition are forced to adapt. In particular, plants are encouraged to produce closer to the production possibility frontier while the frontier itself will move out faster. Evidence indicates that manufacturing concerns exposed to trade pay higher wages, operate at a higher scale, produce with more capital and achieve higher productivity levels. (Van Biesebroeck, 2003).[15]

Productivity growth appears to be directly linked with production of tradable goods. This implies that the benefits from foreign activities are likely to be higher in two areas; firstly,

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[13] Rodrick , D. and A .Subramanian (2004), "From Hindu Growth to Productivity Surge: The Mystery of the Indian Growth Transition", NBER WP. No. 10376.

[14] G. Grossman and E. Helpman (1991), "*Innovation and Growth in the Global Economy*", Cambridge, MIT Press.

[15] Van Biesebrock, J. (2003), "Exporting raises productivity in sub-Saharan African manufacturing plants", NBER Working Paper No. 10020.

in places where the domestic market is small and foreign sales are a precondition to fully exploit scale economies, and secondly where production technology lags best practice, providing ample scope for productivity improvements through imitation and adaptation of foreign technology. Trade liberalisation enables cheaper and easier access to global capital and foreign technologies. Lowering of trade restrictions makes possible the import of capital and intermediate goods which embody superior technology that results cost reduction and also in turn increases productivity growth which uses this product. On the other hand, critics argue that increase in foreign competition may be detrimental to domestic industries if it leads to a closure of factories (Van Biesbroek, 2003). Rodrik (1991)[16] finds that lower protection or higher import competition reduces a firm's investment in productivity often enhancing technological upgrading. This is specially the case when the incentive to invest depends on the firm's output or market share, yet trade liberalisation reduces the market share.

Deraniyagala and Fine (2000)[17] also argue that the magnitude of gains from trade liberalisation could be fairly low. If trade reduces the domestic market shares of the unprotected domestic producers without expanding their international sales, their incentive to invest in improved technology will decrease as protection ceases. This effect reduces the benefits of tariff reductions that are supposed to lower the relative prices of imported capital goods and ease access to foreign technology for domestic firms (Pavcnik, 2000).[18] It is also argued that liberalisation does not facilitate acquisition of better technology by domestic plants because acquisition is dependent on the flexibility of the domestic labour force.

Narayanan, K. and Sabita Bhat (2006)[19] attempt to analyse the differences in the technological strategies adopted by the firms, and how the disparity in the firm characteristics determines the technological behavior of firms drawn from the Indian Basic Chemical industry. The different technological strategies considered are in-house R&D,

[16] Rodrik (1991), "*Closing the productivity gap: Does trade Liberalisation Really Help in Hollemey, G. (Ed). Trade policy, Industrialisation and Development*", Claredon Press Oxford.
[17] S. Deraniyagala and B. Fine (2000), "New Trade Theory versus Old Trade Policy: A Continuing Enigma", *Journal of Political Economy*, Vol. 96, pp. 20-41.
[18] N. Pavcnik (2000), "Trade Liberalisation, Exit and Productivity Improvement: Evidence from Chilean Plants", *NBER WP. No. W7852*.
[19] K. Narayanan and Sabita Bhat (2006), "Technological Strategies and their Determinants: A Study of Indian Basic Chemical Industry".

imports of embodied technology (in the form of import of capital goods), and import of disembodied technology (from the market through lump sum payments, royalties, and technical fees). Using a panel data for the period from 1997 to 2003, an attempt has been made to understand, with the help of cross tabulations and maximum likelihood estimation of the Tobit model, the differences in technological strategies adopted by firms and their determinants. The study finds that the firms in this industry (excluding Pharmaceuticals) are investing in various combinations of the three modes of technological strategies- R&D, imports of embodied technology, and import of disembodied technology. In particular the firms with foreign equity participation have been found to be investing rigorously on technology efforts than the ones without it. The older firms have been found to be technologically more active than the younger ones. The complementarities between imported technology and in-house R & D appear to be most important only for a subset of firms who are using multiple strategies.

Ray, Saon (2004)[20] analyses the impact of liberalisation measures and the consequent technological changes on the efficiency of firms. The study argues that the impact would depend on whether the technological changes are incremental or paradigmatic. It considers incremental changes as a movement along the trajectories and paradigmatic changes as involving changes in the frontier itself. Paradigmatic changes would lead to an increase in efficiency of the firms adopting it but this could raise the distance between the frontier and the average firms. The net result could be a decline in the average efficiency of the industry. An analysis of the results shows that certain industries have performed well in 2001 compared to 1991. These industries like automobiles, personal care or electronics have been characterized by product differentiation and strategic alliances. We find evidence that ownership of domestic firms by MNEs clearly helps in enhancing the efficiency of these firms. Further-more, strategic alliances with these MNEs (as opposed to ownership) also help domestic firms to attain higher levels of efficiency. These results highlight the success o f some of these policies in enhancing the competitiveness of Indian firms in the face of global competition. Significantly, while linkages with foreign R and D by domestic firms has no such effect. This seems to indicate that Indian firms are relying

[20] Saon. Ray (2004): "MNEs Strategic Alliances and Efficiency of Firms: Emerging Trends", *Economic and Political Weekly*, Vol.39, No.5, pp. 434-440.

more on acquiring best practice knowledge from foreign firms, rather than developing it indigenously. These are some of the important lessons that can be learnt about the behavior of Indian manufacturing firms in the context of increases in their efficiency levels. As a result of such increases in firm level competitiveness, the industrial sector is bound to be more resilient to competitive shocks that are an inherent aspect of globalisation. However, there is clearly scope for more reforms that can make the process less dependent on foreign firms and encourage in-house development of more efficient ways of production.

Das, D. K. (2004)[21] examines the productivity performance of Indian manufacturing under varying trade regimes. The analysis focuses on the overall period of 1980-2000 and four sub-periods to reflect the shifts in trade policy regime. There is no evidence of much change in total factor productivity growth following liberalisation of the regime initiated in the early 1990s. As in the 1980s, factor accumulation rather than productivity growth accounts for most of the output growth during this period. TFP growth in the 1990s is found to be lower than in the 1980s. The worsening of TFP growth rate in the 1990s for a vast majority of industries seems perplexing, as this was the phase when substantial and far-reaching trade reforms encompassing the lowering of both tariff and non-tariff barriers were initiated. Two possible explanations for the slowdown in TFP growth may be offered. First, industrial production in 1990-91 and 1991-92 was constrained by factors such as import compression, tight-money policy, inflationary pressures and fiscal contraction initiated by the government as part of the macroeconomic stabilisation programmes. These led to a recessionary trend in the manufacturing sector. Second, mergers began to pick up only towards the end of the 1995 and constraints operate in the functioning of the labour markets, particularly the exit policies that ought to supplement the trade liberalisation attempts. In addition, it should be noted that available evidence from various countries shows that the beneficial impact of trade liberalisation on productivity can take considerable time to show up after structural adjustment and industrial restructuring has taken place. This needs to be explored in future research.

[21] D. K. Das (2004), "Manufacturing Productivity under Varying Trade Regimes, 1980-2000", *Economic and Political Weekly*, Vol. 39, No. 5, pp. 423-433.

Hacer, K. Ansal (1990)[22] analyses the experience of three Turkish truck manufacturing firms under import substitution and export-oriented industrialization strategies. He identifies some of the factors which influence their technological efforts, and examines the rate and nature of technical change generated in the firms. By exploring firms' production performance and technological efforts in a broader macro-economic context, the work highlights the effects of industrialization policies on the nature, rate and impact of technical change. It is widely accepted that technical progress is a crucial element in economic development.

2.5. Studies dealing with Growth and Productivity Analysis of Industry

"Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker (Krugman, Paul 1994)". Measures of productivity constitute core indicators for the analysis of economic growth. However, there are many different approaches to productivity measurement. Productivity growth is the basis for improvements in real incomes and welfare. Slow productivity growth limits the rate at which real incomes can improve, and increases the likelihood of conflicting demands concerning the distribution of income. Measures of productivity growth and of productivity levels therefore constitute important economic indicators.[23]

Fuss, M.A and L. Waverman (1985)[24] calculate and analyse the automobile industry's cost and productivity experience during the 1970's in Canada, the United States and Japan. Utilising an econometric cost function methodology, they are able to isolate the major source of short-run disequilibrium in this industry variation in capacity utilisation and analyse its effects on cost and total factor productivity (TFP). Two striking empirical results emerge. First, TFP grew much faster in the Japanese automobile industry than in the Canadian and U.S. industries. Second, the importance in analysing variations in capacity utilisation is confirmed by the fact that failure to correct for this source of

[22] Hacer K. Ansal (1990), "Technical Change and Industrial Policy: The Case of Truck Manufacturing in Turkey", *World Development*, Vol.18, No.11, pp.1513-28.
[23] P. Schreyer and D. Pilat (2001), "Measuring Productivity", OECD Economics Studies, No. 33, 2001/11.
[24] M.A. Fuss and L .Waverman (1985), "Productivity Growth in the Automobile Industry, 1970-1980: A Comparison of Canada, Japan and the United States, NBER, WP. No.1735.

productivity change would have led to a underestimate of long-run TFP growth in Canada and a underestimate for the United States.

Balakrishnan, P. and K. Pushpangadan (1994)[25] raise the question on the validity of TFPG estimates obtained on the basis of single deflation method of measurement of real value added. They argue that the single deflation method of real value added yields bias in the estimates of TFPG especially in the presence of non-consistency of index of relative price of raw materials. This work provides estimates of total factor productivity for aggregate manufacturing having adjusted for changes in these relative prices for the period 1970-1971 to 1988-1989, which were based on the double deflation method of measurement of real value added. This show that, contrary to that is believed, productivity growth in the 1980s may actually have been slower than in the earlier period.

Beghel, L.M.S. and Pendse (1997)[26] tried to analyse productivity trends and statistical estimation of production function and technical change in the manufacturing sector in India. The ASI data for the period 1973-74 have been used for computing Solow and Kendrick indices of TFP growth along with partial factor productivity indices of labour, capital and raw material and econometric estimation of Cobb-Douglass, CES and VES production function. The analysis reveales that the Indian manufacturing sector has not experienced technological change which was evident from the growth rates of TFP growth indices as well as parameters of time variable in the production functions. The excessive doses of capital have not resulted in technological progress in Indian manufacturing sector because the capital intensity is found to be increasing all the time. They suggest that there is a need to promote R&D efforts in the manufacturing sector of India so that it may survive in the newly emerging era of globalisation and liberalisation.

Seema Sharma (2006)[27] analyses the performance of the Indian automobile industry with respect to the productivity growth through growth accounting approach in post liberalisation period. Partial and total factor productivity of the Indian automobile industry have been calculated for the period from 1990-91 to 2003-04, using the Divisia-Tornquist

[25] P. Balakrishnan and K. Pushpakandan (1994), "Total Factor Productivity Growth in Manufacturing Industry: A Fresh Look", *Economic Political Weekly*, Vol. 29, No. 31, pp. 2028-2211.

[26] L.M.S. Beghel and Pendse (1997), "An Econometric Analysis of Productivity Growth and Technical Change in Total Manufacturing Sector of India", *The Indian Economic Journal*, Vol.44, No. 2, pp. 39-58.

[27] Seema Sharma (2006), "A Study on Productivity Performance of Indian Automobile Industry: Growth Accounting Analysis.

index for estimating the total factor productivity growth. The author finds that the domestic automobile industry has registered a negative and insignificant productivity growth during the last one and a half decades. Among the partial factor productivity indices only labour productivity has seen a significant improvement, while the productivity of other three inputs (capital, energy and materials) have not shown any significant improvement.

Pradhan and Barik (1999)[28] captured the TFPG during the period 1963-1993 for aggregate manufacturing sector and eight selected industries by estimating the translog cost function. The scale factor of aggregate Indian manufacturing sector was found to be less than unity and declaration in scale factor during the 1980s has been noticed. Except pulp and paper, a declaration in scale factor has been found in all selected industries in 1980s for aggregate manufacturing sector and most of the individual industries, a declining trend in technical change has been noticed in recent years. On the whole, a decline trend of TFPG in Indian manufacturing sector both at aggregate and disaggregate levels has been noticed. They observed that a decline in both scale economies and technical change seems to have produced the present character of TFPG, although decline in the latter does not appear to be as sharp as the former.

2.6. Studies on the Relationship between Growth and Profitability

Growth theory of the firm suggests that profits and growth of the firm are interrelated. The company plans to earn a certain amount of profit determined by the amount of investment that it intends to undertake. Profits in turn provide internal funds and incentive for investment and growth. A fundamental assumption of this theory is that the goal of a firm is to cause its sales to grow as rapidly as possible, subject to the constraints imposed by the growth of demand, growth of capacity and the availability of finance for investment.[29] In the Marris (1964) framework,[30] there is a direct relationship between profitability and growth because profitability determines a firm's ability and willingness to grow. This is

[28] G. Paradhan and K. Barik (1999), "Total Factor Productivity Growth in Developing Economics: A Study of Selected Industries in India", *Economic and Political Weekly*, pp. M92-M97.

[29] Adrian Wood (1975), " *The Theory of Profit*", Cambridge University Press, p.62

[30] In the original Marris model, there is an optimum growth path and it deals with demand for and supply of growth functions. While the supply of growth function assumes a direct relationship between profitability and growth, the demand for growth expects an inverted U shaped relationship between profits and growth. Marris presents a simultaneous relationship between growth and profitability. Siddharthan et al (1994) developed the Marris framework and analysed growth-profit determinants for large Indian frims. The present analysis tests the hypothesis that growth is a linear function of profit-margins.

because higher the level of profits, better would be the position of the firm to grow and higher the level of current profitability better would be the position of the firm to raise external funds on favourable terms.

Aggarwal, R. N. (1991)[31] used Tobin q as an indicator of profitability to explain the investment behaviour of Indian automobile manufacturing industry. He made an analysis for automobile industry using firm level data from Bombay Stock Exchange Directory. The industry was divided into two sectors i.e. car sector and non car sector. The two sectors are not significantly different from one another with respect to fixed investment behaviour. The study revealed that the value of Tobin q has remained less than unity throughout the period of study. Further, it is found that q is a significant determinant of investment behaviour. The explanatory power of the investment equation was improved by using Tobin q instead of the traditional use of profit rate as explanatory variable. Besides q other important determinants of investment were found to be the availability of internal and external sources of funds, age of the firm, lagged investment, imports, tax planning and industrial policies of the government. Profit theory turned out to be relatively more relevant than any of other theories.

Siddharthan, N.S., B.L. Pandit and R.N. Aggarwal (1994)[32] analysed inter-firm variations in performance for the large Indian private corporate firms using the Marris managerial framework with certain modifications and extensions. This work used the Marris managerial framework to analyse growth, profits, investment rates, inventory investment rates, external financing and dividend rates. It was found that inter firm variability in investment behaviour could be on account of factors such as liquidity position of a firm largely determined by profits, availability of external finance, tax planning past investment commitments, age of the firm, demand conditions facing a firm, and industry specific factors. Growth of sales did not turn out to be important. This study also included certain technology output variables like royalty, lump sum and technical fee receipts, awards won for R & D activities, and patents registered – in the determination of growth and profitability of firms. The result of their econometric exercise revealed that while foreign

[31] R.N. Agarwal (1991), "Profitability and Growth in Indian Automobile Manufacturing Industry" *Indian Economic Review*, Vol. XXVI, No.1, pp.82-97

[32] N.S. Siddharthan, B.L. Pandit and R.N. Agarwal (1994), "Growth and Profit Behavior of Large-Scale Indian Firms", *The Developing Economics*, XXXII-2, PP. 188-209.

equity participation and technology import through the market has a significant positive influence on profit, but did not turn out to be significant in explaining growth. On the other hand, technology receipts turned out to be important in explaining growth of sales. The other two technology factors, namely, awards won for R & D and patents did not emerge significant in determining either growth or profits.

Shepherd (1972)[33] examines the effects of market share, four firm concentration ratio, absolute size of firm, advertising, sales ratio and estimated barriers to entry on after tax return on equity of 231 large U.S. corporations for the period 1960-1969. He finds that the rates of return closely related to the market shares of the firms rater than concentration and entry barriers. The second study examines the relationship between price-cost margin and concentration ratios, size of the firms (sales) and advertising intensity for all four digit U.S. manufacturing industries. The margins were found positively associated with concentration and advertising intensity.

Gale (1972)[34] states the effect of market share on the rate of return of selected firms operating in different market environment using data of the 106 firms. He explores that high market share is associated with high rates of return and the effect of share on profitability depends on other firm and industry characteristics such as degree of concentration of and rate of growth in the industries in which the firm competes and on the absolute size of the firm. He also finds the relation between rate of return on equity and the equity to capital ratio (a measure of risk in an inter-industry of sample of firms) to be positive and significant.

2.7. Studies on Growth Theory

Growth is an important dimension of a firm whether it is small or a large one. Maximization of growth may be the goal of a firm or an instrument to achieve some other goals like maximization of profits and sales or managerial utility. To begin with the search of the replies to the need for growth, let us first examine the desirability of growth at macro level. There is no doubt about the fact that every country in the world irrespective of its political ideology, pattern of economy, and size, aspires for rapid economic growth.

[33] William G. Shepherd (1972), "The Elements of Market Structure", *The Review of Economics and Statistics*, Vol. 54, No. 1, PP. 25-37.

[34] B. T. Gale (1972), "Market Share and Rate of Return", *The Review of Economics and Statistics*, PP. 412-423.

This means growth of the economy of the country.[35] There are few important theoretical contributions for the growth of the firm. But before doing this, let us go through the concept of the 'firm' again as this will help us in understanding the growth theories of the firm in clear perspective. Major contributions in the theory of growth of the firm came from Downie[36], Penrose[37] and Marris[38].

Downie's theory of the growth of the firm emerges incidentally from his theory of the competitive process as a whole and is set firmly within this broader context. The relationship between growth and profitability is explored by analysing the interaction between the two external restraints, financial and demand. In his book The Competitive Process, Downie is mainly concerned with analysing the way in which alternative forms of market structure and conventions governing business behaviour, which he calls as 'rules of the game', affect the dispersion of efficiency between and the rate of technical progress. His theory of growth of the firm is a by product of this analysis. According to him, in an industry, which he defines as a group of firms having similarity of technical progress, there will be a dispersion of efficiency across the firms, i.e., some firms having greater efficiency than the industry average and some lower than this. The source of variation in efficiency (measured in terms of unit costs) across the firms is attributed to their technical progress by Downie. Given the competitive environment and assuming that the firms pursue the growth maximization objective, the process of growth of the firms in Downie's model starts with the postulation of the steady encroachment on the market share of the less efficient firms by the more efficient firms.

In (Penrose's Theory), in her major theoretical work "The Theory of the Growth of the Firm" (1959), Penrose conceives of the modern industrial firm as an administrative organisation that uses the services of physical and especially human resources to make profits and grow. Five attributes of her theory illuminate the managerial firm's role in technological change. Penrose's most basic proposition is that the firm aims at growth. This dynamic focus differs sharply from neoclassical economic theory, with its eye fixed on the static allocation of resources. Penrose translates the static question—the limits to firm size

[35], R. R. Barthwal (1984), "*Industrial Economics*", Wiley Eastern Limited
[36] J. Downie (1958) "*The Competitive Process*", Duckworth, London,
[37] E. Penrose (1959), "*The Theory of the Growth of the Firm*", Blackwell, Oxford.
[38] Robin Marris (1964), "*The Economic Theory of 'Managerial' Capitalism*", Macmillan, London,

into the dynamic one of the limits to firm expansion. Firms can expand indefinitely, so there is no optimal size. The firm is an entity in process; its size at any time is the outcome of its past growth, and its structure is the basis for future growth.

In understanding growth, Penrose focuses on the internal capabilities of the firm. For her, growth should be thought of as "an internal process of development leading to cumulative leading to cumulative movements" in particular directions [1959, p.1]. She, of course, recognizes the growth of the firm can be limited by external factors such as product or factor markets and the behaviour of other firms. But she holds that resources internal to the firm and the "self conception" emerging out of the practice of the firm are fundamental determinants of growth. According to Penrose, innovation will follow lines created by the firm's strengths, principally its production technologies and marketing systems. Firms will thus innovate where they have advantageous technological and marketing knowledge, which reduces their risks and costs of innovating relative to other firms. Competition makes innovation imperative, and technological change is required for the survival and growth of the firm. She makes the internal, managerial restraints, in centre of her analysis.

Penrose's theory has been criticized for lack of rigorous in the specification of some of the relationships embodied in it, especially for her identification of the objective of maximum long run profit with that of maximum long-run growth. She emphasizes above all the long run, strategic aspects of managerial activity –diversification innovation and merger.[39] Penrose's work is an important contribution in the theory of the firm. Her analysis is very much complex but rigorous and formal. The effect of the managerial restraint on growth of the firm as postulated by Penrose is well known as the 'Penrose effect'. She emphasizes much on the variables for growth of the firm which are non-economic and often difficult to quantify. But her ideas on the process of the growth of the firm are logically consistent. Subsequent works on the theory of the firm used them without any challenge. However, there is a serious drawback in her work. She has neglected financial and other external constraints on growth of the firm. Her work can be called as an organisational theory of the growth of the firm rather than an economic theory of the firm as argued by Marris[40]

[39] P.J.Devine, Jones, R.M. Jones, N. Lee and W.J.Tyson (1976), "*An Introduction to Industrial Economics*", George Allen and Unwin Ltd., London.

[40] R.R. Barthwal (1984), "*Industrial Economics*", Wiley Eastern Limited, p. 351.

Marris's major original contribution to the theory of the growth of the firm is his elaboration of the nature of the financial restraint. The original purpose of this work was to attempt a survey and to consolidate the economic theory of the large, growing corporation as this has developed since the publication of managerial capitalism and to relate the synthetic result to the various problems with which both phases of the present project are concerned. Managerial Capitalism was mainly the internal growth problems of the individual corporation in a generally 'modern institutional environment, described and interpreted from his view point.[41]

In his original model, Marris advocates that corporate growth, '*g*' could be manipulated to maintain an optimum dividend-to-profit retention ratio that keeps the shareholders satisfied but does not retain too high a level of profit, creating a cash-rich business ripe for a take-over. This implies a degree of control on share value that would seem difficult to sustain for even the most effective management team. However, it has been argued that there are simply too many other factors that could affect the valuation ratio of the business beyond corporate growth. Deciding on how best to achieve growth becomes a crucial issue for management during the life cycle of a firm. For example, if a management wishes to grow by product diversification there is a constraint inherent in the Marris model, the *gd* equation that is fairly acute for firms that choose to grow through product diversification rather than by acquisition:

$$gd = f.(d, k)$$

where *d* is the dividend rate and the parameter *k* represents the percentage of successful new products. The *k* parameter ultimately depends on R&D, advertising and promotion; the expenditure on these variables depends on the profits that ultimately depend on the efficiency of the firm. There is a benchmark rule: the higher the valuation of a company the less likely is the threat of takeover. This rule, however, intimates that dividends should stay high to maintain the share price. Alternatively management may wish to invest more profits to secure more growth with a risk that the value of the company falls. Management inability to persuade shareholders gives rise to agency costs.[42]

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[41] Robin Marris and Adrian Wood. (1973), "*The Corporate Economy: Growth, Competition and Innovation Power*", The Macmillan Press Ltd.

[42] Robin Marris (1964), ibid.

2.8. Competitiveness of Automobile Sector

Vision to develop core competencies can only keep a firm front runner in the race of competitiveness, which can only be based on competitive advantage. A firm essentially relies on technological strength to achieve sustainable competitive advantage while it seldom depends on market forces, which are highly dynamic in nature, and beyond one's control.[43]

Sustained increase in competitiveness of an economy is a hallmark of economic strength and stability of that economy. Worldwide, there has been an increasing awareness, especially among emerging market economies (EMEs) about the need to strive for improved competitiveness to face the realities of the globalised trading environment. In the case of India, such recognition is reflected during the recent years, particularly in the constitution of National Manufacturing Competitiveness Council. At micro level, it is relatively easy to define competitiveness of a firm, which is the ability to do better than comparable firms in sales, market share or profitability, but competitiveness of a country is interpreted broadly on development or growth strategy. Thus, a country may be termed competitive if it is able to sell its products at a lower (or same) price and earn the same (or higher) return as its competitors.[44]

There are several interpretations to the concept of competitiveness for which some distinctions have to be made. The most fundamental distinctions is being the difference between microeconomic and macroeconomic concepts. Competitiveness can be observed from different perspectives, through products, firms, industry and branches of the economy or national economies. One of the immediate problems in analysing competitiveness is that despite widespread acceptance of its importance for economic performance and growth, no consensus exists on its definition and measurement. The term competitiveness is defined as 'the ability to compete in markets for goods or services' and explains it as 'an aggressive willingness to compete'. Competitiveness can be observed from different perspectives, through products, firms, industry and branches of the economy or national economies. At

[43] Z. Husain, Sushil and R. D. Pathak (2002), "A Technology Management Perspective on Collaborations in the Indian Automobile Industry: A Case Study", *Journal of Engineering and Technological Management*, Vol., 19, pp. 167-201.

[44] Lakshmanan S. Chinngaihlian and Raj Rajesh, (2007), "Competitiveness of India's Manufacturing Sector: An Assessment of Related Issues", Reserve Bank of India Occasional Papers, Vol.28, No. 1, pp.33-77.

each level of aggregation, there are different measures or indicators of competitiveness. The second issue relating to competitiveness is the distinction between one-dimensional and multi-dimensional concepts, relating to the number of dimensions it integrates and measures. The number of dimensions included in its measurement can be seen as a mark of complexity of the concept (Siggel 2003).[45]

One of the interesting attempts to capture more than one dimension of firm competitiveness was made by Buckley et al. (1988)[46]. According to them, "a firm is competitive if it can produce products and services of superior quality and at lower costs than its domestic and international competitors. Competitiveness is synonymous with a firm's long-run profit performance and its ability to compensate its employees and provide superior returns to its owners." Of the micro indicators assessing the multi-dimensionality of the concept of competitiveness, the best-known attempt was made by Porter (1990) in his 'Diamond Framework'. He identified four main determinants of competitiveness of enterprises as their strategy, structure and rivalry, the demand conditions they face, the factor supply conditions they encounter, and the conditions of related industries. Although there are a multitude of factors that influence the competitiveness of firms, Porter classified those under four above mentioned facets only.[47]

Gelei, A. (2003)[48] defines firm competitiveness as 'the basic capability of perceiving changes in both the external and internal environment and the capability of adapting to these changes in a way that the profit flow generated guarantees the long-term operation of the firm.' As to him, firm competitiveness is basically a function of two factors. First, it is determined by the extent a company can identify those value dimensions that are important for their customers. These are the main features of the firm's complex product and service package a customer expects. The second factor of firm competitiveness is the sum of resources and capabilities that make a firm capable to create and deliver the identified

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[45] S. Eckhard (2003), "Concepts and Measurements of Competitiveness and Comparative Advantage: Towards an Integrated Approach", Paper Prepared for the International Industrial Organisation Conference at Northeastern University, Boston, Massachusetts.

[46] Peter J. Buckley, Christopher L. Pass, and Kate Prescott (1988), "Measures of International Competitiveness: A Critical Survey", *Journal of Marketing Management* 4 (2).

[47] M. E. Porter (1990), "*The Competitive Advantage of Nations*", New York: Free Press.

[48] Andrea Gelei (2003), "Competitiveness: A Match between Value Drivers and Competencies in the Hungarian Automotive Supply Chain, Budapest University of Economic Sciences and Public Administration, Hungary.

important value dimensions for the customer. The competitiveness is the ability to produce the right goods and services of the right quality, at the right price, at the right time. It means meeting customers' needs more efficiently and more effectively than other firms'. (U.K. Government, Department of Trade and Industry, 1994)

Another significant discussion on the concept of competitiveness of firms was published by ADB (2003)[49]. It states that competitiveness can be defined as a firm's ability to survive under competition and being competitive implies succeeding in an environment where firms try to stay ahead of each other by reducing prices, by increasing the quality of their current products and services, and by creating new ones. A firm's competitiveness can thus be examined as a function of factors such as its own resources, market power, behaviour toward rivals and other economic agents, capability to adapt to changing circumstances, capability to create new markets, and the institutional environment, largely provided by the government, including physical infrastructure and the quality of government policies.

OECD defines competitiveness as the degree to which a nation can, under free trade and fair market conditions, produce goods and services, which meet the test of international markets, while simultaneously maintaining and expanding the real incomes of its people over the long-term. The World Economic Forum (WEF) defines competitiveness as the ability of a country to achieve sustained high rates of growth in GDP per capita. According to National Competitiveness Council (in USA), competitiveness is the ability to achieve success in markets leading to better standards of living for all.

Narayanan, K. (1998)[50] has attempted to analyse the effects of de-regulation policy, introduced in India during the mid 1980s, on technology acquisition and competitiveness [defined in terms of market share changes] in the Indian automobile industry during the 1980s. Following evolutionary theoretical framework, the paper argues that asymmetry among firms in terms of technology acquisition through technology imports and in-house efforts explain much of the firm level differences in competitiveness. Asymmetry in technology acquisition is largely due to differences in the firms' ability to bring about technological paradigm and trajectory shifts. The results of the econometric exercise

[49] Asian Development Bank (2003), "Competitiveness in Developing Asia: Taking Advantage of Globalisation, Technology, and Competition in Part 3", Asian Development Outlook, Manila.

[50] K. Narayanan (1998), "Technology Acquisition, De-regulation and Competitiveness: A Study of Indian Automobile Industry", *Research Policy*, Vol.27, No.2, pp. 217-230.

support the view that, even in an era of capacity licensing, development of competitive skills crucially depended upon the ability to build specific technology trajectory advantages. This is achieved by successfully complementing imported technology with in-house technological efforts. Competitiveness in a de-regulated regime would, however, depend upon the ability of the firm to bring about technological paradigm shifts. New firms who depended on intra-firm transfer of technology and firms with in-house R&D efforts, to accomplish paradigm shifts, appear more successful. Further, in a liberal regime, advantages of vertical integration over sub-contracting also appear to be important in the determination of competitiveness.

Narayan, B.G. and Pankaj Vashisht (2008)[51] analyses the determinants of competitiveness in the Indian auto industry. It is based on a field survey and a quantitative analysis of secondary data. The field survey covers 45 firms all over India, of which 31 are auto-component firms and 14 are Original Equipment Manufacturers (OEMs). From 2001-02 to 2005-06, the Indian automobile sector has grown at an average annual rate of over 18 per cent in terms of value of output at constant 1993-94 prices and the auto-component sector has grown at about 26 per cent. During the same period, in terms of domestic sales in numbers, two-wheelers have grown at over 13 per cent per annum; three-wheelers at more than 15 per cent commercial vehicles at about 25 per cent per annum and the number of passenger vehicles by 17 per cent per annum. In the econometric analysis, foreign equity participation is found to be correlated with technical efficiency. Therefore, both centre and state governments should create a conducive environment for attracting more FDI. Product diversification and higher export turnover significantly enhance market shares and promotes competitiveness. Though foreign equity participation is insignificant in influencing competitiveness, foreign collaboration has a significantly positive effect on market share at all levels. Hence, foreign collaboration enhances competitiveness.

Burange L.G. and Shruti Yamini (2008)[52] argue that although opening up of the economy in early 1990's gave the much-awaited impetus, the Indian automobile industry has grown in last five years as never before. Well supported by the changing economic conditions

[51] B. G. Narayan and Pankaj Vashisht (2008), "Determinants of Competitiveness of Indian Auto Industry", ICRIER, Indian Council for Research on International Economic Relations, WP. No. 21.

[52] L. G. Burange and Shruti Yamini (2008), "Competitiveness of Firms in Indian Automobile Industry", WP. No: UDE (CAS) 23/ (8)/1/2008.

particularly in the financial sector and in foreign direct investment, increasing number of global players are entering Indian economy by way of joint ventures, collaborations with the domestic firms or wholly owned subsidiary, which has led to increase in competition among firms in the industry. The competitiveness among the firms in Indian automobile industry has been assessed by understanding the factors that determine its competitive advantage. The efforts have been made to construct a competitiveness index for a sample of fourteen firms for the year 2005-06, which represents around 85% of each segment of the industry namely passenger vehicles, commercial vehicles, three-wheelers and two wheelers. About 50% of the sample firms have recorded above industry average performance from all the segments of the automobile industry. The marginal difference between the competitiveness of different firms reveals the tough competition among the firms in the automobile industry in India.

Ministry of Heavy Industries and Public Enterprises (2006)[53] explained the present status (capacity, production, consumption, imports and exports) with special focus on its potential and challenges and to estimate demands for 2007-2011. Even with this rapid growth, the Indian automotive industry's contribution in global terms is very low. R&D investment is needed for innovations for achieving and retaining the competitiveness in the industry.

Bowonder, B. (1998)[54] presents an overview of the Indian automotive sector. Then it analyses the competitive and technology strategies used by the Tata Engineering and Locomotive Company (TELCO). TELCO has become the largest commercial motor vehicle manufacturer in India using a long term competitive and technology management strategy. It has been able to compete based on its combined its commercial and technical strength. This work analyses the competitive strategy of TELCO in terms of productivity improvement, distribution network, manufacturing automation, strategic alliances and human resource development. The major focus of technology management at TELCO has been intensive R&D, concurrent engineering, standardization, and integration of manufacturing and design. The technology management involves intensive knowledge

[53] Ministry of Heavy Industries and Public Enterprises, (2006), "A Report of Working on Automotive Industry: Eleventh Five Year Plan (2007-2012), *Department of Heavy Industries*

[54] B. Bowonder (1998), "Competitive and Technology Management Strategy: A Case Study of TELCO." *Internarional Journal of Technology Management*, Vol.15, No. 6/7, pp. 646-680.

engineering, organisational learning and intensive R&D. TELCO has aligned its business strategy in such a way that it has been able to leverage its technical capability for realizing its vision, which, together with continuity of leadership, has facilitated the implementation of its strategic program.

2.9. Summary

This chapter has analysed and discussed the future developments in the Indian automobile industry by reviewing a number of drivers that are likely to shape the sector in the future. First, the automobile industry is one of the industries in India which has expanded rapidly over the reform years and typically accounts for a large and increasing share of industrial production, output, exports, and employment. It describes the previous evidences on structure of industry, market structure and liberalisation and growth performance of Indian automobile industry. This work gives an overview and review of government policies on industry development. This work also studies about the determinants dealing with growth and profitability analysis of Indian automobile industry. This chapter has identified factors that facilitate and inhibit the growth in the context of the Indian automobile industry. It has mainly explored the development of an industry that needs to consider several aspects of industry development such as size, structure, investment, growth, performance, competition, product variety, product quality, technology base, R&D, imports, exports and international competitiveness. Most of the studies conducted in automobile industry cover the U.S., Japanese and British automobile industries. These studies reflect activities and events of a particular time. The chapter begins by discussing economic integration, and discussing this in reference to theoretical information. Globalisation, foreign direct investment, inputs, outputs, and policy framework are all discussed in reference to India's economic integration into the global economy. This also discusses the benefits of technology brings to economic integration. The relationship between technology and industry was for a long time understood as a linear relationship where the industrial structure affected the technological advancement.

This work provides brief rationale for studying productivity growth. Productivity and efficiency will be the watchwords in the Indian automobile industry. In sum, a central observation emerging from this literature is the general supposition that a firm's business model, which mainly indicates the way in which a firm decides to compete in its respective

market, should influence the relative persistence of profit margins. This also brings studies, focusing on discussion of relevant theoretical and technical and empirical issues dealing with the growth and productivity measures. The research questions and objectives are outlined clearly here. Details regarding the theoretical framework and methodology are provided in Chapter III. We note that a substantial body of theoretical and empirical studies has examined the relative persistence of contemporaneous conditional on various factors.

Chapter III

Theoretical Models dealing with the Automobile Market, Growth, Competitive Structure, and Productivity of Automobile Industry

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Theoretical Models dealing with the Automobile Market, Growth, Competitive Structure, and Productivity of Automobile Industry

3.1. Introduction

The theoretical framework used in this chapter comes from several strands, but all seek to explain how industries evolve. In this chapter, we consider certain details regarding methodology and the model used in the present context. This chapter reviews theoretical models and describes the estimation procedure. The main contribution of this study is a theoretical framework and empirical estimation explaining the behavior of the manufacturers.

This is followed by analysis of our empirical results. This applies to consumer demand theory, growth, competitive analysis, and forecasting to understand trends in the automobile industry. It consists of statements about three components: demand, supply and market equilibrium. This study considers several aspects of industry development such as size, structure, investment, growth, performance, competition, product variety, product quality, technology base, R&D, international competitiveness and so on.

This chapter focuses on the methods of automobile demand estimation to analyse the factors that influence it. This work is focused on automobile demand without taking into account differences in quality characteristics of different model types. It defines the nature of industry product. The primary objective is to present a framework which enables one to obtain the demand and cost parameters for class oligopolistic differentiated product markets. This could be followed in terms of productivity, technological change, cost and price etc. Alternatively, one could analyse the financial performance in terms of profits, investment and the demand for external sources of funds. Both the procedures are applied in our study. The variables that capture the extent of market competition-related indices in each product market are market shares and Herfindahl indices which are being used in the present study. We examine the effects of these aggregated competition variables on the growth rates of productivity of firms. Market imperfections are typically examined by using the Hirschman-Herfindahl index (HHI). Firms differ widely with respect to size, structure, production activity and specialization under different objectives such as survival,

growth, stability and profit maximization. However, profit behavior is the most essential aspect because different objectives of the firms have ultimately a bearing on profits which is the least imperfect measure of efficiency. Productivity and productivity ratios are good indicators of trend changes in productivity. The productivity improvements along with the growth in production helped automobile industry to become more competitive. Various productivity measures can be computed, depending on treating of inputs and outputs. Total factor (or mullti-factor) productivity ratios are computed in terms of value-added approach. Here, two major approaches are used to measure TFP i.e. growth accounting approach and production function approach. Total factor productivity (TFP) in this study has been measured by using three different methods such as of Kendrick Index, Solow Index and Divisia Index.

3.2. Nature of Industry Product

The most important structural features of the industry are buyer demand, the nature of the product, number of rival sellers and their relative size (concentration), barriers to new competition, and extent of the economies of scale. It is crucial to state the target of the automobile industry is demand. The demand for automobile product is a differentiated good. The problem of heterogeneity in model types will be circumvented by recognizing the fact that implicit markets for automobile characteristics exist, which necessitates the estimations of demand functions for individual characteristics. The model treats automobile product type as if it were a scalar, called 'quality'. All consumers agree as to which automobiles are of high quality, but differ in their willingness to pay for auto quality. This heterogeneity of tastes is essential to the demand side of the model; we don't estimate the number of autos a single consumer buys, but rather the number of consumers who find a particular auto model optimal. On the supply side, the model recognizes the multiproduct nature of the automobile firm. Each firm picks a vector of prices for its many products, taking the prices of all other firms as given. Strong functional form assumptions are made about the cost function and about the distribution of tastes across consumers. Under these assumptions, the equilibrium prices and quantities of all products can be explicitly calculated.[1]

[1] Timothy F. Bresnahan (1981), "Departures from Marginal-Cost Pricing in the American Automobile Industry: Estimates for 1977-1978", *Journal of Econometrics*, Vol. 17, No. 2, pp. 201-227.

We will focus on three key structural elements: the nature of the product, the size distribution of firms and the barriers to entry (including economies of scale). Product and buyer characteristics are clearly an important determinant of industry behaviour. The automobile is a large, expensive, technically complex durable good. The demand for new automobiles does appear to be moderately sensitive to prices and fairly sensitive to incomes. The automobile is a technically complex product, and most consumers do not have the time or the inclination to become expert in its technical aspects. Considerations of styling, comfort, previous experience, reputation and price are the important considerations in comparative choices among cars. Overall, the demand for automobiles is highly variable. Demand is cyclical, as befits an income-sensitive commodity. Individual producers face these swings, plus the vagaries of consumer tastes with respect to particular styles and models.

3.3. Automobile Market: Automobile Demand and Supply

The model discussed here is based on the standard economic model of consumer choice and the theory of the firm. Consumers are presumed to be utility maximizers and firms are presumed to be profit maximizers. These two maximization principles lead to a set of prices and output revealed in the marketplace, reflecting demand and supply conditions in each market. A number of variables determine consumer demand for automobiles within specific submarkets. Presumably, the quantity demanded by a specific size of automobile should be a function of its price, of measures of the level of national economic activity, and of the prices of complements and substitutes. In addition, relative styling or technological changes can be expected to affect demand.[2] For the purpose of analysis, it is convenient to group the independent variables into five broad categories: price (P_i), the prices of substitutes (P_s), the prices of complements (P_c), measures of the economic environment (E), and other factors (F). The demand for the i^{th} size automobile can be expressed in brief form as shown in the following equation:

$$D_i = f(P_i, P_s, P_c, E, F) \qquad (3.3.1)$$

In Equation (3.3.2) supply for the ith size car is modeled as a function of its price (Pi), a vector of prices corresponding to input prices (PA), and the level of technology (T):

[2] James Wetzel and George Hoffer (1982), "Consumer Demand for Automobiles: A Disaggregated Market Approach", *The Journal of Consumer Research*, Vol. 9, No. 2, pp. 195-199.

$$S_i = f(P_i, P_A, T) \qquad (3.3.2)$$

The Rosen (1974)[3] model focuses on the market for a good that can be completely described as a bundle of n objectively-measured characteristics, assumed to be positively valued by consumers. The good is assumed to be indivisible (one cannot buy fractional amounts of any particular brand), and each consumer is assumed to buy not more than one unit at a time: these assumptions make the model more applicable for durable goods. The major simplifying assumption, however, is that alternative brands of the good are available for a continuous range of characteristics. The consumer's and producer's problems can, therefore, be framed directly in terms of characteristics of the good without reference to alternative brands.

The consumer is viewed as choosing a bundle of characteristics, $z_1,\ldots,z_z$, of the good, and a quantity of all other goods, Y, so that the utility that can be obtained from his budget is maximized. The consumer's maximization problem may, therefore, be stated as:

$$\text{Maximise } U(z_1,\ldots,z_n,Y), \qquad (3.3.3)$$

$$\text{subject to } P(z_1,\ldots,z_n)+Y=K,$$

Where $U(z_1,\ldots,z_n,Y)$ is the consumer's utility function; $P(z_1,\ldots,z_n)$ is the price of each alternative bundle of characteristics; K is the consumer's income; and Y, the aggregate of other goods. Except that the choice refers to characteristics rather than goods, and that the functional relation between prices and characteristics in the budget constraint is generally nonlinear, this problem is very similar to the traditional utility maximization model in economics. The first order condition that result from Equation (3.3.3) requires that $U_{zi}/U_{zj} = P_{zi}/P_{zj}$ for all pairs of characteristics, where U_{zi}, P_{zi} are the partial derivatives $\partial U/\partial z_i$, $\partial P/\partial z_i$, etc. That is, the ratios of the marginal utilities of each pair of characteristics must be equated with the ratios of their marginal prices, where marginal prices define the extra amount the consumer has to pay for an additional unit of a given characteristic. Each producer of the good is faced with two fundamental decisions: (1) choice of a bundle of attributes $z_1,\ldots,z_n$ to produce; and (2) number of units of that

[3] Sherwin Rosen (1974), "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition", *Journal of Political Economy*, Vol. 82, pp. 34-55.

particular bundle to manufacture. Producers are assumed to be competitive in the sense that they cannot affect the growing market price of any bundle of attributes by their individual production decisions. In order for this assumption to hold, the usual conditions for perfectly competitive markets must apply: no entry restrictions and no economies of scale in producing additional units of a given attribute bundle. Firms are assumed to maximize profits. Thus, each producer solves the following maximization problem:

$$\text{Maximise } \pi = MP(z_1,\ldots,z_n) - C(M,z_1,\ldots,z_n), \tag{3.3.4}$$

where π is profit, M is number of units produced, $P(z_1,\ldots,z_n)$ is the market price of each alternative bundle of characteristics, and $C(M,z_1,\ldots,z_n)$ is total cost. First order conditions for maximum profit are found by differentiating equation (3.3.4) with respect to M and $z_1,\ldots,z_n$ and setting the result equal to zero. The resulting first order condition for optimal choice of M (units to produce) is the familiar price equals marginal cost per unit condition: e.g., $P(z_1,\ldots,z_n) = C_M$. First order conditions for each of the n characteristics require that $P_{zi} = C_{zi}/M$. In other words, the producer chooses $z_1,\ldots,z_n$ so that the marginal price of each characteristic is equated with the unit cost of incorporating a marginal amount of that characteristic into the good. For each market transaction, this equilibrium requires that the value of an additional unit of any attribute to a consumer be equal to its marginal price, which, in turn, must be equal to the marginal cost to the producer of providing an additional unit of the attribute. Because of the diversity in consumer preferences and producer cost conditions, the attribute quantities and marginal prices at which these equilibria occur will differ from transaction to transaction.[4]

3.3.1. The Automobile Demand (Bresnahan 1987 Model)

It also develops techniques for analysing demand and supply in differentiated products markets and then applies these techniques to analyse equilibrium in the automobile industry. The demand for automobiles is modeled from a discrete choice framework of consumer. It followed Bresnahan's (1987) hypothesis that supply-side factors must have been responsible for the unusual pattern. In Bresnahan's model, consumers are

[4] Manoj K. Agarwal and Brian T. Ratchford (1980), "Estimating Demand Functions for Product Characteristics: The Case of Automobiles", *The Journal of Consumer Research*, Vol. 7, No. 3, pp. 249-262.

differentiated over a continuous (one-dimensional) spec-trum of preferences for car quality it develops the new estimates specification of the automobile investment-demand model and estimation of its parameters. They explained that a change in the gasoline price affects an automobile's equilibrium price via consumer demand.

In Bresnahan's model, consumers are differentiated over a continuous (one-dimensional) spec-trum of preferences for car quality. For households that purchase an automobile, their utility is linear and additive in automobile quantity and consumption of an outside good.

$$U(x,Y,v) = vx + Y - P \tag{3.3.1.1}$$

Here, x is a scalar representing vehicle quality, Y is a household income, and P is the car price. Heterogeneity in consumer preferences is captured by v, which is uniformally-distributed-tastes parameter with density $\delta \sim [0, v_{max}]$ that governs the marginal utility of car quality. Quality is in turn assumed to be a function of automobile characteristics, where the quality of vehicle j is

$$x_j = \sqrt{\beta X_j} \tag{3.3.1.2}$$

The vector X_j includes vehicle weight, length, horsepower, cylinders, and body type, and 'β' are parameters to be estimated. Compressing vehicle characteristics onto a single dimension have serious implications for demand and substitution patterns. Demand for vehicle $i, q_i,$ is determined by the density of consumers on the interval $\lfloor v_{hi} - v_{ij} \rfloor$,

$$q_i = \delta \lfloor v_{ij} - v_{hi} \rfloor, \tag{3.3.1.3}$$

Where v_{ij} represents the selected quality level of consumer who is just indifferent between product i and j. Note that for this consumer

$$P_j - x_j v_{ij} = P_i - x_i v_{ij} \tag{3.3.1.4}$$

And

$$v_{ij} = \frac{P_j - P_i}{x_j - x_i} \tag{3.3.1.5}$$

It follows that the own- and cross -price derivatives, respectively are

$$\frac{\partial q_i}{\partial p_i} = -\left(\frac{\delta}{x_i - x_h} - \frac{\delta}{x_j - x_i} \right) \tag{3.3.1.6}$$

and

$$\frac{\partial q_i}{\partial P_h} = \frac{\delta}{x_i - x_h}. \qquad (3.3.1.7)$$

Notice that these are functions only of price and quality of adjacent models on the quality spectrum.[5]

3.3.2. Factors of Automobile Demand

Before trying to suggest which of these factors are more important, it is desirable to define more precisely just what we sale mean by the "demand for automobiles" in the present study. By the "demand for automobiles" as we shall use the term, is meant that sales of new automobiles to consumers. Sales in a given year, of course represent a point at the intersection of a demand curve and a supply curve, at the quoted price. Here, "automobile demand" is taken as synonymous with sales which are defined as retail sales of new automobiles. 'Demand' is taken to denote actual purchases. Demand is used in the widest possible sense, as comprising the relation of the amount sold to the complex factors which determine it.[6]

Automobile purchasers typically buy one unit or none. The demand for automobiles is thus given by the number of buyers and not by the number bought by any hypothetical single consumer. Formally, we assume a continuum of potential buyers, differentiated by tastes. Each consumer chooses some automobiles or decides to buy none. Aggregating the decisions of all consumers yield the demand functions for automobile models. In this model, different consumers buy different autos not because of differences in income, but because of differences in tastes. The heterogeneity in taste is modeled in such a way as to yield a demand system for automobile models that is linear in prices. This requires strong assumptions.[7]

There are many studies concerned with automobile demand. This study develops a multi-equation to explain automobile demand in India. As expected, all these studies report that income is the prime determinant influencing automobile demand. Furthermore, price and income elasticity can be calculated to analyze relevant factors. Therefore, it is important to

[5] David Rapson (2009), "*Tacit Collusion in the 1950s Automobile Industry*? Revisiting Bresnahan (1987), Department of Economics, University of California.
[6] General Motors Corporation, (1939), "The Dynamics of Automobile Demand", New York.
[7] Timothy F. Bresnahan (1981), "Departures from Marginal-Cost Pricing in the American Automobile Industry: Estimates for 1977-1978" *Journal of Econometrics*, Vol. 17, No. 2, pp. 201-227.

explore and understand the development of the auto market in India, which explains this investigation of the factors influencing the India's auto demand in the period. The demand function indicates that quantity demanded is a function of number of different factors (McGuigan, Moyer, and Harris, 2005). The demand function can be represented as

$$Q_D = f(P, P^S P^C, Y, \ldots) \qquad (3.3.2.1)$$

where QD is quantity demanded of the good or service, P is price of the good or service, PS is price of substitute goods or services, PC is price of complementary goods or services and Y is income of consumers. In order to remain accurate to reality and to obtain the best possible combination of variables, we interpret the simple function representing influences on the automobile demand in India as follows. If QD is the quantity of automobiles demanded, P is the price of automobiles, PC is the price of complementary goods, Y is the income and R is the lending rate, the model can be written as:

$$Q_D = f(P, P^C, Y, R) \quad \text{ceteris paribus} \qquad (3.3.2.2)$$

QD represents the quantity of automobiles demanded. We use actual numbers for automobile sales to represent the quantity of automobiles demanded. P represents the price of automobiles. The price of automobiles could not be found, but since they are a very important durable good, we use the price index of durable goods as a proxy variable. P^C represents the price of complementary goods. The primary complementary good of automobiles is fuel. We use the price of fuels to represent the price of complementary good in this paper. Y represents the income. Gross Domestic Product (GDP) is used in the model. R represents the automobile purchases, which are financed by loans, and the cost of borrowing is likely to influence automobile demand. The higher the cost, the lower the consumers demand for automobiles. So we use the lending rate in the model.[8]

3.3.3. Investment Demand Model and Capacity Utilisation

The first step in developing these new estimates is specification of the investment-demand model and estimation of its parameters. This model, derived from a capital stock adjustment mechanism, does not require the value of capital stock for estimation purposes and thus frees the values of the structural parameters from any particular capital stock series. Nevertheless, the parameters are dependent on the gross investment series used. The

[8] Hui-Yen Lee and Hsin-Hong Kang "The Study of Brazilian Automobile Demand".

investment model follows current economic practice utilizing a capital stock adjustment process with a general specification of desired capital stock. The specification of the demand for investment goods incorporates cash flow as a determinant of the adjustment speed and is written as

$$I_t^{\,g} = \left[\gamma_1 + \gamma_2 \frac{\pi_t}{K_t^{\,*} - (1-\delta)K_{t-1}}\right] \quad \left[K_t^{\,*} - (1-\delta)K_t - 1\right], \qquad (3.3.3.1)$$

Where,

$I^{\,g}$ = automobile industry real gross investment expenditures,

K= actual real capital stock, measured end of period,

K^* = desired real capital stock, measured end of period,

γ_i = an adjustment coefficient, $i = 1,2, 0 < \gamma < 1$,

$K_t^{\,*} - (1-\delta)K_t - 1$= the investment requirement, that is, the gross investment during period t needed to close the gap between actual stock at the beginning of the period and desired end of period of stock,

π = real cash flow (retained earnings + depreciation), and

t = a time subscript.

Cross multiplication of equation (1) produces

$$I_t^{\,g} = \gamma_1[K_t^{\,*} - (1-\delta)K_t - 1] + \gamma_2\pi_t\,. \qquad (3.3.3.2)$$

This particular form follows the suggestion of (Seltzer, 1928, pp. 264-67), who first hypothesized and documented that early automobile industry investment and growth was mainly due to reinvestment of retained earnings. We choose to enter real cash flow as a determinant of the speed of adjustment coefficient and let the specification of desired stock follow a neoclassical definition.[9] The total speed of adjustment is composed of a fixed value and (γ_2) that depends on the level of cash flow (π) relative to the investment

[9] Lawrence H. A. Seltzer (1928) Financial History of the American Automobile Industry. Boston: Houghton Mifflin. Although Seltzer suggests business retained earnings as the proper determinant of investment expenditures, current analysis has broadened this to internally generated cash flow, that is, retained earnings plus depreciation expenses.

requirement.[10] It argues that the degree of market power within an industry is an important determinant of interindustry differences in investment behavior. A neoclassical investment model is analysed to show that market power is positively associated with capital stock flexibility. The intuition for the result is that firms adjust their stocks and investment plans quickly in response to new conditions so as to capture the rents asssociated with their market power.[11] The relationship between firm behavior and market structure has been a central focus of study in the field of industrial organisation. Industrial organisation is a field of economics that studies the structure of and boundaries between firms and markets and the strategic interactions of firms.

3.4. SCP Paradigm (Structure Conduct Performance)

The central hypothesis (of the SCP framework) is that observable structural characteristics of a market determine the behavior of firms within that market, and that the behavior of firms within a market, give structural characteristics, determines measurable market performance. This emphasis is reflected in the manner, in which some economists have defined industrial organisation, namely as the study of firm behavior in imperfectly competitive markets. The theoretical approach is involving the use of oligopoly and monopolistic models to derive production and pricing policy of a firm. The empirical approach is involving the correlation between observed prices and other economic variables representing differences in market structure. Structure refers to market structure. The variables that are used to describe market structure include seller concentration, degree of product differentiation and barriers of entry. These variables can be further classified into two classes, namely:

(a) Intrinsic structural variables - those determined by the nature of products and available production and marketing technologies.

(b) Derived structural variables - those determined by firms and government such as barriers of entry, seller and buyer concentration and product differentiation. This

[10] L. J. Mercer and W. D. Morgan, (1972), "The American Automobile Industry: Investment Demand, Capacity, and Capacity Utilization, 1921-1940", *The Journal of Political Economy*, Vol. 80, No. 6, pp. 1214-1231.

[11] Paula R. Worthington (1992), "Investment and Market Power", *International Journal of Industrial Organisation*, Vol. 2, No. 2, pp. 309-318.

distinction may be important if intrinsic structural variables are exogenously determined, thus making them suitable candidates as instrumental variables.

Conduct refers to a firm's behavior. The variables used to capture firm behaviour include pricing strategies, collusion, advertising, research and development and capacity investment. Some have interpreted conduct as whether firms collude or compete. Performance which refers to outcome or equilibrium assessed in terms of allocative efficiency. The variables mostly used to measure performance are profitability and price cost margin. The SCP paradigm posits specific causal relationships between market structure, conduct and performance. In particular, market structure determines conduct and conduct in turn determines performance:

'Structure' describes the characteristics and composition of markets and industries in an economy. It can refer to the number and size distribution of firms in the economy as whole. Structure also relates to the importance and characteristics of individual markets within the economy. Conduct refers to the behavior (actions) of the firms in a market; to the decisions these firms make and also to the way in which these decisions are taken. It thus focuses on how firms set prices, whether independently or in collusion with others in the market. By conduct is meant how firms in the industry act in regard to pricing, advertising, legal tactics, research and development. Performance of individual firms and the industry is determined in accordance with certain criteria like efficiency, productivity, profitability, innovative record, employment and international competitiveness.

3.4.1. Market Concentration: Some Theoretical Discussion

The most frequently used measure is market concentration to show the extent to which production of a particular good or service is confined to a few large firms. Differences in the number and size distribution of firms are key factors distinguishing the theoretical models of perfect competition, oligopoly, monopoly and monopolistic competition. The purpose of a measure of industrial concentration is to provide a summary statistic reflecting the distribution of firms in an industry, indexing one element of that industry's 'market power'. Market concentration is a feature of the imperfect competition where one or few firms dominate the entire industry. Here let us concentrate on simpler approaches to show the relevance of the number of firms and their relative size distribution for the economic behaviour (conduct and performance) of the firms. Let us assume that there are

few large firms along with many smaller firms selling a homogenous product at a uniform single price. This is what we call as 'homogenous oligopoly'. The large firms will be having inter-dependence among themselves in the sense that variations in the price or supply of any one of them will have significant effect on the market supply, equilibrium market price and revenue of all other firms. This is certainly a situation of market concentration affecting the firms. It can be made explicitly known with the help of the following mathematical derivation. Let the total market supply for the product be specified as Q units and the market demand function be

$$p = f(Q) = f(q_1 + q_2 + \cdots + q_i + \cdots + q_n) \tag{3.4.1.1}$$

Where p = product price; q_i = output of *i*th firm,

$$i = 1, \cdots, n \text{ and } \sum q_i = Q.$$

The revenue function for *i*th firm is given by

$$R_i = p.\, q_i \tag{3.4.1.2}$$

Differentiating (3.4.1.2) with respect to q_i, the marginal revenue for the *i*th firm will be as

$$\frac{\delta R_i}{\delta q_i} = p + q_i . \frac{\delta P}{\delta Q} \cdot \frac{\delta Q}{\delta q_i} \tag{3.4.1.3}$$

Where, $\delta Q / \delta q_i = 1$, since an increase in one unit of output by *i*th firm means one unit increase in the total market supply. Equation (3.4.1.3) can be rewritten as

$$\frac{\delta R_i}{\delta q_i} = p\left[1 + \frac{q_i}{Q} \cdot \frac{Q}{p} \cdot \frac{dp}{dQ}\right] \tag{3.4.1.4}$$

Where q_i / Q is the market share of the *i*th firm. We have assumed uniform price for the industry which changes if output of any big firm changes. Let us define 'the market quantity elasticity of demand' (e_Q) as the percentage change in market price with a marginal percent change in the market quantity supplied, that is

$$e_Q = \frac{dp}{dQ} \cdot \frac{Q}{p} \tag{3.4.1.5}$$

Substituting (3.4.1.5) in (3.4.1.4), we get

$$\frac{\delta R_i}{\delta q_i} = p[1 + \frac{q_i}{Q} \cdot e_Q](i =, \cdots n) \tag{3.4.1.6}$$

This equation shows that marginal revenue for the *i*th firm depends on product price, market share in output for the firm and quantity-elasticity of price. If the firms are of uneven sizes then the average marginal revenue for the firm in the industry be written as

$$MR = \frac{q_i}{Q}(MR_1) + \frac{q_2}{Q}(MR_2) + \cdots + \frac{q_n}{Q}(MR_n) \qquad (3.4.1.7)$$

Market shares of the firms are being taken as weights to compute the average marginal revenue (MR). Making the substitution for MR_1, MR_2 …MR_n from equation 3.4.1.6 and simplifying, we get

$$MR = p + \left[1 + \sum_{i=1}^{n}\left(\frac{q_i}{Q}\right)^2 \cdot e_Q\right]$$

or

$$MR = p[1 + H \cdot e_Q] \qquad (3.4.1.8)$$

where $i = \sum_{I=1}^{n}\left(\frac{q_i}{Q}\right)^2 = H$ is the Herfindahl index of concentration. This equation says that average marginal revenue depends on product price (P), concentration index (H) and the elasticity coefficient (e_Q). If all n firms are of equal size then H=1/n which tends to zero as n becomes greater and greater as in competitive situation. If so the marginal revenue will be almost equal to price. This is the familiar result for the competitive market. If there is only one firm then H = 1, and so we get the monopoly extreme of the market structure which is the most concentrated situation. Between these limits of H, we get the various degrees of market concentration, and marginal revenue for the firms varies in direct proportion of that. If e_Q is negative then it is inverse of the price elasticity of demand. The marginal revenue cannot therefore be greater than product price. Marginal revenue will be positive when e_Q is less than one which is the situation where price elasticity is greater than one, i.e., $e_q\left(=\frac{1}{e_p}\right)<1$, when e_p>1. The deviation of marginal revenue from the price is a direct consequence of the monopoly power prevailing in the market due to market concentration.[12] It is the sum of the squares of the relative sizes (i.e. market shares) of the

[12] R.R. Barthwal (1984), "*Industrial Economics*", Wiley Eastern Limited.

firms in the market, where the relative sizes are expressed as proportions of the total size of the market. Symbolically

$$\text{Hirschman Herfindahl Index (H)} = \sum_{i=1}^{n} (p_i)^2 \qquad (3.4.1.9)$$

where $p_i = q_i / Q, q_i$ is output of *i*th firm and Q is total output of all the firms in the market, and n is the total number of firms in the market. This index takes account of all firms in the market (i.e. industry). Their market shares are weighted by the market share itself. The larger the firm more will be its weight in the index. The maximum value for the index is one where only one firm occupies the whole market. Concentration can shed light on the degree of market power. The extent to which a firm has market power may be revealed by the margin between price and marginal cost. This is the case of monopoly. The index will have minimum value when the n firms in the market hold an identical share.

3. 5. Market Structure, Market Share and Profitability of Firms

The field of industrial organisation has acquired an abundance of hypotheses about what comprises market structure. This abundance yields vitality, but it has also left uncertain the relative importance and inter-relations of the individual structural elements. The premise in static analysis is that a firm's market position (defined by its share, industry concentration and barriers, and possibly other elements) affects its attainable degree of profitability. These elements are cast as determinants of profitability can then clarify the role of each element. [13]

Market Share: For given market demand conditions, the neoclassical expectation is that a higher market share (M) yields the firm higher profitability (RR, for rate of return)[14]. Alternatively, passive dominant-firm behaviour along Cournot lines would give a zero relationship. Dominant firms would yield up their shares over time, so that profitability would ultimately be invariant with market share. At the extreme, "umbrella pricing" could result in a negative share-profitability relationship, particularly in mature homogenous-good industries with marked cyclical.

[13] W.G. Shephered (1972), "The Elements of Market Structure", *Review of economics and statistics*, Vol. 54. No.1. pp. 25-37.

[14] Profitability is the average rate of return on invested capital, either as such or adjusted for risk (Knight, 1921, Cootner and Holland, 1970, Fisher and Hall, 1969).

Entry Barriers: Barriers (B) may determine the attainable profitability for all or only the dominant firms in oligopolies. An intermediate hypothesis is that barriers are only necessary; Profitbility varies both with them and with other determinants. Variable (B) representing barriers in the firm's industry would therefore be directly related to profitability, if it supplants both market share and the group, the extreme barrier hypothesis holds. An alternative is to introduce barrier factors separately and precisely, such as size and advertising intensity.

Firm size: Size (S) is one main possible source of entry barriers. Yet the net effect, if any, of size on profitability may be positive, null, or negative. Firm size relative to the total size distribution of firms may increase attainable profitability and it may raise "capital requirements" barriers to entry. Yet absolute size may raise average costs even if competitive constraints are tight. Also the constrained sacrificing of profits by sales-maximizing firms (Baumol, 1967) would yield a succession of short-run profit rates lower and size levels higher than would otherwise occur, thereby lowering the observed size-profitability relation. The net effect of these opposed factors cannot be derived a priori.

Advertising Intensity: Another barriers factor is product differentiability, of which one source is high advertising intensity. Accordingly, a positive long-run partial relationship between advertising intensity and profitability is expected.

Growth Rate: In addition to structural elements, growth (E) is likely to associate positively with profitability (Hall and Weiss, 1967). Yet extreme growth may reduce profitability; also growth may be achieved via pricing strategies which sacrifice current profitability (Gaskins, 1970). The net growth effect can, in any event, be held constant in estimating the structural relationships. The hypotheses then combine into this static model explaining the firm's rate of return on capital (RR):

$$RR = f(M, G, B, E). \tag{3.5.1}$$

If barriers information is imperfect, one may rely instead on size and advertising data, which are relatively precise. Alternative basic models for estimation are then:

$$RR = a + bM + cG + dB + eE + \varepsilon \tag{3.5.2}$$

The variables refer to long period conditions. The two variables - Δ market share and profitability are jointly determined by the firm's long run profitability choices and

constraints. The changes in market shares, a model for preliminary analysis for the period $t = 1 \ldots n$ is

$$\Delta M_1 = a + bRR_1 + cM_1 + dS_1 + eA_1 + fRR_{2 \to n} + \varepsilon \qquad (3.5.3)$$

where the subscripts refers to time. The first four-right hand variables each allow for a factor which is likely to affect changes in market share. An initially high profit rate would invite increased competitive pressure. Size and advertising intensity are likely to help insulate against losses of market share. [15]

3. 5.1. Market Share and Rate of Return

The effect of market share on the rate of return depends on the degree of concentration and rate of growth in the industries in which the firms compete, and on the absolute size of the firm. Large market share may be expected to yield high profitability. The effect of share on profitability however will depend upon other industry and firm characteristics. In particular it will depend on the level of concentration in the industries in which the firm competes, on the rate of growth in industry demand and on the absolute size of the firm. Industry concentration is a measure of market power. Market shares in both homogeneous and differentiated oligopolies are determined by past and present rent yielding intangible assets (unit cost and market advantages) possess by the firm.[16]

3.6. Measures of Market Performance

In the SCP paradigm, an industry's performance is the success of an industry in producing benefits for consumers depends on the structure of the market. SCP study has two main stages. First, one obtains a measure of performance through direct measurement rather than through estimation and several measures of industry structure for many industries. Second, the economist uses the cross country observations to regress the performance measure on the various structure measures to explain the difference in market performance across industries. We first discuss the measurement of performance and structure variables and then examine the evidence relating performance to structure.

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[15], W.G. Shephered (1972), "The Elements of Market Structure", *Review of Economics and Statistics*, Vol. 54, No. 1. pp. 25-37.

[16] B.T. Gale (1972), "Market Share and Rate of Return", *The Review of Economics and Statistics*, PP. 412-423.

Measures of market performance provide whether market power is exercised in an industry and directly or indirectly reflect profit or the relationship of price to costs are commonly used to gauge how close an industry's performance is to a competitive benchmark.

- The rate of return is the profit per of investment.
- The price-cost margin reflects the difference between price and marginal cost.
- Tobin's q is the ratio of the market value of a firm to its value based upon the replacement cost of its assets.

3.6.1. Rate of Return

Determining whether a firm or industry's rate of return differs from the competitive level is difficult. A firm's profit is revenue less labor, material, and capital costs,

$$\pi = R - labor\ costs - material\ costs - (r + \delta) p_k K \qquad (3.6.1.1)$$

Where R is revenue, r is the earned rate of return, δ is the depreciation rate, P_k is the price of capital, [r + δ] P_k is the rental rate of capital, and K is the quantity of capital. The competitive earned rate of return is r such that economic profit is zero:

$$r = \frac{R - labor\ costs - material\ costs - \delta p_k K}{p_k K} \qquad (3.6.1.2)$$

3.6.2. Price-Cost Margin

Market power usually measured by the relative mark up of price above marginal cost, called the Lerner index. If all firms have identical marginal cost of production then

$$L = \frac{P - MC}{P} \qquad (3.6.2.1)$$

if firms have different MC of production, then, the Lerner index looks at the weighted average of each firm's mark-up of price above marginal cost where the weight is the market share of each firm. If there are n firms and s_i is the market share of firm i, MC_i is the marginal cost of firm i, then

$$L = s_1\left(\frac{P - MC_1}{P}\right) + s_2\left(\frac{P - MC_2}{P}\right) + \cdots s_n\left(\frac{P - MC_n}{P}\right) \qquad (3.6.2.2)$$

The SCP paradigm implies that differences in H explain differences in L. A Relationship between H & L Based on cournot oligopoly follows

Let ξ =price elasticity of demand.

$$L = \frac{H}{\xi} \qquad (3.6.2.3)$$

In a monopoly, H = 1 and in that case we have seen that this rule holds. The relationship argues that market power is directly related to market concentration and the strength of their relationship is affected by the elasticity of demand. If market demand is very elastic, changes in concentration won't have very large effects on pricing and hence market power. If demand is very inelastic, changes in concentration can have big effects. Basic hypothesis treats market structure as an exogenous explanatory variable. But in reality, market structure (concentration) is itself affected by firm's conduct (and hence by performance). That is because entry and exit of firms in the industry responds to how collusive or competitive firms are, what kind of entry barriers they create, how larger firms predate small firms etc. Entry and exit, in turn, affect market concentration. In others, both concentration & market power are determined endogenously, each affecting the other.

The correlation between concentration and market power need not always be positive. For example, the more collusive an industry is the higher the price and hence, market power, but at the same time, higher prices and profits can attract new entry so that concentration may decline. So we would observe greater market power and smaller concentration. Finally, even if one does hypothetically observe that higher concentration always leads to market power, there remains an interpretation problem. What does it tell us? If you believe the statistical result arises greater concentration creates collusion, then this suggests antitrust intervention, pro-competitive public policy - in industries with high values of H. If you believe on the other hand that the statistical result arises because industries with rapid technological innovation and Schumpeterian competition (creative destruction) will always have high concentration and market power (in order to compensate firms for their innovation & investment), then no intervention is suggested.

3.6.3. Tobin's q Theory

Tobin's q is less commonly used as a measure of performance than either a rate of return or a price cost margin. Tobin's q is the ratio of the market value of firm (as measured by the market value of its outstanding stock and debt) to the replacement cost of the firm's assets. The advantage of using Tobin's *q* is that the difficult problem of estimating either rates of return or marginal costs are avoided. On the other hand, for *q* to be meaningful,

one needs accurate measures of both the market value and replacement cost of a firm's assets. Tobin and Brainard (1977) defined 'q' as the ratio of market valuation of reproducible capital assets to the current replacement cost of assets. If the market valuation of an asset is higher than the cost of purchasing it then there will be an incentive to invest in that asset. Therefore, the authors argued that investment is related to 'q'.[17] Thus Tobin (1969) identifies 'q' as a link variable between the financial markets and market for real goods and services. [18] Tobin q has been calculated as the ratio of market value of the firm to the replacement cost of assets. In symbols,

$$Tq_t = V_t / RA_t \qquad (3.6.3.1)$$

The main limitation of the 'q' theory has been highlighted by Auerbach (1978).[19] Although q theory of investment suggests that q >1 would induce investment while q<1 would discourage it. Auerback argued that q<1 may also encourage investment due to tax differentials between dividends and capital gains, leverage ratios, tax incentives by the government, credit facilities and market pressure of demand etc. However, it can be concluded that Tobin q is principal determinant of investment irrespective of its value.

Michael Smirlock, Thomas Gilligan, and William Marshal (1984)[20] argued that Tobin's q can provide a more appropriate measure of firm rents than more standard measures. Further, the use of q is suggestive of the general value of capital market data to investigate issues in industrial organisation. Tobin 'q' was used by Lindenberg and Ross (1981)[21] as a measure of monopoly rents. Profitability analysis is the assessment of the impact of various marketing strategies on the profit contribution that can be expected from a product or product line. Productivity and profitability are important concepts and measures describing the performance and success of a firm. Productivity improvement is one among others for increasing the profitability of actions.

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[17] Tobin, J. and Brainard (1977), "Asset Market and Cost of Capital in Bela Balasse (eds.), *Economic Progress and Public Policy*, Amsterdam (1977), pp.235-262.

[18] J. Tobin (1969), "A general Equilibrium Approach to Monetary Theory", *Journal of Money Credit and Banking*, Vol.1, pp.15-29.

[19] A. J. Auerbach (1985), "Real Determinants of Corporate Leverage, in Friedman (eds.) of Corporate Capital Structures in the United States", A NBER Project Report, pp. 301-324.

[20] Michael, Smirlock; Thomas Gilligan and William, Marshall (1984), "Tobin's *q* and the Structure-Performance Relationship", *American Economic Review*, Vol. 74, No. 5, pp. 1051-60.

[21] Eric B. Lindenberg and Stephen A. Ross (1981), "Tobin's *q* Ratio and Industrial Organisation" *Journal of Business*, Vol. 54, No. 1, pp. 54:1-32.

3.7. Productivity Analysis: Concept and Methods of Measurement of TFP

The need for studying productivity growth arises due to the intimate link between productivity growth and economic growth. Productivity growth is the basis of efficient economic growth. This work shows that technological advancement is a major source of productivity improvement for the automobile industry. Productivity growth is crucially affected by technological change. Their relationship is so close that the two terms are often used interchangeably. Productivity is a wider concept. Even though a crucial one, technological change is only one of the many factors which affect productivity growth. In the standard neo-classical economic model technology refers to a collection of techniques, or ways of specifying how much of various outputs can be produced using given quantities of various inputs. This is simplified as a single output production function which specifies the maximum quantity of output predictable from given quantities of labour and capital. Technology is then the production function. It is generally represented graphically with the help of level curves or isoquants. Technological progress in this simple framework is a shift upwards of the production function, or shift downwards of the representative isoquant. Given input prices, one can view technological improvement as a downward shift of the cost function.

Technology has two aspects, 'embodied' or 'disembodied'. The former is identified with 'hardware' and consists of tools, machinery, equipment and vehicles, which together make up the category of capital goods. Disembodied technology is identified with 'software' and encompasses the knowledge and skills required for the use, maintenance, repairs, production, adaptation and innovation of capital goods. These are often called the 'know-how and the know-why of processes and products'. Technological change does not affect all factors equally. When it does, it is considered neutral technical change. Otherwise, it may have a specific factor using or factor saving bias.

The terms, technological change and technical change are used interchangeably in the literature under review, both being indicators of a shift in the production function. It would have been useful to reserve the latter term for indicating change in techniques or processes. The terms technological progress and technical progress are synonymous with technological change and technical change respectively, all change being considered as being for the better.

3.7.1. Production Function and Productivity Growth

As indicated above, the notion of a production function is central to the meaning of technology. It is consequently crucial for the measurement of productivity. A production function is a technological relationship which specifies the maximum level of output of a good which can be obtained from a given level of one or several inputs. In its general form a two input production function can be written as

$$V_t = f(K_t, L_t) \qquad (3.7.1.1)$$

where,

V_t = level of net output (value added)

K_t = capital input (or service of factor capital)

L_t = labour input

t = time

3.7.2. Partial or Single Factor Productivity

The partial or single factor productivity of labour or capital is indicated by the ratio V/L, or V/K i.e. output per unit, or the average product of the factor concerned. The productivity defined this way is merely the inverse of factor intensity. An increase in this ratio, other things remaining the same, implies, an increased efficiency of input use, whereby, the same level of output can be produced by a smaller quantity of given input. However, when other things cannot be assumed to be the same, the interpretation of these output factor ratios as indicators of productivity becomes problematic. For example, an increase in labour productivity may only reflect capital deepening - a rise in the K/L ratio. In such cases it becomes necessary to compute total factor productivity.

3.7.3. Total Factor Productivity

Total factor productivity (TFP) extends the concept of single factor productivity such as output per unit labour or capital to more than one factor. Thus TFP is the ratio of gross output to a weighted combination of inputs. For the case of production function, TFP at time t would be given by:

$$A_t = \frac{V_t}{g(\alpha K_t, \beta L_t)} \qquad (3.7.3.1)$$

Where A_t : Index of TFP at time t.

g: the aggregation procedure implicit in the specific production function adopted. α, β are appropriate weights. Different functional forms of the production function imply different aggregation procedures or weighting schemes for combining factor inputs.

3.8. Approaches to the Measurement of Productivity Growth

There are three principal approaches to measurement of productivity growth. These are:

- The index number approach,
- Parametric approach and
- Non-parametric approach.

We focus primarily on studies which have estimated productivity growth using the first approach. Wherever appropriate, the results from the estimation of cost and production functions have been mentioned in support of as alternative explanations to the results of the first approach. The non-parametric approach which is based on linear programming models of relative efficiency is not used here.

3.8.1. Index Number Approach

In this Index number approach, the observed growth in output is sought to be explained in terms of growth in factor inputs. The unexplained part or the residual is attributed to growth in productivity of factors. It consists in assuming a certain functional form for the producers' production function and then deriving an index number formula that is consistent (exact) with the assumed functional form. Preferred functional forms are the flexible ones. These indices differ from each other on the basis of underlying production function or the aggregation scheme assumed. Total factor productivity (TFP) in this study has been measured by using three different methods such as of Kendrick Index, Solow Index and Divisia Index.

3.8.1.1. Kendrick Index

Kendrick's index of total factor productivity for the case of value added as output, and two inputs can be written as

$$A_t = \frac{V_t}{(r_0 K_t + w_0 L_t)} \qquad (3.8.1.1.1)$$

where,

A_t is the value of index in a given year,

V_t is the value of gross output,

W_0 and r_0 denote the factor rewards of labour and capital respectively in the base year. The index measures average productivity of an arithmetic combination of labour and capital with base year period factor prices. It assumes a linear and a homogeneous production function of degree one. Besides constant returns to scale and neutral technical progress, it assumes an infinite elasticity of substitutability between labour and capital. The index can be generalised to allow for more than two factors. If a sufficient long time series for this index is constructed, then a trend rate of growth can be estimated econometrically. From the time series of Kendrick index, yearly series (g_t) can be formed by writing growth between successive years as

$$g_{t+1}^{K} = (A_{t+1} - A_t)/A_t$$

3.8.1.2. Solow Index

Solow's measure of productivity growth for two input case is given by

$$g_{t+1}^{S} = \left[\frac{V_{t+1} - V_t}{V_t}\right] - \left[\alpha\frac{L_{t+1} - L_t}{L_t} + \beta\frac{K_{t+1} - K_t}{K_t}\right] \qquad (3.8.1.2.1)$$

Where,

V_j = measure of output,

α, β are shares of labour (L) and capital (K) in output. This measure is based on the general neo-classical production function. It assumes constant returns to scale, Hicks-neutral technical change, competitive equilibrium and factor rewards being determined by marginal products. Under these conditions, the growth of total factor productivity is the difference between the growth of value added and the rate of growth of total factor inputs. The latter is in the form of a Divisia index number i.e. a weighted combination of the growth rates, the weights being the respective shares. If we assumed specific Cobb-Douglas production function, with unit elasticity of output (unlike in the general functional form above) and took base year factor shares as weights, we would get Domar's geometric index of TFPG. Assuming $A_1 = 1$, a time series of Solow index of productivity (A_t) can be formed from the formula:

$$A_{t+1} = A_t * (1 + g_{t+1}^{S})$$

Kendrick and Solow indices have certain limitations therefore, a less restrictive index, known as Divisia Index, has gained more importance.

3.8.1.3. Translog Index

The Translog index of Total Factor Productivity (TFP) is a discrete approximation to the Divisia index of technical change. It has the advantage that it does not make rigid assumptions about elasticity of substitution between factors of production (as for instance done by the Solow index). It allows variable elasticity of substitution. Another advantage of the Translog index is that it does not require technological progress to be Hicks-neutral. The Translog index provides an estimate of the shift of the production function even if the technological change is non-neutral. For the two-input case, taking value added as output, and labor and capital as inputs, the Translog index of TFP growth is given by the following equation:

$$\Delta \ln TFP(t) = \Delta \ln Y(t) - [\frac{SL(t) + SL(t-1)}{2} \times \Delta \ln L(t)] - [\frac{SK(t) + SK(t-1)}{2} \times \Delta \ln K(t) \quad (3.8.1.3.1)$$

In the above equation, Y is output, L labor and K capital. SL is income share of labor and SK denotes income share of capital. $\Delta \ln Y(t) = \ln Y(t) - \ln Y(t-1)$. In the same way, $\Delta \ln L(t)$, and $\Delta \ln K(t)$ are defined. SK and SL add up to unity. $\Delta \ln TFP$ is the rate of technological change or the rate of growth of TFP. This expresses TFP as the difference between growth rate of output and weighted average of growth rates of labour and capital input. This is equivalent to Tornquist's discrete approximation to continuous Divisia index. The index is based on the translog function which describes the relationship between output and inputs and also between the aggregate and its components. The homogeneous translog functional form is flexible in a sense that it can provide a second order approximation to an arbitrary twice continuously differentiable linear homogeneous function. This functional form helps to overcome the problem which arises with the Solow index where discrete set of data on prices and quantities need to be used in a continuous function. This index also imposes fewer a priori restrictions on the underlying production technology. The index can be generalised for more than two inputs. Like in the previous case, from year to year changes in productivity growth one can construct a time series of the translog index as follows:

$$A_{t+1} = A_t * (1 + g^T{}_{t+1})$$

3.8.2. Parametric Approach

Parametric approach consists of econometric estimation of production functions to infer contributions of different factors and of an autonomous increase in production over time and independent of inputs. This latter increase, which is a shift over time in the production function, can be more properly identified as technological progress. It is one of the factors underlying in productivity growth. Below, we give some commonly used specifications of production functions. Cobb-Douglas Specification:

$$V = A_0 e^{\lambda t} L^{\alpha} k^{\beta} \qquad (3.8.2.1)$$

Where, V, L, K and t refer to value added, labour, capital and time. A and β give factor shares respectively for labour and capital. A_0 describes initial conditions. Technological change takes place at a constant rate l. It is assumed to be disembodied and Hicks-neutral, so that when there is a shift in the production function, K/L ratio remains unchanged at constant prices. In log-linear form this function can be written as

$$\log V = a + a \log L + b \log K + \lambda t \qquad (3.8.2.2)$$

The estimated value of λ provides a measure of technological progress, which is often identified with total factor productivity growth.[22]

3.8.3. Growth Accounting Approach of Measuring TFP

In this method the output growth is decomposed to calculate the contribution of each factor of production. To decompose the GVA growth, the coefficients of Cobb-Douglas production function is used as weights for the estimated growth rates of the factor inputs. The World Bank team used the Cobb Douglas production function and the differential calculus estimating the growth rates of output and TFP in the developed countries (Cororaton and Caparas 1999).[23] In the Growth Accounting Approach, it is assumed that there are constant returns to scale, markets are perfect, and factors of production are paid to according to their marginal product. This makes the elasticities of output with respect to inputs equal to the income shares of the inputs. The growth accounting equation, used for the present study, is as follows:

[22] Puran Mongia and Jayant Sathaye (1998) "Productivity Growth and Technical Change in India's Energy Intensive Industries: A Survey", Environmental Energy Technologies Division LBNL- 41840.

[23] C.B. Cororaton and M.T.D. Caparas (1999), "TFP: Estimates for the Philippine Economy", Philippine Institute for Development Studies, Discussion Paper Series No. 99-06.

$$r_G = \alpha r_L + \beta r_K + \lambda_T \qquad (3.8.3.1)$$

Where r_G is the growth rate of gross value added, r_L is the growth rate of employment, r_K is the growth rate of capital stock, λ_T is the technical progress, and α, β and λ are the coefficients for labour, capital and time (representing technology) in the Cobb-Douglas production function. It is important to note that this study has considered the GVA instead of the value of gross output, because the use of GVA avoids the effects of variations in the quality of raw materials. The use of gross output would require the inclusion of raw materials which may obscure the role of labour and capital in the estimation of TFP growth. The growth accounting method implicitly assumes a well behaved neoclassical production function that facilitates the decomposition of the sources of growth. The TFP in the growth accounting method is the residual between the growth in GVA and the weighted sum of the growth of the primary factors of production i.e. labour and capital. Thus the TFP corresponds to the growth in GVA due to technological change and exogenous factors. In equation form this can be written as:

$$\lambda_T = r_G - \alpha r_L - \beta r_k \qquad (3.8.3.2)$$

In this equation the λ_T is the TFP. Thus, TFP growth is the contribution of technical efficiency as well as technological progress. Technical efficiency means the existing strengths of the organisation, whereas the technological progress means the shift in the productivity brought about through the induction of improved technology, training of employees, investment in the research and development activities, etc.[24]

3.9. Summary

The Third chapter provides basic concepts related to the studies and models dealing with structure of the industry, productivity, market size, growth and profitability. It develops the theoretical model and describes the estimation procedure. It consists of statements about three components: demand, supply and market equilibrium. The demand for automobiles is modelled from a discrete choice framework of consumer. It followed Bresnahan's (1987) hypothesis that supply-side factors must have been responsible for the unusual pattern. The relationship between firm behavior and market structure has been a central focus of this

[24] Hina Sidhu (2007), "TFP: A Sectoral Analysis of Indian Industry", *Productivity,* Vol. 48, No-2, pp. 172-181.

study. Tobin's q is less commonly used as a measure of performance than either a rate of return or a price cost margin. H is a measure of industry concentration. The competition-related indices in each product market are market shares, Herfindahl indices and import ratios. A connection between market concentration and productivity is based on the reasoning that market is discussed

Productivity and profitability are important concepts and measure describing the performance and success of a firm. Productivity improvement is one of the means among others in increasing the profitability of actions. Productivity growth is crucially affected by technological change. There are three principal approaches to measurement of productivity growth. These are: (i) The index number approach, (ii) parametric approach and (iii) non-parametric approach. This study is an analytical-descriptive account of the existing studies on productivity and technical change. Total Factor Productivity (TFP) in this study has been measured by discussing the following three different methods of productivity Kendrick Index, Solow Index and Divisia Index. The Translog index of total factor productivity (TFP) which is a discrete approximation to the Divisia index of technical change is discussed here. Two important methodologies used in most studies on productivity growth are growth accounting and the econometric estimation of production functions.

Chapter IV

Impact of Liberalisation on Structure and Growth of Firms in the Indian Automobile Industry

Chapter IV

Impact of Liberalisation on Structure and Growth of Firms in the Indian Automobile Industry

4.1. Introduction

This chapter attempts to examine the impact of economic liberalisation on performances of the Indian automobile industry. The Indian automobile market has been heavily protected using various tools since 1985 as the industry is considered to be a key industry that would stimulate growth. It highlights how the rationale and instruments of industrial policy have changed since the 1990s. The Indian automotive industry has grown at a spectacular rate after de-licensing in July 1991. This chapter attempts to evaluate the effects of industrial liberalisation in 1991 in terms of its profitability and growth performances of Indian automobile industry. It embarked a new journey in 1991 with delicensing of the sector and subsequent opening up for 50% FDI was allowed on an automatic basis. Being the pillar of Indian industry, with the support by the government both in financial and market wise, automobile industry seems to be formidable. The automobile manufacturing sector is characterized by a high cyclical growth patterns, high fixed cost and break-even point levels and an excessive number of participants. Barriers to entry into automobile manufacturing activity are formidable. It includes the cost of developing high volume production facilities, in order to benefit from economies of scale and the ability to gain access to technology of major operators, as the present incumbents include some of the largest multinationals that have considerable claims to new technology.

Following India's growing openness, the arrival of new and existing models, easy availability of finance at relatively low rate of interest and price discounts offered by the dealers and manufacturers, all have stirred the demand for vehicles and a strong growth of the Indian automobile industry. Rising per capita income and the changing demographic distribution are conducive for growth. Higher disposable incomes coupled with availability of easy finance options have driven the passenger vehicle segment. In the commercial vehicle segment, increased investment in road infrastructure and availability of cheaper finance has led to a growth in multi-axle vehicles. The convergence of government policies, economic growth, and people's purchasing power have all contributed to the

phenomenal growth of Indian auto industry. Auto financing started emerging as an important driver for demand. Between 1995 and 2000 several international players entered the market. Advanced technology was introduced to meet competitive pressures, and environmental and safety imperatives. Automobile companies started investing in service network to support maintenance of on-road vehicles.

The government has also taken several policy measures and incentives to boost investment in the automobile sector of India. The most prominent policy is 'auto policy-2002'. Auto policy 2002 comprises several policy decisions that aim at making the Indian automotive industry globally competitive and for raising its contribution to the economy.[1] The Indian consumer benefited the most from the intensified competition, which brought his requirements of a cost-effective, technologically-competent, fuel-efficient and reliable means of transport into perspective. Strong macroeconomic base of demand growth drivers along with convenient credit facilities have ensured rising demand for vehicles in the country. The market for automotive vehicles in India, which had earlier been virtually a seller's market, was transformed into a buyer's market. The Automotive Mission Plan 2006-2016 was released in 2006. The government aims to encourage growth, promote domestic competition and stimulate innovation with its policies.[2]

After having recorded a strong volume growth over the last two years, the auto industry may face strong crisis leading to moderation in growth contributed by firming up of commodity prices, rising fuel costs and interest rates. While the industry has made big strides over the last decade towards improving internal efficiency and thereby partially offsetting input cost pressures, efficiency gains alone may be insufficient going forward for players to use as a lever to combat cost headwinds. Industry players will therefore need to

[1] Government of India (2002), "*Auto Policy, March 2002*", Ministry of Heavy Industries and Public Enterprises, Department of Heavy Industry, New Delhi.

[2] Ministry of Heavy Industries and Public Enterprises (2006), "Automotive Mission Plan 2006-2016". The Automotive Mission Plan 2006-2016: A Mission for Development of Indian Automotive Industry, Development Council on Automobile and Ministry of Heavy Industries and Public Enterprises. In order to develop and realize the growth potential of this sector and to retain the attractiveness of Indian market and for further enhancing the competitiveness of Indian companies, both at domestic and global level, and to optimize its contribution to the national economy the government through the Development Council on Automobile and Allied Industries and the Department of Heavy Industry have decided to draw up a ten year mission plan for the development of Indian automotive industry and creation of global hub.

intensify their focus on deploying more cost effective vehicle systems in their new product development and existing model refurbishment programmes.

This chapter studies the influence of important policies on the development of the industry. The key policy decisions highlighted during 1991-1992 to 2000-2001 are grouped together as 'liberalisation policy' and the ones on right as 'auto policy 2002' (2002-2009). The first period represents the period when major changes in the macro-economic environment came into being, with the broad liberalisation of controls and restrictions, implementation of the structural adjustment programme with delicensing and efforts came to be directed at globalizing economy. The 'auto policy- 2002' recognizes the need to provide direction to the growth and development of the automotive industry. As a result of these policy changes, the automobile industry in India, witnessed a number of new entrants. Entry of firms, mostly with foreign capital and technology, threatened the market share and the rate of progress of most of the veterans in the Indian automobile industry. Foreign Direct Investment, resulted in the transfer of latest technological configurations to produce/assemble vehicles involving technological up-gradation, raised serious questions about sustainability of growth in the already existing firms

The present chapter is intended to check the relationship between the policy and growth of Indian automobile industry. This chapter mainly focuses to check how the change in policy has altered the structure of the industry and growth of the industry. Firstly, in order to mention upon the development of an industry, one needs to consider several aspects of industry development, such as size, structure, investment, growth, performance, product variety, product quality, technology base, R&D, imports, exports and so on. This chapter considers the role of the automobile industry in the current cycle. It first examines the role of the industry in the economy, before analysing the relation between the automobile and business cycles. In this study, we believe that the first large scale empirical analysis linking differences in the extent of interdependencies across industries to differences in the distribution of firm profits within and across those industries. This work is a pioneer effort to estimate simultaneously supply and demand of automobiles in India in a differentiated product oligopolistic market. This chapter attempts to analyse the automobile demand at macro level using time series analysis approach. The model allows automobiles to be highly differentiated and consumers to be heterogeneous. This chapter investigates the

correlation between the hike in fuel prices, inflation rate, and GDP per capita with India's automobile sales.

4.2. Database and Methodology

The analysis explained in this chapter is based mainly on the secondary data. The study includes data on production and sales have been taken by the two automotive associations, namely Society of Indian Automobile Manufacturers (SIAM) and Automotive Component Manufacturers Association (ACMA). The basic data are available in different units and for different time-span. Here, adjustments for the data are essential for the estimation purposes. The empirical analysis has been conducted with the help of a sample of Indian automobile firms drawn from the Prowess Data Base of the Centre for Monitoring Indian Economy (CMIE). The database contains balanced panel data of 10 firms over 1990-91 to 2000-2009.

The wholesale price indices of automobiles and all commodities are collected from Ministry of Statistics and Programme Implementation. The wholesale price indices of Fuel, power, light and lubricants and machinery and equipment other than transport equipment are collected from Ministry of Commerce and Industry, Government of India. This chapter deals with analytical framework, methodology of analysis, samples and adjustments. It also discusses the various sources of data, definitions of variables and compilation of data on the relevant variables particularly of the wholesale price indices which are used as deflators.

The methodology adopted for this chapter is as follows. The present chapter addresses these objectives follows: Firstly, the analysis has been carried out during the period 1990-1991 to 2008-2009 to explain the interface between policy, structure and growth of Indian automobile industry. It analyses the determinants of growth and profitability during these two policy regimes between 'liberalisation policy' (1991-2001) and 'auto policy-2002 (2002-2009). Secondly, in order to show the difference between the different stages of industrial development, the growth performance has been compared by using various kinds of growth rates. In this regard, annual average growth rate and linear trend growth rates have been used. Growth rate is measured to any particular variable with respect to time. Time (t) is an important variable. Growth rate is the rate at which a variable (say income or output) under consideration has changed (increased or decreased) over a period of time.

1. The annual average growth rate (Percentage change) is $(Y_t - Y_{t-1})/ Y_{t-1}$ where, $(Y_t - Y_{t-1})$ represents absolute change, where, Y_t and Y_{t-1} are, respectively, current and previous values of the variable Y. Y_t is the relavant variable for year t. $(Y_t - Y_{t-1})/ Y_{t-1} = (Y_t/ Y_{t-1} - 1)$ is the relative or proportional change.

2. The linear trend growth rate is $g_2 = b$; where b is estimated separately for each period by using the relation: $\ln Y_t = \beta_1 + \beta_2 t + u_t$ where t=0….T denotes time variable and u_t denotes error term. 'T' is the trend variable, β_2 is the trend growth rate. If T=0 means initial period. If $\beta_2 > 0$ upward trend in Y. growth rate is increasing and if $\beta_2 < 0$, downward trend in Y. growth rate is declining.

4.3. Trend in Production Volumes of India's Automobile Industry

Automobile demand across all automobile segments gave a strong thrust to volumes and revenues of the automotive industry. The automotive industry of India is categorized into passenger vehicles (PVs), commercial vehicles (CVs), two wheelers, and three wheelers, with two wheelers dominating the market. PVs are classified into passenger cars and multi utility vehicles. Commercial vehicles are classified into light commercial vehicles and heavy commercial vehicles. India is currently the world's second largest market for 2-wheelers (IBEF, 2008)[3] and is considered to be one of the fastest growing passenger car markets (GOI, 2006a)[4]. In the year 2007, India ranked 8th in the production of commercial vehicles and 9th in the production of passenger cars worldwide, moving up from a rank of 13th and 15th respectively in the year 2000 (OICA 2008a).[5] According to a report from UNIDO[6], 'in international year book of industrial statistics 2008', India holds 12th position amongst top 15 automakers in the world. India is at the 4th position amongst the automakers of developing countries. India is also home to the world's largest 2-wheeler

[3] IBEF (2008): "Automotive market & opportunities", India Brand Equity Foundation, New Delhi. The India Brand Equity Foundation (IBEF) is a Public Private Partnership between the Ministry of Commerce and Industry, Government of India and the Confederation of Indian Industry.

[4] GOI (2006a): "Automotive Mission Plan 2006-2016", Department of Heavy Industry, Ministry of Heavy Industries and Public Enterprises, Government of India, New Delhi.

[5] Ranking in terms of the number of units produced.

[6] UNIDO-United Nations Industrial Development Organisation.

manufacturer and the 11th largest commercial vehicle manufacturer (Hero Honda, 2008 and OICA, 2008b).[7]The motor vehicles production is shown in table 4.3.1.

Table 4.3.1

Trend in Production Volumes of Automobiles ('000' Numbers)

Year	HCVs	LCVs	CVs	CARs	MUVs	PVs	2W	3W	Total
1990-91	87	58	145	182	37	219	1821	89	2274
1991-92	89	54	143	166	32	198	1606	77	2024
1992-93	75	53	128	164	39	203	1503	66	1900
1993-94	66	76	142	208	50	258	1765	92	2256
1994-95	102	93	195	264	50	314	2195	129	2834
1995-96	130	88	218	348	106	454	2656	176	3466
1996-97	156	85	241	411	135	546	2979	222	3984
1997-98	96	65	161	401	135	536	3073	235	4004
1998-99	81	55	136	391	113	504	3375	209	4223
1999-00	112	63	175	577	124	701	3778	206	4858
2000-01	88	64	152	505	126	631	3758	203	4758
2001-02	97	66	163	564	124	688	4324	213	5369
2002-03	121	83	204	609	115	724	5076	277	6280
2003-04	166	109	275	843	146	989	5623	356	7244
2004-05	215	139	354	1028	182	1210	6530	374	8468
2005-06	219	172	391	1113	196	1,309	7601	435	9735
2006-07	294	226	520	1238	223	1461	8436	556	10973
2007-08	291	254	549	1417	245	1662	8009	501	10716
2008-09	288	129	417	1571	267	1,839	8419	501	11175
2009-10	251	316	567	1927	220	2147	10512	619	13845

Source: Society of Indian Automobile Manufacturers and Motor Transport Statistics of India, Ministry of Road Transport and Highways, Govt. of India, 2010.
CVs: Commercial Vehicles include Medium and Heavy and Light Commercial Vehicles
PVS: Passenger Vehicles includes Passenger Cars and Multi Utility Vehicles
2W&3W: Two and Three Wheelers include Scooters, motorcycles, mopeds and three wheelers

Table 4.3.1 shows the production trends in the Indian automobile industry from 1990-91 onwards. The automotive industry in India has been witnessing an impressive growth since the country's economic liberalisation. In contrast to the 2256 thousand units produced in 1993-94, the production of vehicles in the country crossed a historic land mark of 10973 thousand units in the year 2006-07 and 11 million units in 2008-09. The production of

[7] Hero Honda (2008): "Corporate profile", Hero Honda Motors Ltd., New Delhi and OICA (2008b): "World ranking of manufacturers – Year 2007", International Organisation of Motor Vehicle Manufacturers, Paris,

Indian automobile industry size is 11175 thousand units in 2008-2009. The production of passenger vehicle and commercial vehicle segment's size are 1839 and 417 thousand units in 2008-2009. The production of two and three wheeler vehicles segments size are 8419 and 501 thousand units during the same period. Although the sector was hit by economic slowdown, overall production (passenger vehicles, commercial vehicles, two and three wheelers) increased from 10719 thousand vehicles in 2007-2008 to 11175 thousand vehicles in 2008-2009. Passenger vehicles increase marginally from 1662 thousand units to 1839 thousand while two wheelers increased from 8009 thousand to 8419 thousand (SIAM, 2009). The Indian automotive industry has recorded a strong volume growth over the last one year. The production of passenger vehicle and commercial vehicle segment's size are 2147 and 567 thousands units in 2009-2010. The production of two and three wheeler vehicles segments size are 10512 and 619 million units during the same period. Rising demand owing to the strong growth of Indian economy in post liberalisation and the changing landscape in the global automotive industry have fuelled such growth. India is being recognized as potential emerging auto market.

While the total motor vehicles production decreased from 2,274 thousand in 1990-1991 to 1900 thousand in 1992-1993, the passenger vehicles sector alone registered a decrease from a mere 219 thousand to 203 thousand during the same period. The commercial vehicles [consisting of HCV and LCV] production also decreased from 145 thousand in 1990-1991 to 128 thousand in 1992-1993. However, within the commercial vehicle segment, it is the LCV sector whose production has decreased during the same period. But the HCV sector also registered a decrease, but relatively less than both the LCV and Car sector. The total motor vehicles production increased from 2257 thousand in 1993-1994 to 4857 thousand in 1999-2000, the Passenger Vehicles sector alone registered an increase from a mere 258 thousand to 698 thousand during the same period. The commercial vehicles production also increased from 142 thousand in 1993-1994 to 241 thousand in 1996-1997. However, within the commercial vehicles segment, it is the LCV sector whose production increased from 1992-1993 to 1994-1995 and declined between1995-1996 to 1998-1999. The HCV also increased from 1993-1994 to 1996-1997. But the total vehicles production increased from 4757 thousand in 2000-2001 to 11088 thousand in 2006-2007, the Passenger Vehicles sector alone started an increase from 644 thousand to 1545

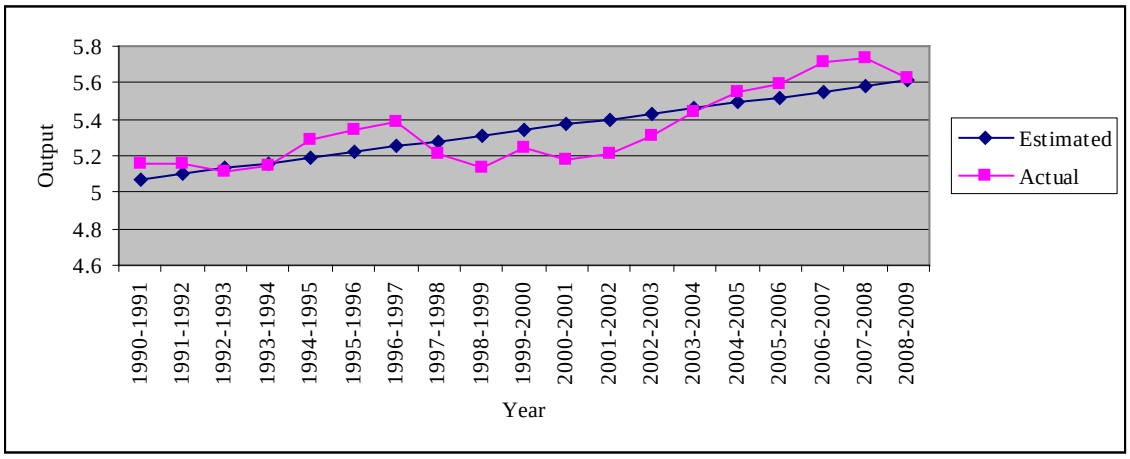
thousand during the same period. The commercial vehicles production also increased during the same period. The periods from 2000-2001 to 2007-2008 are an important period for rapid increase in the automobile vehicles production than previous period. But the production of automobiles is declining trend in 2008-2009. It is recovered in 2009-2010.

Over the last few years there has been an increasing trend in the production of vehicles, both in value and quantity terms. The only lean patch in production was during the year 2000-01, and recently in 2007-08, during which the growth in absolute numbers declined marginally. However, in the long term, the production growth is expected to improve again in-line with the expected growth in the economy, and it is likely that the momentum in the production may increase further with India being considered favourably as an outsourcing destination. Keeping in pace with the growing demand for automobiles, the production has increased over the years. Commercial vehicle and passenger vehicle production have seen a significant rise in the last couple of years, thus implying demand growth in these segments. The Indian automotive industry has been growing strongly over the last decade. All vehicle segments of Indian automobile industry have registered impressive growth.

4.3.1. Growth Trends of Various Segments of Automobile Industry in India

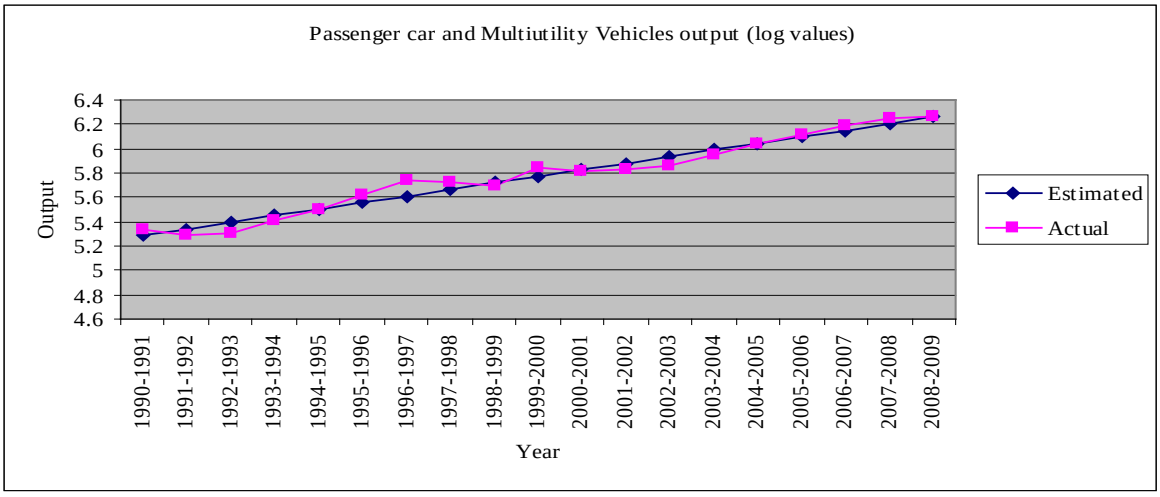
The Indian economy has grown at an annual rate of more than 8% over the last five years and the industrial production has made an outstanding contribution to this growth. The industry currently contributes about 5% of the GDP and it is targeted to become double by 2016 and account for over 10% of India's GDP. Vehicle manufacturers are increasingly adopting an outward looking approach and exploring new markets. The dominant products of the industry are two wheelers. The Indian CV industry is currently going through demand correction following one of the longest up cycles in its history. The industry grew at a rate of above 25% over 2001-07. Over the last five years, light commercial vehicles (LCV) and medium/heavy commercial vehicles (M/HCV) segment have grown at a CAGR of 27% and 17% respectively. Crisil estimates the PVs exports to cross 7 lakh units by 2011-12. The automobile industry of India is categorized into passenger cars, commercial vehicles, two wheelers and three wheelers, with two wheelers dominating the market. The overall growth trends are given below by some important differences amongst different types of CVs, and PVs (are confined to the period from 1990-1991 onwards), can be seen in Table4.3.1 and in Figure 4.3.1.1 and 4.3.2.2.

Figure 4.3.1.1
Average Growth Rate of Commercial Vehicles Output (Log values)



Fitted equation: log Y = 5.040 + 0.031* t
Where Y = Output, t = time, and * implies statistical significance at 1%, 5% and 10%
The Commercial Vehicles (CVs) industry (consists M/HCVs and LCVs).

Figure 4.3.1.2
Average Growth Rate of Passenger Vehicle (PV) Output
(Log values)

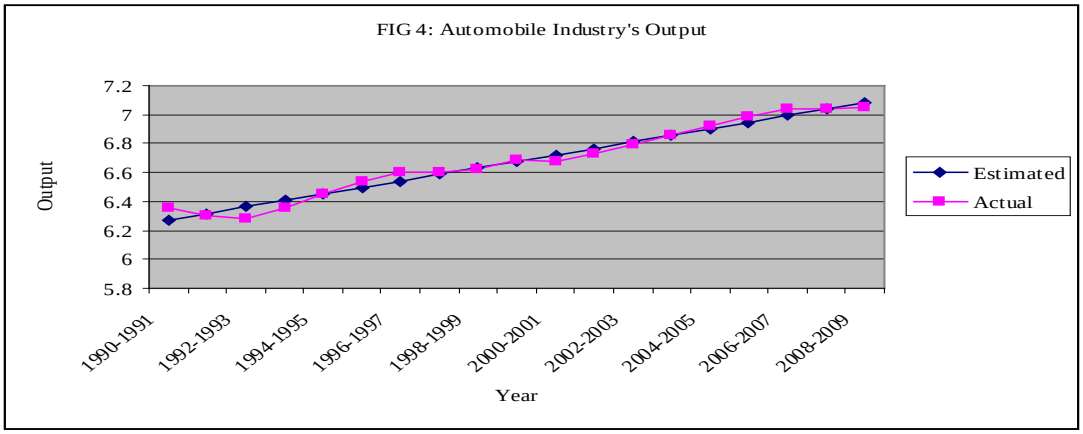


Fitted equation: log Y = 5.233 + 0.054* t
Where Y = Output, t = time, and * implies statistical significance
PV: The passenger Vehicle (PV) industry is divided into passenger cars, utility vehicles (UV) and multi utility vehicles (MUV).

The table 4.3.1 and the figures 4.3.1.1 and 4.3.1.2 (which graphs the logarithmic value of output, the slope of which indicates the percentage growth rate) clearly show the fluctuating growth trends of the commercial vehicle and passenger vehicle industry.

Overall, the entire period, 1990-1991 to 2008-2009, the estimated growth rate of commercial vehicles output is 3.1 percent. In spite of the inherent cyclical nature, the long term growth prospects for the industry remain closely linked to the development of road infrastructure, growth in gross domestic product (GDP) and industrial production. The industry follows the path by which these two goes and good performance of GDP and IIP results in higher demand for CVs. Overall the entire period, 1990-1991 to 2008-2009, the estimated growth rate of passenger Vehicle output is 5.4 percent. The past few years have witnessed a rapid change in all the segments of the Indian passenger vehicle industry. Overall the entire period, 1990-1991 to 2008-2009, the estimated growth rate of two and three wheeler output is 4.5 percent, which is not reported here. The figure 4.3.1.3 shows the growth trends of the automobile industry in India.

Figure 4.3.1.3
Average Growth Rate of Automobile Industry's Output
(Log values)



Fitted equation: log Y = 6.227 + 0.045*t
Where Y = Output, t = time, and * implies statistical significance
CVs: Commercial Vehicles include Medium and Heavy and Light Commercial Vehicles
PVS: Passenger Vehicles includes Passenger Cars and Multi Utility Vehicles

Table 4.3.1 and the figure 4.3.1.3 (which graphs the logarithmic value of automobile industry's output, the slope of which indicates the percentage growth rate) clearly show the growth trends of automobile industry in India. The entire period, from 1990-1991 to 2008-2009, the estimated growth rate automobile industry's output is 4.5 percent. The growth of overall automobile sector depends on the growth of all these three segments i.e. commercial vehicles, passenger vehicles and two and three wheelers sectors. since two and three wheelers sector is not part of the study. Although growth of these segments has

shown similar trend, volume growth in the M/HCV segment has been more volatile. The CV industry has high degree of correlation with the GDP and IIP (Index of Industrial production) of the country. The past few years have witnessed a rapid change in all the segments of the Indian PV industry. The expected continuance of economic growth and investments in infrastructure will help the commercial vehicle sector's growth going forward. Similarly, the increasing per head disposable income, lowering age of first-time car users, shorter replacement cycles and lower car penetration, it is expected that the Indian automobile industry would continue to grow at a healthy growth rate in the long run. With allies in a strong economy, rising demand and financial backing, Indian auto industry is standing at the threshold of success.

4.3.2. Policy Regime, Growth of Production of Automobiles

The automotive industry in India is characterized by a high growth patterns. The automotive industry in India has reached an impressive growth since the country's economic liberalisation. The Indian automobile sector is described as the sunrise sector. The study analyses the production growth of Indian automobile industry during two policy regimes, namely, liberalisation policy (1991-92 to 2000-2001) and the 'auto policy-2002' (2001-02 to 2008-2009). The past few years have witnessed a rapid change in all the segments of the Indian automobile industry. The annual average growth rate of production of vehicles explained in table 4.3.2.1.

Table 4.3.2.1
Annual Average Growth of Production of Automobiles (%)

Sectors	1991-92 to 2000-2001	2001-02 to 2008-2009	1991-92 to 2008-2009
M/HCVS	4.87	16.94	9.95
LCVS	4.03	20.83	11.11
ALL CVS	3.74	15.08	8.52
Passenger Cars	11.62	15.74	13.24
MUVS	13.64	10.55	12.34
ALL PVS	11.51	14.40	12.73
Total	8.99	14.57	11.34

Source: Computed, ACMA, Statistical Profile, SIAM and Indian Transport Motor statistics of Govt. of India, 2009. CVS: Commercial Vehicles, PVS: Passenger Vehicles, M/HCVS: Medium and Heavy Commercial Vehicles, LCVS: Light Commercial Vehicles, MUVS: Multi Utility Vehicles.

On the whole, Indian automobile sector grew at a much faster rate in the post 2001 era [14.57% per annum] when compared to [8.99% per annum] the period of 1991-2001. Medium and Heavy commercial vehicles sector also registered a growth rate of about 16.94% in the post 2001era over the growth rate of 4.87% per annum in the previous period, 1991-2001. Passenger vehicles sector [MUV and other utility vehicles] experienced the decrease in growth about 13.64 % per annum to 10.55 % per annum between the two periods. The car sector also had an increase of about 13.24 percent in its growth rate over the period. This was the only sector which had highest growth rate over the period. The Indian CV industry is currently going through demand correction. Although growth of these segments has shown similar trend, volume growth in the M/HCV segment has been more volatile. During the last decade, the sector had been growing at approximately 12-15% per annum, however in 2008-09 the automobile sector was badly hit due to the global economic downturn. In order to tide over the situation, Government of India took immediate remedial action and packages. These measures resulted in the Indian automotive industry bouncing back on the high growth track as enshrined in the Automotive Mission Plan (AMP) 2006-2016. International competition, increase in the number of participants, and the need to counter pressure on margins have made it a buyer's market rather than a seller's one.

4.3.3. Trend in Sales Growth of Automobiles

Domestic sales of automobiles in India have followed an increasing trend over the past few years, except a marginal dip in sales in the year 2007-08. The buoyant economy, rising income, easy availability of finance, together with several other factors had contributed to the growth in automobile sales in India during the analysed period. This sales growth trend may not be continuing in the year 2008-09 due to slowdown in overall economic activity in the world and in India. The growth in automobile sales in India increases during the liberalisation period. International competition, increase in the number of participants, and the need to counter pressure on margins have made it a buyer's market rather than a seller's one. A low ownership of 8 vehicles per 1000 persons (ACMA 2008a) and the presence of strong demand drivers have identified India as an attractive automobile market. Table 4.3.3.1 below shows the domestic sales trend for different vehicle types from the year 2001-02 to 2009-10 and its annual growth rate.

Table 4.3.3.1:

Recent Trend in Sales Growth Rates of Indian Automobile Industry
(In %, based on number of vehicles sold)

Year	PV	CV	Two wheeler	Three Wheeler	Automobile
2001-02	-5.92	-2.51	12.23	-3.30	8.40
2002-03	4.75	30.01	14.47	15.60	13.70
2003-04	27.56	36.41	11.47	22.70	14.63
2004-05	17.68	22.42	15.76	8.37	15.96
2005-06	7.68	10.24	13.57	16.91	12.77
2006-07	20.73	33.25	11.63	12.22	13.67
2007-08	12.31	4.86	-7.91	-9.69	-4.64
2008-09	0.18	-21.67	2.60	-4.13	0.72
2009-10	25.57	38.31	26.00	25.92	26.41

Source: Calculation from SIAM, Society of Indian Automobile Manufacturers, July 20, 2011.

During the period 2002-03 to 2006-07, there has been an increasing trend in the sales of all categories of automobiles. The growth of sales of both the commercial and the passenger vehicles segment during 2001 to 2002 were negative. The growth of passenger vehicle sector increased up to 2004 and again it declined up to 2006. The growth of this whole automobile segment from 2007 to 2009 looks declining trend. The domestic sales of whole automobile industry with a negative growth rate of 4.64 percent in 2008 and 0.72 percent in 2009. The growth of commercial vehicle sales is negative of 21.67 percent in 2009. The CV sector is adversely affected in the year 2009. This is due to the slowdown of Indian economy. These two years 2007-08 and 2008-09 remained sluggish due to both factors. First, bank rates were not conducive to the buyers of cars and secondly rejuvenation automobile market was stunted by non-introduction of newer models of cars. Further, a look into the sub-segment-wise demand for each of the vehicle segments gives an idea about the preferences of Indian consumers. One was not so sure about an immediate upturn in the industry, but may be the worst was behind now. Things are remain difficult for the next few quarters because the essential solution is an economic recovery. A recovery could be expected by 2010. The rise in input prices have been a key concern over the last two years particularly steel prices. Other major concerns are higher domestic inflation and increases in fuel prices have a negative impact on demand for CVs. Reduced

availability of credit and high cost of finance remain the main reasons for the current scenario in the commercial vehicle market, while falling industrial growth rate added to its woes.

4.3.4. Growth of Firms and its Variability

Growth of firms, in this analysis, is defined in terms of rate of change in the annual sales turnover at current prices. The sales turnover could not be converted into constant prices because most of the firms produce and market different models of cars and commercial vehicles. These models are priced differently, but data on model-wise sale of the number of vehicles is not available. Therefore, part of the changes in the rate of growth could also be attributed to changes in the models, differences in quality, product mix and fluctuations in prices. The average annual growth rate and the coefficient of variation [CV] of sales turnover in current prices of Indian automobile firms during the two periods, namely liberalisaion policy period during (1991- 2001) and a separate auto policy period from 2002 onwards are presented in table 4.3.4.1

Table 4.3.4.1

Average Annual Growth of Indian Automobile Firms and its Variability

Firms	Policy Regimes					
	Liberalisation policy Regime (1992-93 to 2001-2002		Auto Policy (2002-03 to 2008-2009		Whole liberalisation policy phase (1991-92 to 2008-2009)	
	Mean	C.V	Mean	C.V	Mean	C.V
ALL	12.31	149.11	14.09	140.23	13.08	136.77
FML	15.89	142.08	15.41	367.55	14.91	265.71
FML	10.77	193.22	6.12	303.88	8.74	214.75
SML	15.44	115.51	11.82	146.83	11.52	165.81
TATA	14.48	193.80	18.62	96.36	16.68	135.22
HML	12.81	97.68	-2.29	-1747.14	5.27	537.71
M&M	15.77	77.24	17.25	70.87	16.65	69.13
MSI	20.25	103.52	12.88	66.73	17.43	92.22.
All Firms	15.33	122.50	14.40	91.40	15.04	102.59

Source: Computed. Prowess Data Base, CMIE, 2009.
Note: Growth of firm is defined in terms of rate of change in the annual sales turnover. C.V. represents coefficient of variation in the respective growth rates. ALL: Ashok Leyland Ltd, FML: Force Motor Ltd, TATA: Tata Motors Ltd, SML: Swaraj Mazda Ltd, HML: Hindusthan Motors Ltd., M&M: Mahindra and Mahindra Ltd and MSI: Maruti Suzuki Ltd.

The table 4.3.4.1 clearly indicates large differences across firms and wide year-to-year fluctuations in growth during all the two periods. Although the average annual growth rate of all firms as a group was 15.33 percent in the liberalisation period and 14.40 percent during the 'auto policy' period, the variability during the second is much lower than that during the first period. From the table it emerges that the rate of growth of three leading firms, Tata Motor, Mahindra & Mahindra, and Ashok Leyland in the 'auto policy' regime is higher than the growth rate in liberalisation period. The variability in the growth rate of Ashok Leyland, Tata, Mahindra and Mahindra, Maruti Suzuki in the second period is lower compared to the first period. Both Ashok Leyland and Tata Motors operate in the heavy commercial vehicles segment of the automobile industry and have long experience of being in this business. Similarly Maruti Suzuki and Mahindra and Mahindra operate in the passenger cars and utility vehicles segments of the automobile industry and have long experience of being in this business. The growth rate of Hindustan Motor is negative during 2001-02 to 2008-2009 and its variability is very large. Because it is a very old firm and continues in the same product line.

Table 4.3.4.2

Inter Temporal Growth rate of Automobile Firms during the Two Different Policy Regimes

	Policy Regimes		
Years	Delicensing 1992-1993 to 2000-2001	Years	Auto policy 2001-2002 to 2008-2009
1993-1994	24.95	2002-2003	11.93
1994-1995	39.22	2003-2004	32.26
1995-1996	40.12	2004-2005	27.92
1996-1997	22.43	2005-2006	12.98
1997-1998	-8.76	2006-2007	25.45
1998-1999	-3.34	2007-2008	8.56
1999-2000	23.16	2008-2009	-4.64
2000-2001	-4.52		

Source: Computed, Prowess Data Base, CMIE, 2009.
Note: Growth of firm is defined in terms of rate of change in the annual sales turnover.

Table 4.3.4.2 indicates large year-to-year fluctuations in the growth of Indian automobile firms. During the liberalisation policy period, the growth of firms increased from 24.95% in 1993-1994 to 40.12% in 1995-1996. It started declining from 40.12% in 1995-96 to -3.34% in 1998-99. However, it appears to have picked up momentum in 1999-2000 with an increase of about 23.16%. Then the growth of firms has large momentum in 2000-2001 with a decrease about -4.52%. There are large fluctuations in the growth rates of firms particularly from 1998-1999 to 2000-2001. During these periods, the growth does not appear to be stable.

The fragmentation of the market with the entry of new players and the general recessionary conditions in the country simply exacerbated the situation in early 1990s. The industry suffered from the problem of overcapacity and the sales-capacity ratio of automobile manufacturers improved only after 1998 (Singh 2004). The passenger car segment with the highest untapped growth potential saw the most hectic activities from the foreign automotive firms. By mid-1990s, several foreign players had entered into the Indian passenger car market by mainly setting up JVs with the local firms. In the CV segment, most of these new ventures proposed to initially only assemble SKD/CKD kits. In 1997, the Ministry of Industry in its policy for automotive industry placed import of capital goods and auto-components under Open General License (OGL), but regulated the import of automotive vehicles in CBU form or in SKD/CKD condition. The fluctuations in the growth rates during the auto policy period appear to have abated and declined after 2006-2007 and became negative growth rate in 2008-2009. This is badly hit by the slowdown of Indian Economy.

4.3.5. Capacity Utilisation of Automobile Firms

The automobile industry especially over a period of time and particularly after liberalisation, has installed a robust capacity. Capacity utilisation measures the extent to which a business is using its production potential. Capacity utilisation can be defined as the percentage of total capacity that is actually being achieved in a given period. Capacity utilisation (which is traditionally expressed as a percentage) is calculated using this formula

$$\frac{Actual\ level\ of\ output}{Maximum\ possible\ output} \times 100$$

Capacity utilisation is an important concept because it is often used as a measure of productive efficiency. Average production costs tend to fall as output rises, so higher capacity utilisation can reduce unit costs, making a business more competitive. So firms usually aim to produce as close to full capacity (100% utilisation) as possible. It is important to remember that increasing capacity often results in higher fixed costs. A business should aim to make the most productive use it can of its existing capacity. The investment in production capacity is often significant. Capacity utilization is a concept in economics which refers to the extent to which an enterprise or a nation actually uses its installed productive capacity. Thus, it refers to the relationship between actual output that is produced with the installed equipment and the potential output which could be produced with it, if capacity was fully used the other day. If market demand grows, capacity utilisation will rise. If demand weakens, capacity utilization will slacken. Economists and bankers often watch capacity utilization indicators for signs of inflation pressures. It is believed that when utilization rises above somewhere between 82% and 85%, price inflation will increase. Excess capacity means that insufficient demand exists to warrant expansion of output. Implicitly the capacity utilization rate is also an indicator of how efficiently the factors of production are being used. The capacity utilisation of Indian automobile firms is clearly shown in appendix 2.1.

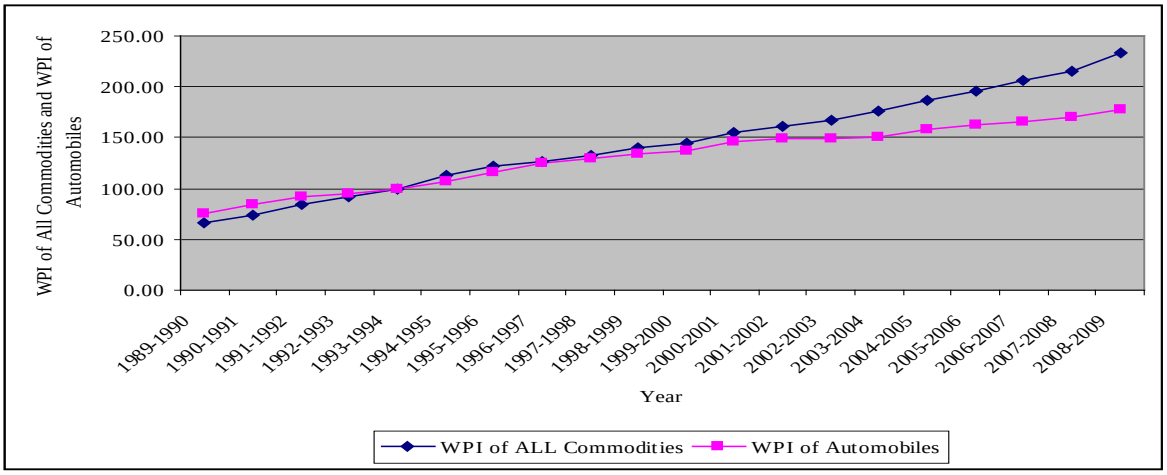
4.4. Price Indices of Automobiles

The study includes an application of the theory to analyse automobile prices in India during the period 1989-90 to 2008-2009. The price index is an indicator of the average price movement over time of a fixed basket of goods and services. The constitution of the basket of goods and services is done keeping in to consideration whether the changes are to be measured in retail, wholesale, or producer prices etc. The basket will also vary for economy-wide, regional, or sector specific series. The grouping and classification of WPI is also useful for in depth analysis as separate inflation rates can be worked out for groups with items whose prices are given to extreme fluctuations, affected by international prices or have administered prices. The wholesale prices index (WPI) is taken in (1993-194) prices. The wholesale prices index data is given in appendix 2.3. Figures 4.4.1 & 4.4.2

show that the wholesale price index (WPI) of all commodities, automobiles, cars, buses and trucks.

Figure 4.4.1

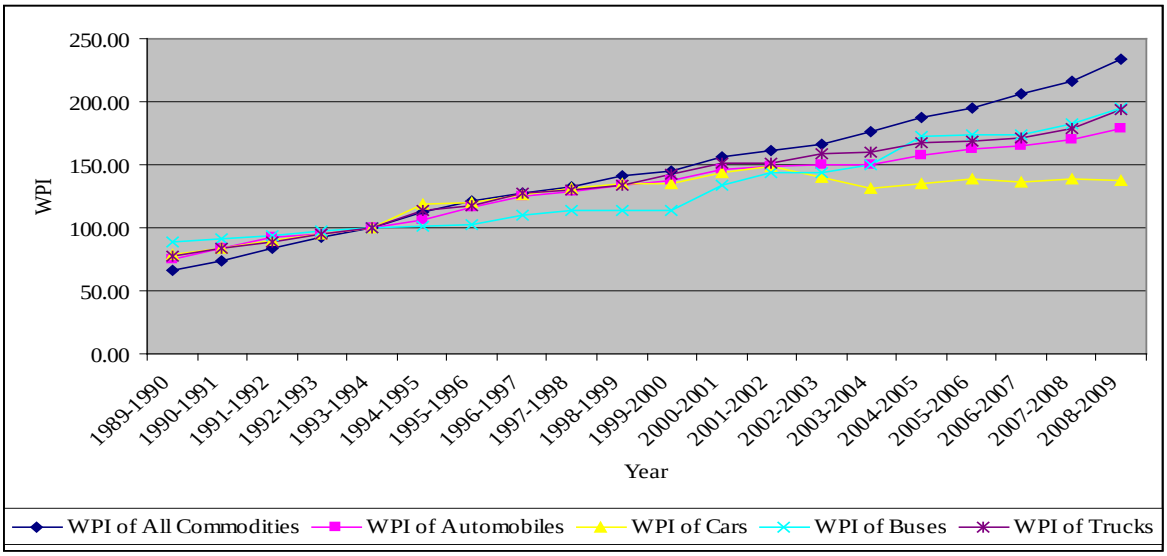
WPI of Automobiles and All Commodities



Source: Ministry of Statistics and Programme Implementation, Government of India, New Delhi, 2009.

Figure 4.4.2

WPI of All Commodities, Cars, Buses and Trucks



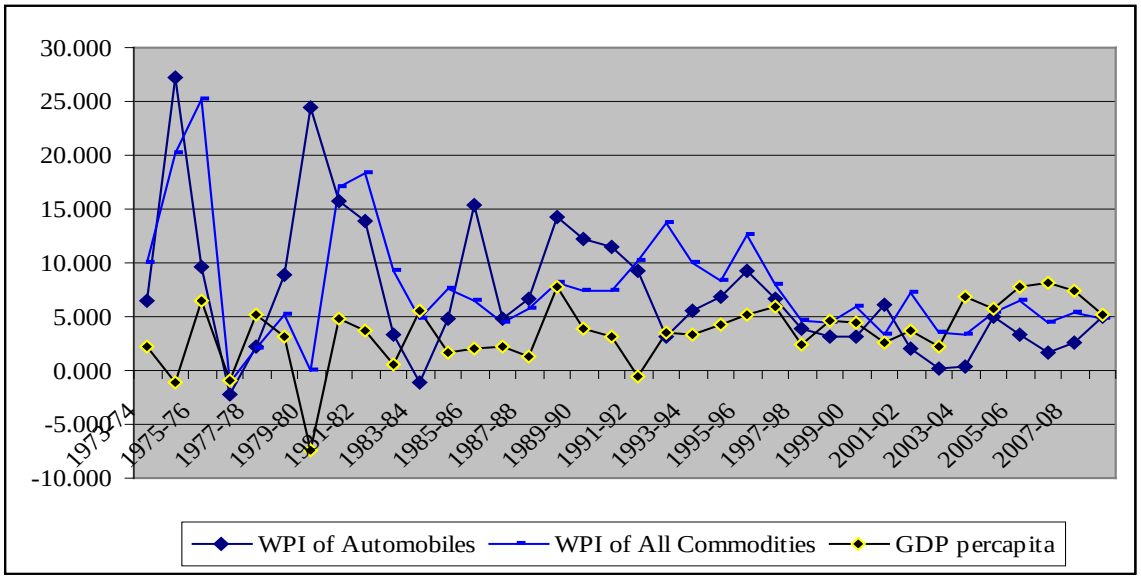
Source: Ministry of Statistics and Programme Implementation, Government of India, New Delhi, 2009.

In this section, we will look at the different segment of automobile industry which are available in the Indian market and the price range at which they come. Wholesale price of

automobiles was almost identical to the WPI of all commodities, till 1996-97. Since 1996-97, WPI of all commodities have risen at a lower rate than that of automobiles, and the gap between these two WPIs have become conspicuously wide by 2007-08. It illustrates the fact that prices have fallen for cars in 2002-03 and motorcycles in 2001-02, due to the cuts in excise duties for these vehicles. All WPIs have moved together except WPI of buses from 1993-94 to 2000-01, but the WPIs of all the automobile segments have been consistently lower than those of all commodities. After 2000-01, WPIs of trucks and buses have been rising at a higher rate than cars and motorcycles but at a lower rate than the index for all commodities. Across countries, there is a strong relation between the level of economic development and the level of motorization. The motor vehicles are purchased by individuals, households, or firms and are privately owned; motorization is normalized with respect to the population and normally measured per thousand persons. Vehicle ownership increases with income. As automotive industry was hardest hit by economic recession during 2008-2009, many consumers demonstrated strong shift in spending trends. Figure 4.4.3 sheds light on an interesting trend regarding the growth of real prices of automobiles over the years.

Figure 4.4.3

Growth Rate of Wholesale Price Indices of Automobiles, All Commodities and Per capita GDP (Base Year: 1993-94)



Source: Calculations from Ministry of Statistics and Programme Implementation and RBI Handbook of Statistics on Indian Economy, September 15, 2010

When we compare the growth of auto prices with growth in real per capita GDP, it is noteworthy that auto prices had been growing at much higher rate than per capita income in the 1970s. However, the difference has been falling drastically since the early 1990s, and this has been negative persistently since 2001-02. This means that compared to the rate at which Indian per capita income has been growing in real terms in the past few years, the growth in auto prices has been low. This could be because of the fact that tariffs have been cut since the 1990s and also because of the huge volumes accumulated by many auto majors, as reflected in the analysis of growth trends in inventories. Consumers have benefited from a significant decrease in car prices adjusted for headline inflation in 2007. The growth rate of WPI of automobiles, all commodities, fuel and GDP percapia is depicted in appendix 2.3.1.

4.5. Factors Related to Domestic Automobile Demand

The determinants of demand for this industry include vehicle prices (which are determined largely by wage material and equipment costs) and exchange rates, preferences, the running cost of a vehicle (mainly determined by the price of petrol), income, interest rates, scrapping rates, and product innovation. Movement in income and interest rates determine the affordability of new motor vehicles. Allowing large FDI led to increase in competition in the domestic market hence, making better vehicles available at affordable prices. Movement in oil prices also has an impact on demand for large cars in India. Product innovation is an important determinant as it allows better models to be available each year and also encourages manufacturing of environmental friendly cars.

The factors contributing to the increased demand of automobiles and the growth of this sector are the convergence of government policies, economic growth and people's purchasing power. These factors have contributed to the phenomenal growth of Indian auto industry. Higher GDP means more purchasing power. The following studies are concerned with automobile demand. Carlson (1978)[8] develops a multi-equation to explain automobile demand in the United States using quarterly data. On the one hand, the results indicate that the level of disposable income is the most important determinant of automobile demand, moreover, that gasoline shortages and higher gasoline prices cause a fall in the demand.

[8] Rodney L. Carlson (1978), "Seemingly Unrelated Regression and the Demand for Automobiles of different Sizes, 1965- 75: A Disaggregate Approach", *Journal of Business*, Vol.51, No.2, pp. 243-262.

Carlson and Michael (1980)[9] use quarterly data to forecast the automobile demand and to analyse automobile demands of different sizes and show that disposable income has the greatest impact in their model and price is a significant factor under conditions of depressed levels of automobile sales. Furthermore, price and income elasticity can be calculated to analyse relevant factors. This study examines the factors that are most likely to influence the Indian automobile demand. We adopt four variables (the price index of durable goods, the price of fuels, the lending rate and GDP. The model of Indian auto demand can be written as follows:

$$Y_t = \beta 0 + \beta 1\ X_{1t} + \beta 2\ X_{2t} + \beta 3\ X_{3t} + \beta 4\ X_{4t} + u_t \qquad (4.5.1)$$

Where

Y_t is the quantity demanded for automobiles; X_{1t} is the price index of durable goods; X_{2t} is the price of fuels; X_{3t} is the lending rate; X_{4t} is the GDP and u_t is the stochastic disturbance item. We employ the log linear model to estimate the elasticity of demand for automobiles in this study. The log linear model can be represented as

$$\log Y_t = \beta 0 + \beta 1\ \log X_{1t} + \beta 2 \log X_{2t} + \beta 3\ \log X_{3t} + \beta 4\ \log X_{4t} + \mu t \qquad (4.5.2)$$

In what follows, we interpret and list the results of the data checking conducted by means of the multicollinearity, and autocorrelation tests. We use the OLS model to run a regression analysis in order to develop the model for automobile demand in India for the period 1990-91 to 2008-2009. We also present the final regression model after modifications performed on the basis of the OLS method. The results of regression analysis are given below in table 4.5.1.

[9] Rodney L. Carlson and Umble M. Michael (1980), "Statistical Demand Functions for Automobiles and their use for Forcasting in an Energy Crisis", *Journal of Business*, Vol. 53, No. 2, pp. 193-204.

Table 4.5.1

OLS Model for Automobile Demand in India
(Dependent Variable: Automobile Sales)

Variables	Automobile Sector	Variables	Passenger Cars and Utility Vehicle sector (PVs)		Commercial Vehicle Sector (CVs)
Variables	Coefficients	Variables	Coefficients	Variables	Coefficients
C	-2.679 (0.91)	C	-5.455 (1.11)	C	-6.148 (2.28)**
X_{1t}	-0.126 (0.48)	D (X_{1t})	-0.081 (0.52)	X_{1t}	-0.961 (3.25)*
X_{2t}	-0.288 (0.52)	X_{2t}(-1)	-1.188 (2.05)**	D(X_{2t})	-0.922 (0.99)
X_{3t}(-1)	-0.798 (1.75)***	X_{3t}(-1)	-0.491(1.68)***	X_{3t}(-1)	-1.285 (2.07)**
X_{4t}(-1)	2.411(2.64)*	X_{4t}	3.348 (2.93)*	X_{4t}	3.462 (4.58)*
AR(1)	0.561(2.32)**	AR(1)	0.851 (6.35)*	AR(1)	0.159 (0.41)
R^2	0.96	R^2	0.97	R^2	0.89
Adj. R^2	0.94	Adj. R^2	0.96	Adj. R^2	0.84
D.W.Stat.	1.96	D.W.Stat.	1.64	D.W.Stat	1.68

Notes: Figures in the parenthesis indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %. D indicates the first difference level respectively.

The study finds from the results that income will have a positive influence on their demand, while an increase in price should have a negative impact. The results reveal a positive relationship between automobile demand and gross domestic product and negative relationship between automobile demand and prices of consumer durables, fuel price, and lending rate. In summary, the table shows the main factors influencing the quantity of automobiles demand to be the price of consumer durables, the fuel price, the lending rate and GDP in the context of the period of time under observation. GDP per capita emerged positively significant at one percent level for all three sectors. Lending rate is negatively significant in determining both CVs and PVs and as well as the whole automobile sector. The study finds that automobile demand in India is influenced by real income, the price of the automobile, fuel prices, and interest rates.

The results find that the price index of durable good has significantly negative impact on the automobile demand in India. The study shows that the price of cars has a greater impact on the demand in the small and compact market than it does in the luxury and intermediate market. This finding can be justified when one considers the small and

compact market as the market for the not-so-wealthy segment of society who is usually quite sensitive to price changes. The price elasticity of the demand is 0.126, suggesting that if the price of vehicles increased by 1 percent, the quantity of automobile demanded would decrease by 0.126 percent in the whole automobile sector. The price elasticity of the demand is 0.081, suggesting that if the price of vehicles increased by 1 percent, the quantity of automobile demanded would decrease by 0.081 percent in the PVs. Similarly, the price elasticity of the demand is 0.961, suggesting that if the price of vehicles increased by 1 percent, the quantity of automobile demanded would decrease by 0.961 percent in the CVs. Conventional economic wisdom holds that automobiles are a luxury good in India. Thus, the more GDP increases, the greater the quantity of automobiles demanded must be. It is obvious to show that automobiles are not common in India, and thus expenditure on them is still high. Automobiles having high income elasticity can be promoted as being luxurious and stylish products for auto manufacturers in India.

The cross-price elasticity of demand is 0.288, suggesting that if the price of fuels increased by 1 percent, the quantity of automobile demanded would decrease by 0.798 percent in the whole automobile sector. The cross-price elasticity of demand is 1.188, suggesting that if the price of fuels increased by 1 percent, the quantity of automobile demanded would decrease by 1.188 percent in the PVs. Similarly in the CVs, the cross-price elasticity of the demand is 0.922, suggesting that if the price of fuels increased by 1 percent, the quantity of automobile demanded would decrease by 0.922 percent. The coefficient of price of fuel is only statistically significant in PVs. The higher the price of fuels, the lower the quantity demanded. The results find that the price of fuel is not the main factor in the CVs influencing auto demand in India. But the price of fuel is the main factor in PVs influencing auto demand in India.

The coefficient of lending rate indicates that a one hundred basis points increase in the cost of borrowing results in a 0.798 percent decrease in the quantity of automobile demanded in the whole automobile sector. Similarly, the coefficient of lending rate shows that a one hundred basis points increase in the cost of borrowing results in a 0.491 percent decrease in the quantity of automobile demanded in PVs. Similarly in the CVs the coefficient of lending rate indicates that a one hundred basis points increase in the cost of borrowing results in a 1.285 percent decrease in the quantity of commercial vehicle demand. But the

coefficients of lending rate are negative and statistically significant in all these three sectors. Rise in interest rates may prove to be a dampener on the automobile demand, especially given the fact that around 60-70% of commercial vehicles purchased are financed. The income elasticity of demand is 2.411, suggesting that if GDP increases by 1 percent, the quantity of automobiles demanded would increase by 2.411 percent, which is to say that the sales of automobiles would increase by 2.411 units in the whole automobile sector. Similarly, the income elasticity of the demand is 3.348, suggesting that if GDP increases by 1 percent, the quantity of automobiles demanded would increase by 3.348 percent, which means the sales of automobiles would increase by 3.348 units in the PVs. Similarly in the CVs, the income elasticity of the demand is 3.462 percent, suggesting that if GDP increased by 1 percent, the quantity of automobiles demanded would increase by 3.462 percent, which means the sales of automobiles would increase by 3.462 units in the CVs.

4.5.1. Error Correction Model for Automobile Sales Growth

The automobile industry has been affected by the crisis. The short-term economic impacts of these measures are difficult to assess, given the lack of information on what would have happened in their absence. Evidence from for the U.S. and Canada suggests that the reduction in car sales since mid 2008 has been magnified by the lack of access to credit, leading many households to postpone their car purchases. This study describes the model of passenger vehicles (PVs) sales growth which has been used to explain the fall in passenger vehicle sales in the year 2008 and the effect of the improvement in financial conditions and the recovery in demand on short-term prospects for sales. For country like India the equation is specified as an error-correction model. In the long-term, sales depend on GDP per capita (gdppc). Over the short-term, sales growth is driven by growth of GDP per capita, fuel prices and cost of borrowing conditions as well as the gradual level adjustment of sales to their long-term trend.

$$Log(sales) = \alpha_1 + \beta_1 \log(gdppc) + \beta_2 \log(oil) + \beta_3 ci \qquad (4.5.1.1)$$

Data for sales are passenger vehicle sales. Oil price is taken as fuel power, light and lubricants. ci is the cost of borrowing condition is taken as lending rate likely to influence automobile demand. The equation is estimated by error correction model for the time period 1990-91 to 2009-2010. The cointegrating regression so far considers only the long-

run property of the model, and does not deal with the short-run dynamics explicitly. Clearly, a good time series modelling should describe both short-run dynamics and the long-run equilibrium simultaneously. For this purpose we now develop an error correction model (ECM). The short-run behavior is partially but crucially captured by the error correction coefficient. The error correction results are shown below in table 4.5.1.1.

Table 4.5.1.1

Error Correction Model for Passenger Vehicles and Commercial Vehicles Sales Growth

Passenger Vehicles Sector (PVs)		Commercial Vehiclec Sector (CVs)	
Variables	Coefficients	Variables	
gdppc (Long run)	4.307 (4.88)*	gdppc (Long run)	1.849 (8.15)*
Δ Sales(-1)	0.041 (0.16)	Δ Sales(-1)	0.552 (2.93)*
Δ dgdppc (-1)	2.328 (1.18)	Δ dgdppc (-1)	-4.678 (2.02)**
D(fuel)	-0.465 (0.81)	D(fuel)	-2.005 (3.35)*
Lending (-1)	-0.645 (2.28)**	Lending (-1)	-0.582 (2.66)*
ECM	-0.111 (3.31)*	ECM	-0.267 (1.71)***
R^2	0.59	R^2	0.76
Adj. R^2	0.43	Adj. R^2	0.66

Notes: Figures in the parenthesis indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %. Lag length 1 is selected using log likelihood ratio (LR) test. D indicates the first difference level respectively.

On one hand, the demand for automobiles in India is shrinking due to lack of available consumer finance, high interest rates and high cost of fuel, and on the other hand, cost of input material has witnessed massive increases. The error correction model results of PVs shows that sales growth depends on GDP per capita in the long run and in the short run depends on GDP per capita (gdppc), fuel price (*oil*) and cost of borrowing (lending rate). They are also cointegrated, that is, there is a long term equilibrium relationship between these variables. Of course, in the short run there may be disequilibrium. The short-run behavior is partially but crucially captured by the error correction coefficient. We can use this error term to tie the short run behaviour of car sales growth to its long run value. We just showed that PVs sales growth depends on growth of gdppc and fuel price, lending rate and also the equilibrium error term. The coefficient of gdppc is highly significant. The error correction term in the estimated equation is highly significant and has correct sign. The error correction term is negative and statistically significant with a coefficient of 0.11,

suggesting that it takes a little over one year for long run equilibrium to be restored after economic downturn to the system. It suggests that about 11 percent of errors are corrected in each period to maintain the equilibrium relationship between PVs sales growth and per capita GDP.

The short run changes in gdppc have a positive impact on short run changes in PVs sales growth. The coefficient of GDP per capita (gdppc) is positive and not statistically significant. If gdppc increases by one percent, the quantity of car sales growth increases by 2.32 percentages. It can be interpreted 2.328 as the short run changes. The results also suggest that the changes in fuel price have significantly negative impact on car sales growth in the short run. The coefficient of fuel price is negative and not statistically significant. The results show that short run changes in fuel price have a negative impact on short changes in PVs sales demand. It can be interpreted that 0.465 is the short run marginal propensity to consume. The coefficient of lending rate is negative and statistically significant at 5 percent level. The results suggest that the changes in interest rate have significantly negative impact on car sales growth in the short run. The results show that short run changes in lending rate have a negative impact on short changes in PVs sales demand. It can be interpreted that 0.64 as the short run changes.

Similarly, the error correction model results of CVs show that in the long-term, sales depend on gdppc and in the short run depend on gdppc, fuel price (*oil*) and cost of borrowing (lending rate). The results find that there is a long term relationship between the commercial vehicle sales growth and gross domestic product per capita. The coefficient of gdppc is positive and highly significant. The error correction term in the estimated equation is significant and has correct sign. The error correction term is negative and statistically significant with a coefficient of 0.26, suggesting that it takes a little over one year for long run equilibrium to be restored after economic downturn to the system. It suggests that about 23 percent of errors are corrected in each period to maintain the equilibrium relationship between the CVs sales growth and per capita GDP.

The short run changes in GDP per capita have a negative impact on short run changes in CVs sales growth. The coefficient of GDP per capita (gdppc) is negative and statistically significant. The short run changes in fuel price have a negative impact on short run changes in commercial vehicle sales growth. One can interpret that 2.01 as the short run

changes in fuel price (marginal propensity to consume). The short run changes in interest rate have a significantly negative impact on sales growth. It can be interpreted that 0.58 as the short run changes in lending rate. In the long run, a slowing industrial production can be more ominous than the short-run problem of non-availability of credit. The commercial vehicle industry has a high degree of correlation with the GDP and IIP (Index of Industrial production) of the country. In the long run, a slowing industrial production can be more ominous than the short-run problem of non-availability of credit. Another concern is a slowdown in the Indian economy. The economic scenario has to improve and banks have to start lending.

4.6. Determinants of Growth of Firms

This study attempts to analyse the differences in the technological strategies adopted by the firms, and how the difference in the firm characteristics determine the technological behavior of firms drawn from the Indian automobile industry. Studies explaining growth of firms mostly defined growth in terms of rate of change in the annual sales turnover of the firm. This study also defines growth in terms of annual sales turnover and examines the role of firm size, age, profits and technological factors in determining growth of firms. But it postulates changing nature of the role of these explanatory variables in determining growth. While changes in the role of size, age and profits are largely governed by the policy regime in which the firms operate, differences in the nature and direction of the technology variables are guided by changes in the technological regime. This is largely due to the ways in which a firm changes its technological strategy. Details of the policy environment in which the firms have been operating during the two policy periods like 'liberalisation policy' and 'auto policy' effects are explained here. The study attempts to examine the following functional form:

Growth = f (IMCAP, IMTECH, RD, FE, Size, PCM, VI, CI, AGE) (4.6.1)

where Growth-growth of firms defined in terms of rate of change in annual sales turnover; IMCAP-embodied technology imports measured by value of imports of capital goods as a proportion of sales; IMTECH, disembodied technology imports measured by lumps um and royalty payments as a proportion of sales turnover; RD-R&D intensity measured by research and development expenditure as a proportion of sales; FE- foreign equity

participation measured by percentage of foreign equity shares to the total paid up capital of the firm; Size-size of the firm measured by the log value of annual sales turnover; PCM-price-cost margin is defined by gross profits as a proportion of sales turnover; VI-degree of vertical integration defined by value added as a proportion of annual sales turnover; Cl-capital intensity is defined by book value of plant and machinery as a proportion of sales turnover; AGE-age of the firm measured by depreciation as a ratio of gross block. The study analyses the determinants of the growth of firms in the Indian automobile industry during two policy regimes, namely, liberalisation policy (1990-91 to 2000-2001) and the 'auto policy-2002' (2001-02 to 2008-2009). The empirical analysis follows the observations are pooled. The study uses fixed effect estimations to analyse the determinants of growth of firms during these policy regimes. The empirical results of fixed effect estimates of the slope parameters are presented in table 4.6.1.

Table 4.6.1

Fixed Effects Estimation of Determinants of Growth by Policy Regimes
(Dependent Variable: Sales Growth)

Liberalisation policy period (1990-91 to 2000-01)		Auto policy (2001-02 to 2008-09)	
Variable	Coefficient	Variables	Coefficient
Constant (C)	44.901 (0.95)	Constant (C)	0.331 (0.05)
Firm Size	0.0582 (0.02)	Firm Size	5.281 (0.31)
D(CI)	-0.084 (2.36)**	CI (-1)	0.274 (3.71)*
D(AGE)	-1.591 (0.66)	AGE	-1.833 (2.97)*
IMCAP (-1)	4.801 (6.05)*	IMCAP (-1)	2.678 (1.75)***
IMTECH (-1)	2.295 (0.23)	D(IMTECH)	-6.834 (1.49)
PCM	4.401(5.11)*	PCM	1.393 (2.48)**
D(VI)	-3.998 (3.01)*	D(VI)	1.672 (2.42)**
RD	-60.025 (6.33)*	RD	-6.611 (1.91)**
D(FE)	-16.648 (0.11)	D(FE)	0.041 (0.08)
R SQR	0.73	R SQR	0.55
ADJ. RQR	0.66	ADJ. RQR	0.39
F	10.83	F	3.38
NOBS	88	NOBS	80
No of Firms	8	No of Firms	10

Notes: Figures in the parentheses indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %. D indicates the first difference level respectively.

The results broadly indicate that technological factors play an important role in determining the growth of firms in this industry. The nature of effect, however, appears to vary across different technological regime. The different technological strategies considered are in-house R&D, imports of embodied technology (in the form of import of capital goods), Import of disembodied technology (lump sum and royalty payments), and foreign equity (intra-firm transfer of technology through foreign direct investment). During the liberalisation regime, import of capital goods (IMCAP) emerged significant with a positive coefficient. Consequently the share of machinery in fixed investment has risen constantly during the market reform. Another important policy decision was the relaxation of imports of capital goods and technology. The coefficient of disembodied technology (IMTECH) is positive but is not statistically significant. Liberalisation of restrictions on lumpsum and royalty payments could have led to an increase in the use of this mode of technology imports. The increasing presence of multinationals and transfer of better quality technology could have also led to an increase in technology. R&D emerged significant with a negative coefficient. During the liberalisation period, most firms show quite declining trend in terms of R&D intensities. Indian automobile companies spend a very low amount on R&D. Most companies spend a part of their sales, less than 1%, on R&D. R&D intensities for these firms are lower during liberalisation period is given in appendix 2.2.1. Thus, their R&D intensities (R&D spending as a percentage of total sales) declined. We find that the R&D expenditures vary with firm size. Therefore, the effect of R&D expenditures on firm growth varies with firm size. The coefficient of FE (Foreign equity) emerged insignificant with a negative sign. Restrictions on foreign equity investment and selective permission allocate a limited role for intra-firm transfer of technology. With liberalisation multinational firms could have majority equity holdings and therefore influence management of the firm as well. But the negative sign may be due to the fragmentation of the market with the entry of new players and the general recessionary conditions in the country simply exacerbated the situation in early 1990s. The industry suffered from the problem of overcapacity and the sales-capacity ratio of automobile manufacturers improved only after 1998 (Singh 2004).

The coefficient of firm size is positive and is not statistically significant. Firm size appears to be positively influencing growth during the liberalisation policy regime. Siddharthan et

al (1994) could be argued that size is a catchall variable that could capture effects of multinationality, technological capabilities, age, capital intensity and vertical integration advantages. If these variables were introduced separately, the inverse relationship would still hold true. This would imply that if the effect of technology, vertical integration and age are separated, large firms were not be able to grow faster due to economies of scale irrespective of the policy regime in which they operate. One possible explanation for this inverse relationship is that the large firms may have grown beyond the optimum, and so would be growing slower compared to their smaller counterparts, which are moving towards the optimum.

Capital intensity has also turned out to be significant with negative coefficient in liberalisation regimes. It influences growth negatively. This implies that efficient utilisation of capital stock, with a corresponding reduction in the marginal cost of production, does enable a firm to grow at a higher rate than the others. Efficient utilisation of capital appears to be very important, especially with delicensing, for firms drawn from a particular industry. Similarly, the age of the firm emerged insignificant with a negative coefficient during liberalisation period indicating that new firms are growing at a faster rate than their older counterparts. However, the longer the time the firm has already spent in the same line of business, more difficult it would be for the firm to grow. Ability of the new firms to facilitate technological paradigm shifts speedily and access to foreign capital and technology could both be possible explanations for this inverse relationship.

The relationship between growth and vertical integration (VI) is negative and significant during the liberalisation policy regime. This inverse relationship between VI and growth could largely be due to the limits that VI imposes on the firms to diversify into other sectors within the automobile industry. The results also confirm a positive relationship between profits and growth, the coefficient of profits emerged significant with a positive coefficient. Kumar (1994)[10] also reported a positive relationship between profits and growth for U.K. firms. This could be because, higher the level of profits, firms may find themselves in a better position to raise funds needed for investment and diversification

[10] Nagesh Kumar and N.S. Siddharthan (1994), "Technology, Firm Size, and Export Behavior in Developing Countries: the Case of Indian Enterprise," *Journal of Development Studie*s, Vol. 31, No. 2, pp. 289-309.

from external sources and that too at favourable terms. Following Marris, it could be stated that profits determine the ability and willingness of the firms to grow.

Auto policies, however, seems to have changed the role played by these technological factors. The coefficient of Import of capital goods (IMCAP) is positively significant. Import of capital goods (IMPACP) influences growth positively. The import of disembodied technology is negative and not statistically significant. It influences growth negatively. FE is the technological variable that emerged positive and not significant. This implies that even during 'auto policy' regime, firms with foreign equity participation tend to grow faster than the others due to ownership and/ or resource advantages that these firms enjoy. R and D did take a negative sign, but its coefficient is significant. During auto policy period, most firms have increased R&D expenses compared to liberalisation period. Although the R and D activity of some of these firms have also gone up during this period, it may still not be adequate enough to result in improving the growth prospects. However, Indian automobile companies still spend very low amount on R&D as a percentage of sales. Therefore, the effect of R&D expenditures on firm growth varies with firm size.

Firm size appears to be positively influencing growth during the auto policy period. In this period, however, the coefficient of CI emerged positively significant. This implies that efficient utilization of capital stock, with a corresponding reduction in the marginal cost of production, does not enable a firm to grow at a higher rate than the others. Efficient utilisation of capital appears to be very important, especially with delicensing, for firms drawn from a particular industry. Age of the firm emerged significant with a negative sign. The relationship between growth and vertical integration is positive and significant during this policy regime. This inverse relationship between VI and growth could largely be due to the limits that VI does not impose on the firms to diversify into other sectors within the automobile industry. The results also confirm a positive relationship between profits and growth, the coefficient of profits emerged significant in all the periods with positive sign. Moreover, since firms in this industry made heavy investment during these two periods, profits may actually have been used to fund these investments. In both these regimes, technological factors play an important role in determining the growth of firms in this industry. Thus growth is mainly technology driven. The nature and direction of the effect of technology variables are governed largely by the technological regime in which a firm

operates. The level of technology change in the motor vehicle industry has been high but the rate of change in technology has been medium. Overall, Liberalisation in economic policies, however, seems to have changed the role played by these technological factors. Growth theory of the firm suggests that profits and growth of the firm are interrelated. The company plans to earn a certain amount of profit determined by the amount of investment that it intends to undertake. Profits in turn provide internal funds and incentive for investment and growth. A fundamental assumption of this theory is that the goal of the firm is to cause its sales to grow as rapidly as possible subject to the constraints imposed by the growth of demand, growth of capacity and the availability of finance for investment.

4.7. Profitability of Firms (Tobin's q Measure)

Profit is an important indicator of the financial performance of an industry. It gives incentives to the shareholders for further investment with the expectation of appreciation of capital and obtaining higher rates of dividend on the share money. The important task is that of bearing risk in a dynamic economy.[11] Different rates of profit exist in different industries on accounting of the varying amounts of risk involved. However, Knight (1921)[12] has argued against Clark and Hawley (1899) on the ground that changes and risk are heterogeneous. He asserts that uncertainty about price, demand, market conditions and technology is the major factor which explains profits. The industry and factor market structure theory that considers market imperfections, factor cost structure, government controls and seller concentration etc. as decisive factors in explaining profits. Conventionally, profitability is measured as the ratio of profits before tax (after paying interest) to the book value of capital (fixed assets plus working capital), or alternatively as the ratio of net (after tax) profits to net worth. However, this ratio does not adequately measure profitability particularly in an inflationary situation. We have followed Lindenberg and Ross (1981) and Smirlock et al (1984)[13] for estimating q which is defined by the ratio of market value of the firm to the replacement cost of assets.

$$Tq_t = V_t / RA_t \qquad (4.7.1)$$

[11] A dynamic economy is one in which population capital production techniques, and the forms of industrial organisation etc. are changing.

[12] F. H. Knight (1921) Risk, Uncertainty and Profit (New York: Harper).

[13] Michael Smirlock; Thomas Gilligan and William, Marshall (1984), "Tobin's *q* and the Structure-Performance Relationship", *American Economic Review*, Vol. 74, No. 5, pp. 1051-60.

V_t is the market value of the firm. Value of the firm consists of the value of the shareholder's money and the total liabilities of the firm. RA_t is the replacement cost of asset is the sum of values of inventories and fixed assets at current prices plus the value of miscellaneous current assets (total current assets-inventories). If the market valuation of an asset is higher than the cost of purchasing it then there will be an incentive to invest in that asset.

Where

V_t is the market value of the firm and is computed as below

$$V_t = NW_t + TBO_t + OCL_t, \tag{4.7.2}$$

in which,

$NW_t =$ Net worth in period t

$TBO_t =$ Total borrowing in period t

$OCL_t =$ Other current liabilities in period t

RA_t is the replacement cost of assets and is defined as

$$RA_t = RFA_t + RINV_t + FIA_t \tag{4.7.3}$$

in which

$RFA_t =$ Replacement cost of fixed assets in period t

= net fixed assets at the end of period t multiplied by wholesale price index of capital assets

$RINV_t =$ Replacement cost of inventory in period t

= inventory at the end of period t multiplied by wholesale price index of output.

$FIA_t =$ Financial assets at the end of period t

= Difference of total gross assets and gross fixed assets and inventory at the end of

Tobin and Brainard (1977) defined 'q' as the ratio of market valuation of reproducible capital assets to the current replacement cost of assets. Therefore, the authors argued that investment is related to 'q'.[14] Thus Tobin (1969) identifies 'q' as a link variable between the financial markets and market for real goods and services. Although q theory of

[14] J. Tobin and Brainard (1977), "), "Asset Market and Cost of Capital in Bela Balasse… (eds), *Economic Progress and Public Policy*, Amsterdam (1977), pp.235-262.

investment suggests that q >1 would induce investment while q<1 would discourage it. Auerback argued that q<1 may also encourage investment due to tax differentials between dividends and capital gains, leverage ratios, tax incentives by the government, credit facilities and market pressure of demand etc. However, it can be concluded that Tobin q is principal determinant of investment irrespective of its value. The value of Tobin's q is given below in table 4.7.1.

Table 4.7.1
Firm-Wise Value of Tobin's 'q'

Year	ALL	FML	TATA	SML	MML	HML	MSI
1990-91	1.282	3.019	1.337	1.085	1.185	1.181	1.122
1991-92	1.165	2.982	1.208	1.121	1.158	1.238	1.156
1992-93	1.118	3.032	1.173	1.157	1.163	1.159	1.057
1993-94	1.043	2.222	1.134	1.131	1.154	1.174	1.091
1994-95	0.994	2.006	1.059	1.118	1.095	1.158	1.049
1995-96	0.989	1.866	1.003	1.223	1.031	1.156	0.975
1996-97	1.011	2.027	0.970	1.261	0.981	1.191	1.057
1997-98	1.016	3.334	0.929	1.255	0.968	1.213	1.115
1998-99	0.989	3.051	0.910	1.263	0.971	1.013	1.186
1999-00	1.031	3.329	0.930	1.202	0.986	0.999	0.972
2000-01	1.016	3.803	0.930	1.198	0.941	1.026	0.926
2001-02	1.041	3.661	0.981	1.183	0.943	1.234	0.977
2002-03	1.111	3.125	1.026	1.216	0.978	1.164	1.076
2003-04	1.135	2.821	1.034	1.171	1.001	1.193	1.288
2004-05	1.087	2.252	1.008	1.161	1.017	1.192	1.325
2005-06	1.101	1.248	1.008	1.109	1.027	1.301	1.233
2006-07	0.947	1.391	0.912	1.041	0.972	1.242	1.055
2007-08	0.873	1.391	0.783	0.939	0.937	1.431	0.945
2008-09	0.668	1.519	0.745	0.979	0.901	1.222	0.869

Source: Computed, Prowess Data Base, CMIE, 2009.
Notes: Value of the firm consists of the value of the shareholders money and the total liabilities of the firm. Liabilities are repaid on the basis of the books values while the shareholders wealth depends upon the market share price. Thus shareholders money value has been obtained as the sum of preference share capital. Replacement cost of assets is the sum of values of inventories and fixed assets at current prices plus the value of miscellaneous current assets.

The value of Tobin's q given in table 4.7.1 has remained more than unity throughout the period of all the companies except Tata Motors and Mahindra and Mahindra Ltd. However it is clear from the values of q that in the Tata Motor and Mahindra & Mahindra Company has declined from 19976-97 to 2001-02. The values of q for these two companies have

more than unity after 2002-03 to 2005-06 and again become less than unity after 2006 onwards. But the value of Tobin's q in the Force Motor Company has remained more than unity over the period of study. The value of Tobin's q in the Hindusthan Motors Company also has remained more than unity except in 1990- 2000. Overall the values of Tobin's show a rising trend for all companies. Clearly Tobin's q seems to be better measure as compared to the conventional measure of profitability in spite of the difficulties arising with regard to its measurement. Tobin's q to be meaningful, one needs accurate measures of both the market value and replacement cost of a firm's assets. The market valuation of firms and replacement cost of asset is given in appendix 3.5 and 3.51.

4.7.1. Determinants of Profitability of Firms in Indian Automobile Industry

In keeping with the alternative theoretical considerations, empirical studies have attempted to examine the relative importance of the factors as the determinants of profitability. The major objective of the present study is to evaluate the impact of changes in government policies on profitability of the industry. This study mainly examines the impact of industrial liberalisation on profitability of firms in the Indian automobile sector. The present study is confined to the manufacturers of passenger vehicles and commercial vehicles in the private sector only. We shall attempt a review of some of the important studies considering each variable at a time. It describes the determinants of profitability then gives the mathematical formulation of the model. The theory suggests a positive relationship between sales and profits. A higher level of capacity utilisation is expected to increase profits largely on account of the economies of scale in production and larger volume of sales. There have been very few studies investigating the relationship between growth and profitability. As for profitability we consider an equation in which q is explained in terms of advertisement intensity, export intensity, import intensity, vertical integration, capacity utilisation, diversification index, size and industry policy changes.

$$q = a2 + \beta_1 SIZE + \beta_2 MT + \beta_3 DIV + \beta_4 CU + \beta_5 AGE + \beta_6 VI + \beta_7 EXP + \beta_8 ADV \quad (4.7.1.1)$$

Where SIZE-size of the firm, MT-import intensity, DIV Diversification Index, CU-capacity utilization index, AGE- age of the plant and machinery, VI-vertical integration, EXP-export intensity, ADV-advertisement intensity, GRP- gross retain profit and LOANS. The study analyses the determinants of profitability firms in Indian automobile industry during two policy regimes, namely, liberalisation policy (1990-91 to 2000-2001) and the

'auto policy-2002' (2001-02 to 2008-2009). The empirical analysis follows the observations are pooled. The study uses fixed effect estimations to analyse the determinants of profitability during these policy regimes. In order to take care of hetroschedasticity problems, variables were generally considered in the form of ratios such as q for the dependent variable and import intensity, export intensity etc., as independent variables. Empirical results on determinants profitability in the automobile industry are discussed.

Table 4.7.1.1

Fixed Effect Estimation Results on Determinants Profitability by Policy Regimes

Liberalisation policy period (1991-92 to 2000-01)		Auto policy (2001-02 to 2008-09)	
Variable	Coefficient	Variables	Coefficient
Constant (C)	0.144 (0.11)	Constant (C)	3.525 (1.45)
SIZE (-1)	-0.285 (2.28)**	SIZE	-0.804 (2.76)
MT(-1)	0.069 (0.81)	D(MT)	0.411 (3.71)
DIV(-1)	1.405 (1.85)***	DIV	0.0303 (0.01)
CU	-0.004 (4.33)*	CU	0.011 (3.53)
AGE	0.571(8.62)*	AGE(-1)	0.193 (3.07)
VI(-1)	0.154 (0.15)	D(VI)	0.586 (0.36)
X	-0.977 (0.88)	X	0.001 (0.04)
R^2	0.94	R^2	0.81
ADJ. R^2	0.93	ADJ. R^2	0.73
F	79.81	F	9.77
NOBS	77	NOBS	56
No of Firms	7	No of Firms	7

Notes: Figures in the parentheses indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %. D indicates the first difference level respectively.

During the liberalisation period fixed effect results suggest that profitability (as measured by q) in the automobile sector tended to improve with diversification and age of the firm. But profitability tends to decline with size of the firm and capacity utilisation. They are found statistically significant. Only the age factor is found important. Thus profitability has mainly increased through experience of the older firms. However, older firms might show better performance than the new firms on account of better skill and experience in the business line. Therefore, this variable may also possess a positive or negative coefficient. Firm size emerged significant with a negative coefficient. It is negatively related with

profitability of firms in the automobile sector. However, the role of firm size in explaining profitability is a complex one and the empirical evidence in this regard is a mixed one. Therefore it is difficult to find a definite sign to the coefficient of size variable. The nature of the relationship between firm size and profitability is an important issue that may shed some light on the factors that maximize profits.

Diversification index emerged significant with a positive coefficient. It may be noted that a lower value of the Diversification index means a higher level of diversification. Theoretically, smaller the firm size, higher is the tendency to diversify. The criterion of risk reduction is more relevant to small/marginal firms whose risk bearing ability is very low. The converse is also true as firm size increases, i.e., large firms tend to specialise. It is constructed as the inverse of a Herfindal index. Capacity utilization emerged significant with a negative coefficient. It is inversely related with profitability of firms. But, if the firm is operating at full capacity, an increase in output must be preceded by an increase in capacity resulting in lower profitability. It suggests that profitability increase in sales when there is an idle capacity, but decrease in sales when firm approached full capacity. Consistently, we confirm that firms experiencing high growth in sales operating in industries with high capacity utilization experience abnormally low stock returns in the following period.

Vertical integration emerged insignificant with a positive coefficient. Vertical integration might help in improving the performance of firms through internalization of production process, minimization of transaction costs, reduction of inventories and availability of ancillaries etc. at lower prices. Therefore, this variable is expected to possess positive coefficients in the equation. Import of technology is found to be positively related with profitability and not statistically significant. Import of technology through licensing or through foreign equity participation might affect profitability of firms.

Higher export intensity may encourage profitability and more of exports will allow more of imports of raw materials, components and machinery at concessional duty rates. However, in a developing country like India where goods are exported to meet export obligations for imports and goods are exported at lower prices than the prices at which they are sold in the domestic market, more of export intensity might apply lower profitability. Better utilization of existing capacities is obviously in the interest of the firm. It will reduce the

fixed cost and might also reduce variable cost per unit. Investment in fixed assets and inventories may improve profitability. Investment in physical assets may improve the quality of products and efficiency of production through import of technology and equipment. The firms might grow in sales and profit by trading in inventory goods. Liberalisation policies of the government followed during 1991 has proved very effective for raising profitability in the automobile sector. During the auto policy regime profitability (as measured by q) in the automobile sector tended to improve with import of technology, capacity utilization and age of the firms. But profitability tends to decline with size of the firm. They are found statistically significant. Vertical integration, export intensity and diversification have positively influenced profitability but are not statistically significant.

4.8. Summary

This chapter examines the effects of liberalisation policy on performances of firms in Indian automobile industry. It has been observed that the approaches and capabilities with the challenges of liberalisation policies resulting development patterns of automobile industry. India's automobile industry is well-positioned for growth, servicing domestic demand. After having recorded a strong volume growth over the last decade, the auto industry may have face strong crisis during the last two years leading to moderation in growth contributed by firming up of commodity prices, rising fuel costs and interest rates. The production trend indicates distinct transitions, with each successive transition demonstrating a higher production growth. However in spite of such credentials, the commercial vehicles segment has probably grown at the most sedate pace since the delicensing of Indian auto industry in 1991. However, post-2006 the industry showed a sudden surge in demand. The automobile vehicles production are increasing at a faster rate during the 'auto policy' period (2002-2009) compared to its liberalisation period. But the growth of production of these whole segments from 2007 to 2009 looks declining trend. So the growth of the whole automobile industry is negative in 2007- 2008 and positive in 2009 onwards. Capacity utilization of all automobile companies is also declining during the same period.

The variability in the growth rate of Ashok Leyland, Tata Motor, Mahindra and Mahindra is lower during 'auto policy' phase compared to the liberalisation policy phase. There are

large fluctuations in the growth rates of automobile firms particularly from 1998-1999 to 2000-2001. During these periods the growth does not appear to be stable. The fluctuations in the growth rates during the 'auto policy' period appear to be stable and declined after 2006-2007 and became negative growth rate in 2008-2009. This is due to the slowdown of the Indian economy. Both Ashok Leyland and Tata Motors operate in the heavy commercial vehicles segment of the automobile industry and have long experience of being in this business. Similarly Maruti Suzuki and Mahindra and Mahindra operate in the passenger cars and utility vehicles segments and have long experience of being in this business. The growth rate of Hindustan Motor is negative during 2001-02 to 2008-2009 and its variability is very large it is a very old firm and continues in the same product line.

It also shows the behavior of whole price index (WPI) of automobiles and all commodities. The wholesale price index of automobiles was almost identical to the WPI of all commodities, till 1996-97. Since 1996-97, WPI of all commodities has risen at a lower rate than that of automobiles, and the gap between these two WPIs has become conspicuously wide by 2007-08.

This chapter attempts to analyse the automobile demand at macro level using time series analysis approach. Looking at the India's automobile demand, the results find that the price of fuel is not the main factor in CVs. But the price of fuel is the main factor in PVs influencing auto demand in India. The lending rate is the main factor influencing the whole auto demand in India. Income is the prime determinant influencing both passenger and commercial vehicles demand.

This work examines the correlation between the hike in fuel prices, inflation rate, and GDP per capita with India's automobile sales. It develops the vector error correction model to analyse the factors that are most likely to influence India's automobile sales. The vector error correction model (VECM) in Johansen cointegration test results find the short term changes in the rate of interest and changes in fuel price have significantly negative impact on short run changes in both PVs and CVs sales growth. In the long-term, sales growth depends on GDP per capita.

The analysis has been carried out during two policy periods namely 'liberalisation policy' (1991-92 to 2000-01) and 'auto policy-2002' (2001-02 to 2008-09) in order to explain the interface between policy, structure and growth of Indian automobile industry. The analysis

broadly follows the evolutionary theoretical framework. The fixed effect results indicate that technological factors play an important role in determining the growth of firms in this industry. The nature of effect, however, appears to vary across different technological regime.

During the liberalisation regime, IMCAP, IMTECH, and PCM influence growth positively. Auto policies, however, seems to have changed the role played by these technological factors. IMCAP and FE influence growth positively. R&D emerged significant but its coefficient value is negatively related with growth. R&D activity, according to this study, appears to have long-term implications for growth. In both these regime, technological factors play an important role in determining the growth of firms in this industry. Thus growth is mainly technology driven. Investment in technology by producers has been on the rise. The results also confirm a positive relationship between profits and growth in all the periods. The profitability of automobile manufacturers has been rising over the years, mainly due to rising demand and growth of Indian middle class.

The results of fixed effect model suggest that profitability (as measured by Tobin' q) in the automobile sector tended to improve with diversification and age of the firm during the liberalisation period. But profitability tended to decline with firm size and capacity utilization during the same period. It finds that profitability increase in sales when there is an idle capacity, but decrease in sales when firm approached full capacity. Thus profitability has mainly increased through experience of the older firms. Import of technology is found to be positively related with profitability and not statistically significant. Liberalisation policies of the government followed during 1991 has proved very effective for raising profitability in automobile sector. During the auto policy regime profitability in the automobile sector tended to improve with import of technology, capacity utilization and age of the firms. But profitability tends to decline with size of the firm. Vertical integration, export intensity and diversification have positively influenced profitability but are not statistically significant. Therefore, policy efforts to encourage R&D and some concentration of size of the domestic firms in the industry may be more desirable.

Given the significant challenges facing the automobile industry, in particular globalisation, liberalisation and increasing competition, there is a need to review the strategic direction

and policy framework for the domestic automobile sector. This is crucial to maintain the competitiveness of manufacturers in the automotive sector, in order to be viable for them in the long term. In this respect, the Government will maintain existing measures which are considered necessary and moving forward, institute new measures to replace existing measures which no longer serve national interest, in order to continuously support the development and viability of the automotive sector. Then, it provides a conducive environment for the automobile sector to flourish and become world class.

Chapter V

Analysis of competitiveness of Firms in Indian Automobile Industry

Chapter V

Analysis of Competitiveness of Firms in Indian Automobile Industry

5.1. Introduction

The economic liberalisation that started in India in 1991 has succeeded in bringing about a sustained growth in the automotive sector which, was triggered by enhanced competitiveness and relaxed restrictions prevailing in the Indian industry. In a process that arguably began in the 1980s, but gained prominence only after 1991, progressively deregulated and exposed the Indian industry to domestic and foreign competition. India emerged as one of the favourite investment destinations for the automotive manufacturers as it boasts of a rapidly growing middle class, market oriented stable economy, availability of trained manpower at competitive cost, fairly well-developed credit, financing facilities and availability of raw materials locally at a competitive cost. These advantages need to be leveraged in a manner to attain twin objectives: To ensure the availability of best quality product at a lower cost to the consumers to the consumers on the one hand as well as to develop and assimilate latest technology in the industry on the other. In fact, the government has liberalised the norms for foreign investment in the sector.

The most prominent policy is 'Auto Policy-2002'. This policy basically aims to establish a globally competitive automobile industry in India and to double its contribution to the economy by 2010. The Auto Policy allows automatic approval for foreign equity investment up to 100 percent in the automotive sector and does not lay down any minimum investment criteria.[1] The Automotive Mission Plan 2006-2016 was released in 2006, which visualises India as an emerging destination of choice in the world for design and manufacture of automobiles and auto components with output reaching a level of $ 145 billion accounting for more than 10% of the GDP and providing additional employment to 25 million people by 2016.[2] Emphasis on R&D activities is one of the main focuses of Indian automotive policy. As per Automotive Mission Plan 2006-2016, the Indian government recognises its role as a catalyst and facilitator that encourages companies to move to higher level of competitive performance. The India government aims to create a

[1] Government of India (2002), "*Auto Policy, March 2002*", Ministry of Heavy Industries and Public Enterprises, Department of Heavy Industry, New Delhi, (March-2002).

[2] Ministry of Heavy Industries and Public Enterprises, Government of India (2006), ibid.

policy environment that helps companies gain competitive advantage. These government policies may promote domestic competition and stimulate innovation that induces growth. Automotive Industry is a volume driven industry and a certain critical mass is a pre-requisite to attract investment for research and development. Research and development investment is needed for innovations which is the lifeline for achieving and retaining competitiveness in the industry. A greater emphasis is required on the development of the factors like innovation which can ensure competitiveness on a long-term basis.[3]

Competition in this industry is increasing. The size of the domestic market which is relatively larger along with high competition has significantly rationalized the automotive industry. The level of technology change is high. There is a rise in investment on the technology by producers. Investment in new technology such as supply-chain management and collaborative forecasting will make industry more competitive. Hence the prime mover of competition is rivalry among firms to control market share and to internalize externalities rather than adjustments brought about by the price mechanism. This studies industrial concentration in Indian automobile manufacturing sectors during the liberalisation period. Deregulation after 1985 allowed greater scope for competitive processes, so that concentration levels are now more likely to be determined by industry characteristics rather than government policy.

The Indian automobile industry undergoes technological changes where each firm changes its processes and technologies to maintain the competitive advantage. Hence they provide their customers with the optimized products and services. This chapter analyses the relation between industrial organisation, technological change and economic policy-making. This study attempts to analyse the differences in the technological strategies adopted by the firms. It evaluates how the disparity in the firm characteristics determines the technological behavior of firms drawn from the Indian automobile industry. It is now a widely established fact that a firm's competitiveness and performance in an industry is greatly affected by the technological strategy adopted by the firm. Whereas the technological strategy itself is determined by the technological regime in which the firm operates. As the competition is becomes tougher, Indian firms that were so far having a

[3] Ministry of Heavy Industries and Public Enterprises, Government of India (2006), ibid.

comfortable position in the Indian market have been, after liberalisation, forced to review their strategy in order to choose different, more appropriate, and feasible one that would aid in improvising on their existing technological knowledge base so that they survive in the market.

The competitiveness among the firms in Indian automobile industry has been assessed by understanding the factors that determine its competitive advantage. The marginal difference between the competitiveness of different firms reveals the tough competition among the firms in India. This study has tried to bring out the competitive trends of the Indian automobile industry. It observes that the industry is gripped by intense competition in recent years, as major world players enter the market bringing along better technology and experience. Therefore, this study on competitiveness of the firms in domestic market, at the present state is interesting area to examine. It is mainly concerned with the determinants of competitiveness in the enterprises: their strategy, structure and rivalry, and conditions that relate other industries.

5.2 Database and Methodology

The data set contains firm level data for 10 automobile manufacturing companies from 1991-1992 to 2008-2009. The data relate to firms that assemble or produce cars and other four wheeled drives, light commercial vehicles, and the heavy commercial vehicles. The nature of the markets is different for these products.[4] The data are collected from: Centre for Monitoring of Indian Economy (CMIE), Annual Survey of Industries (ASI), Society of Indian Automobile Manufacturers Association (SIAM), and Auto Component Manufacturers Association (ACMA). The study used the data on world automobile production collected from OICA.[5]

The chapter analyses various aspects of the domestic market competitiveness in the chosen firms. It includes an analysis of market shares, profitability and productivity ratios, and performance. Market concentration is a feature of the imperfect competition where one or few firms dominate the entire industry. The most frequently used measure is Hirschman-Herfindahl index of market concentration. Competitiveness of a firm is defined in terms of

[4] For example, while the cars and four wheeled drives are meant for personal use, light, medium and heavy commercial vehicles are all meant for commercial purposes.

[5] OICA, the Organisation Internationale des Constructeurs d'Automobiles (OICA) commonly called the International Organisational of Motor Vehicle Manufacturers is a federation of automobile manufacturers.

the rate of change in market share. Market share of a firm is estimated by taking the ratio of the annual sales turnover of a firm to that of the total sales in all the firms of that sector. Market share analysis indicates how well a firm is doing in the market compared to its competitors. Sales turnover, rather than the number of vehicles sold, is used because the large scale differences between vehicles manufactured by these firms may not be useful for a comparison. Finally, we make an overall assessment of the domestic market competitiveness in different firms.

5.3. Current Status of the Indian Automobile Industry

During the period 2002-03 to 2007- 08, the production and domestic sales of various categories of automobiles have grown steadily. If we look all the three parameters, viz., production, domestic sales and exports, they have registered a continuous growth in the last few years, except the year 2007-08. Export of production has also increased over the period of study. The improvement in exports shows the growing capability of the Indian automobile industry to meet the international norms and standards, and increasing acceptance of automobiles manufactured from India in the global market. Domestic manufacturers acting as a global hub for exports is also gaining acceptance. Exports are lucrative, it will enable domestic players to increase exposure and maintain capacity utilisation at a healthy level. The Indian automobile market is still in its evolutionary stage. It is categorized into following four segments namely; commercial vehicles, passenger vehicles, two wheeler and three wheelers, which covers 5%, 14%, 77% and 4% of the total market share of the industry respectively (Society of Indian Automobile Manufacturers, 2007). The Indian automotive industry is dominated by two-wheelers, while cars account for about 10.7 percent of the total industry. The potential for growth is enormous. Another striking characteristic of the market is the rapidly growing demand for passenger vehicles and commercial vehicles (CVs). These segments grew at a compound annual growth rate (CAGR) of 14% and 17% respectively in contrast to 6% for 3-wheelers and 8% for 2-wheelers for the period 2003-04 to 2007-08 (SIAM, 2008b).[6] Growth trends of key industry indicators are improving every year up to 2006-2007 as seen in Table 5.3.1.

[6] SIAM (2008c): "*Domestic Sales Trend*", Society of Indian Automobile Manufacturers (SIAM), New Delhi.

Table 5.3.1
Growth Trends of Key Variables of the Industry ('000' Numbers)

	Production		Domestic Sales		Export	
Year	Number	Growth (%)	Number	Growth (%)	Number	Growth (%)
1998-99	4223		4259		159	
1999-00	4859	15.06	4900	15.05	139	-12.59
2000-01	4744	-2.35	4812	-1.81	168	20.76
2001-02	5372	13.23	5237	8.83	185	9.97
2002-03	6280	16.91	4942	13.46	307	66.11
2003-04	7244	15.33	6811	14.63	480	56.16
2004-05	8468	16.90	7898	15.96	630	31.17
2005-06	9744	15.06	8906	12.77	806	28.06
2006-07	11088	13.79	10123	13.67	1011	25.46
2007-08	10854	-2.11	9654	-4.63	1238	22.42
2008-09	11175	2.96	9723	0.71	1530	23.61
2009-10	14057	25.78	12295	26.45	1804	17.90

Source: Computed, SIAM, Society of Indian Automobile Manufacturers, July 20, 2011.

The Table 5.3.1 depicts the recent growth trend in key variables of the industry from 1998-1999 onwards. While the production of automobile industry increased from 4223 thousand in 1998-1999 to 4859 thousand in 1999-2000; its growth rate is 15.06 percentage and the domestic sales increased from 4259 thousand to 4900 thousand with the growth rate at 15.05 percentage. While the production in the automobile industry decreased from 4859 thousand in 1999-00 to 4744 thousand in 2000-2001; its growth rate is negative, then it started to increase up to 2006-2007. But the domestic sales of automobile decreased from 4900 thousands in 1999-2000 to 4812 thousand in 2000-2001 with a negative growth rate. However, it started to increase up to 2006-2007. Again the automobile production decreased from 11088 in 2006-2007 to 10854 thousand in 2007-2008 onwards along with its negative growth rate. The domestic sales of automobiles decreased from 10123 thousand in 2006-2007 to 9654 thousand in 2007-2008 onwards with its negative growth rate. After that it increased in 2008-2009. Automobile industry has been registering a healthy positive growth in terms of its production and sales as well over the period of study. But, both production and sales are registering negative growth rate in 2007-2008. Only there has been a decrease in the production and sales of the automobile industry in

the past two years. This is due to the slow down of Indian Economy. It finds that the Indian automobile market provides a strong demand base for the growth of the automotive industry.

The export of automobile industry declines from 159 thousand in 1998-99 to 139 thousand in 1999-00 and its growth rate is -12.59 % during the same period. After that export increased from 139 thousand in 1999-2000 to 1530 in 2008-2009 along with a positive growth rate. Export has increased over the period of study.

The export of growth in the automobile industry is 9.97% in 2001-02 is very low. Export growth of automobile industry is 56.16% in 2003-04 which is very high. As observed in the above table, the Indian automobile industry is witnessing rising trend in terms of exports in all vehicle types. All this testifies to the fact that the 'Made in India' brand is gaining increasing acceptance in the global export markets. Both domestic as well as foreign automobile manufacturers have been instrumental in such a growth, by making either direct or indirect exports. The domestic manufacturers are forging partnerships with foreign players or are making outward foreign investments for developing and strengthening their sales overseas. Indian automotive industry has been registering a healthy growth in terms of its exports as well. Increasing pressure in the global competition to supply from low-cost countries combined with the skills and quality advantages of India, is the commonly cited explanation for the growth in India's automotive exports; see for instance (Singh, N., 2004)[7] and GOI (2006a)[8]. Additionally, supporting policy measures of the Indian government such as export-linked fiscal incentives, establishment of export-processing zones, bilateral or multilateral trade agreements with other countries, etc. have furthered this growth. It shows the domestic sales, industry volumes and export performance from the year 1999-00 to 2008-09 are increasing on a steady rate.

5.4. India's Position in World Motor Vehicles Production

The automobile industry is increasingly becoming a global industry. The global auto industry is a key sector of the economy for every major country in the world. The

[7] N. Singh (2004), "*Strategic Approach to Strengthening theIinternational Competitiveness in Knowledge based Industries: The case of Indian Automotive Industry*", Research and Information Systems for the Non-Aligned and Other Developing Countries (RIS), New Delhi.

[8] GOI (2006a)**:** "*Automotive Mission Plan 2006-2016*", Department of Heavy Industry, Ministry of Heavy Industries and Public Enterprises, Government of India, New Delhi.

automobile industry in India happens to be the 9th largest in the world. Following Japan, South Korea and Thailand; India emerged as the fourth largest exporter of automobiles in 2009. Several Indian automobile manufacturers have spread their operations globally as well as, asking for more investments in the Indian automobile sector by the MNCs.[9] The worldwide production of cars and commercial vehicles in India is explained below in table 5.4.1.

Table 5.4.1

Worldwide Production of Cars and Commercial Vehicles in India ('000' units)

Year	Cars	CVS	Total	%Change
1998-99	533	285	818	
1999-00	518	283	801	-2.1
2000-01	655	160	815	1.7
2001-02	704	191	895	9.8
2002-03	908	254	1162	29.8
2003-04	1178	333	1511	30.1
2004-05	1264	363	1627	7.7
2005-06	1473	547	2020	24.2
2006-07	1714	540	2254	11.6
2007-08	1830	485	2315	2.7
2008-09	2175	466	2641	14.08
2009-10	2815	722	3537	33.92

Source: OICA Provisional Production Statistics, International Organisation of Motor Vehicle Manufacturers, 2010.

India's production of passenger cars and commercial vehicles reached a new record of 29.8 percent in 2002-03, 30.1 percent in 2003-04 and 24 percent in 2005-06. This section considers the global spread of vehicle sales and production. Rising demand owing to the strong growth of Indian economy post liberalisation and the changing landscape in the global automotive industry have fuelled such a growth. The production growth of passenger cars and commercial vehicles has declined to 2.7 percent in 2007-2008. The automobile industry was affected by the economic downturn that was deep and highly synchronized by late 2008. The production growth of passenger cars and commercial vehicle increased from 14.08% in 2008-09 to 33.92% in 2009-10.

[9] Live Tips Market Research Pvt. ltd. (2010), "*Indian Automobile Industry: The Road Ahead-2010*".

5.4.1. Passenger Vehicle Production Levels and Growth in Countries

Car sales declined markedly in almost all OECD countries. Automakers have adjusted their production and almost all the vehicle-producing countries experienced sharp drops in production growth in 2008. Falls were particularly dramatic in Spain and Italy. In the United States, the fall in durables consumption and business investment in automobiles contributed 20-30% of the decline in total output in the second half of 2008. The reduction in car sales appears to have been more pronounced than predicted by fundamentals, such as income growth and real oil prices. This trend can then be compared with current sales to shed light on future demand developments and with production capacity to indicate where the greatest challenges for the industry may lie.[10] The worldwide production of passenger vehicles is explained below in table 5.4.1.1.

Table 5.4.1.1
Passenger Vehicle Production Levels and Growth in Countries Producing One Million or More Units in 2008

Countries	2006-2007 Levels (thousands)	2007-2008 Levels (thousands)	Growth (percentage)
United Sates	10546	8503	-33.4
Japan	9945	9916	-0.3
Germany	5709	5527	-3.2
France	2551	2146	-15.9
Italy	911	659	-23.4
United Kingdom	1535	1447	-5.7
Canada	1565	1633	4.3
Spain	2196	1943	-11.5
Korea	3723	3450	-7.3
Mexico	1209	1241	2.7
Turkey	635	622	-2.1
Brazil	2391	2561	7.1
China	6381	6738	5.6
India	1713	1830	6.8
Russia	1289	1469	14.0

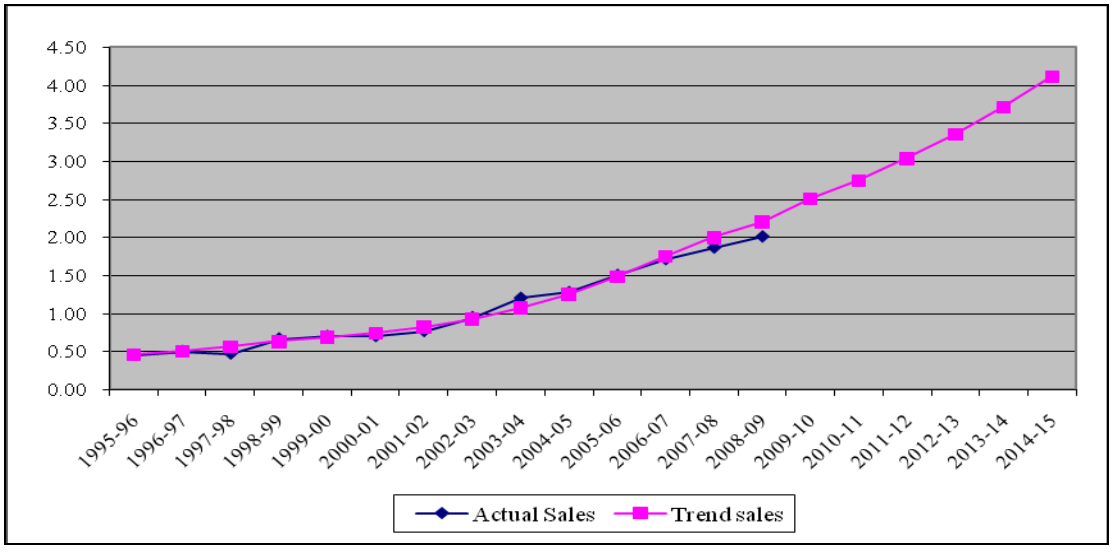
Source: International Organisation of Motor Vehicle Manufacturers, 2010.

[10] OECD Economic Outlook, (2009), "*The Automobile Industry in and Beyond the Crisis*", Vol. 85. Issue 2.

Future trends in car sales are likely to vary considerably across other advanced countries, China, India and Mexico. In high-income countries, car ownership per capita is likely to be relatively close to saturation and therefore future developments are likely to be driven by a slow increase in vehicles per capita. In Japan, trend car sales may stagnate as a slight increase in car ownership per capita is more than offset by a declining population. In Germany and Italy, as well, trend car sales are expected to be broadly flat. In France, the United Kingdom and the United States, trend sales are expected to continue to increase due to population increases as well as some increase in car ownership per capita, though the latter effect is less important in the United States, where the density is already high. Trend car sales are increasing at a rapid pace in China and India.[11] Indeed, the high cost of credit and the inability to obtain auto loans on affordable terms prompted buyers to postpone purchases they might have otherwise made. Finally, heightened uncertainty surrounding future economic developments may have encouraged consumers to postpone their car purchases. Actual and Trend car sales in India and China can be seen in graphs below.

Figure 5.4.1

Actual and Trend Car Sales 1995 - 2015 (Number of cars, Millions, India)

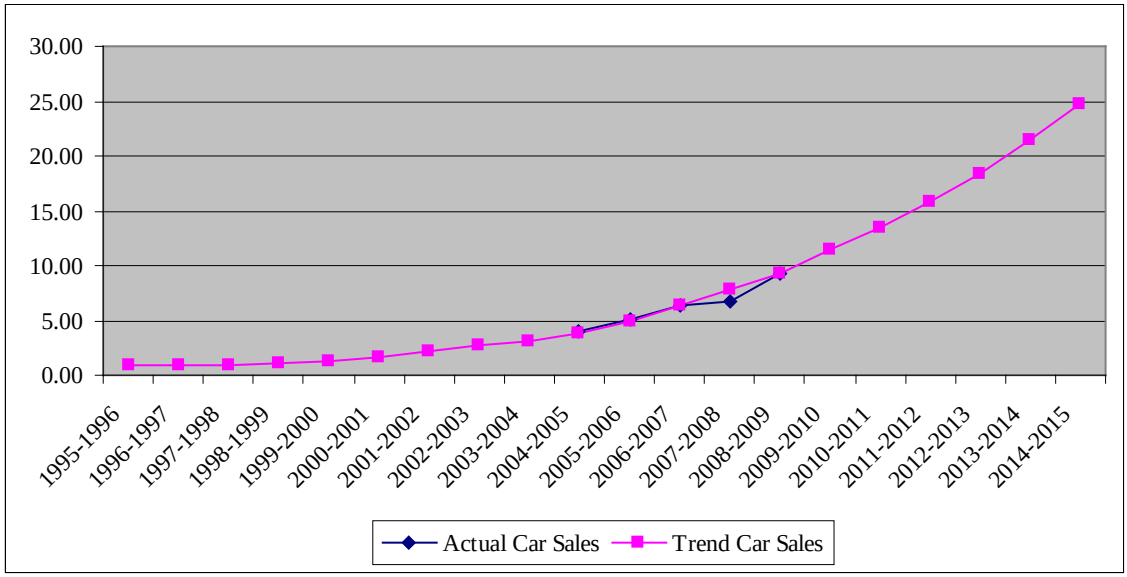


Source: OECD calculations; Datastream; China Association of Automobile Manufacturers, 2009.

[11] OECD Economic Outlook, (2009), ibid.

Figure 5.4.2

Actual and Trend Car Sales 1995 – 2015 (Number of cars, Millions, China)



Source: OECD Calculations; Datastream; China Association of Automobile Manufacturers, 2009.

In contrast with the G7 countries, car ownership levels in China are very low and incomes have now risen to a level where the income elasticity of vehicle ownership per capita is typically high. Historical patterns both across countries and time suggest that automobile ownership tends to rise with GDP per capita but in a non-linear way. At first, ownership rises slowly with income, then rapidly at middle-income levels, before slowing at higher income levels as saturation levels. The combination of low car ownership per capita, a high income elasticity, and rapidly rising income levels means that trend car sales in China increase rapidly and are likely to do so in the future, as well. Starting from a lower level than in China, trend sales are also increasing at a fast rate in India.[12] As a result, the Indian government has paid special attention to the investment and growth within the industry. The industry structure does not depend on current industry performance and industry performance as it does not depend on industry conduct, although it is sensitive to industry structure. The inverse relation between the degree of market concentration and degree of

[12] OECD Economic Outlook, (2009), ibid.

competition has an underlying assumption of the market structure conduct performance (SCP) hypothesis. This is because market concentration encourages firms to collude. More specifically, the standard SCP paradigm asserts that there is a direct relationship between the degree of market concentration and the degree of competition among firms. Structure refers to market structure defined mainly by the concentration of market shares in the market. The SCP approach indicates that market performance is determined by market conduct which in turn depends on market structure.

5.5. Market shares of Commercial and Passenger Vehicles Firms and its Herfindahl Index

Market share analysis is an important part of market analysis and indicates how well a firm is doing in the market compared to its competitors. It is generally necessary to estimate the total market size and a company's market share. Market share of a firm is estimated by taking the ratio of the annual sales turnover of a firm to that of the total sales of all firms in that sector. Here, we discuss the method of measuring industry concentration. The Herfindahl Index is also known as Herfindahl-Hirschman Index or HHI, is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them**.** In perfectly competitive markets, market participants have no market power. A firm with market power can raise prices without losing its customers to competitors. Market participants that have market power are therefore sometimes referred to as "price makers," while those without are sometimes called 'price takers'. A firm with market power has the ability to individually affect either the total quantity or the prevailing price in the market. Structure refers to market structure defined mainly by the concentration of market shares in the market. Conduct refers to be the behavior of firms - competitive or collusive. As such, it can range from 0 to 1.0, moving from a huge number of very small firms to a single monopolistic producer. Increases in the Herfindahl index generally indicate a decrease in competition and an increase of market power, whereas decreases indicate the opposite. Structure influences performance directly. The market shares of commercial vehicle firms and its concentration index is given below in table 5.5.1.

Table 5.5.1

Market shares (percentage) of Commercial Vehicle Firms and Herfindahl Index (Sales in Crores)

Year	ALL	FML	SML	TATA	HHI
1990-91	24.80	6.62	2.93	65.66	0.50
1991-92	23.80	6.32	1.85	68.03	0.52
1992-93	22.80	7.98	2.09	67.13	0.51
1993-94	22.60	9.54	2.11	65.75	0.49
1994-95	19.87	7.17	1.89	71.07	0.55
1995-96	19.43	6.50	1.72	72.36	0.57
1996-97	19.17	5.22	1.41	74.20	0.59
1997-98	21.01	6.28	1.71	71.00	0.55
1998-99	23.14	6.00	1.68	69.18	0.54
1999-00	22.06	5.56	1.75	70.62	0.55
2000-01	23.38	5.36	2.36	68.90	0.53
2001-02	22.01	5.12	2.73	70.14	0.54
2002-03	20.94	5.51	2.81	70.74	0.55
2003-04	19.15	5.33	2.61	72.91	0.57
2004-05	18.31	3.73	2.53	75.43	0.60
2005-06	19.73	3.46	2.25	74.57	0.60
2006-07	20.59	2.77	1.67	74.97	0.61
2007-08	21.14	2.51	1.76	74.59	0.60
2008-09	18.53	2.42	1.64	77.41	0.63

Sources: Prowess data base, CMIE, 2009.

Note: Hirschman Herfindahl index = $\sum S_i^2$ where s_i is the share of the ith firm in total sales, and i= ALL: Ashok Leyland Ltd, FML: Force Motor Ltd, Tata Motors Ltd, SML: Swaraj Mazda Ltd.

Table 5.5.1 provides the market shares (percentages) of manufacturers in terms of domestic sales of all commercial vehicle firms from 1990-1991 to 2008-2009. Let us look at the unique Indian market characteristics in terms of market shares (percentages). An analysis of competitiveness of commercial vehicle firms in the automobile industry in India in terms of market shares is presented in table 5.5. It reveals a significant change in the relative position of the old and pioneering firms since economic liberalisation. In commercial vehicle Market, Tata Motors dominates over 70% of the Indian commercial vehicle market. Tata Motors is the largest medium and heavy commercial vehicle manufacturer. Ashok Leyland dominates over 21% market share of Indian CV market. The

firms like Tata motor Ltd. and Ashok Leyland Ltd. are the dominant firms in Indian Commercial vehicle firms. The commercial vehicle industry is highly rivalrous oligopoly.

The market share of sales by Ashok Leyland Ltd decreased from 25 percentage in 1991 to 19 percentage in 1997. Similarly the market share of sales by Tata Motor Company decreased from 65 percentage in 1991 to 74 percentage in 1997. But in 1998 onwards the market shares of both firms are increasing at a slow rate. Tata's new product is the net result of its trajectory development and arms- length purchases of technology for components and parts. While most of the old firms were struggling to prevent a drastic loss in the market shares, the new ones with the latest technology were trying to capture the market.

The changes in the concentration index over time (Table 5.5.1) make interesting reading. The concentration index rose over 1997 and it declined to 55 percent in 1999-2000. After that, there was unchanging level of concentration index from 1997-98 to 1999-00 between 54 and 55 percentages. After 2001 onwards the concentration index has been at an increasing level. The market concentration is higher over the period that leads less competitive the behaviour of firms. Less competitive behaviour results in more market power (i.e., lower social efficiency). Car manufacturers in India dominate the passenger vehicle market by 79%. Maruti Suzuki is the largest car producer in India and has 52% share in passenger cars and is a complete monopoly in multi purpose vehicles. In utility vehicles Mahindra holds 42% share. Hyundai and Tata Motors is the second and third car producer in India.

In commercial vehicle, Tata Motors dominates over 60% of the Indian commercial vehicle market. Tata Motors is the largest medium and heavy commercial vehicle manufacturer. India is the fourth largest commercial vehicle market worldwide. However in spite of such credentials, the commercial vehicles segment has probably grown at the most sedate pace since the delicensing of Indian auto industry in 1991. However, post-2006 the industry showed a sudden surge in demand. According to the IBEF report of 2008, commercial vehicles segment enjoyed the highest growth rate in the automobile industry. The figures

for 2008-2009 indicate that the commercial vehicles had a 3.95% market share as compared to the 15.96% of the passenger vehicles (4 wheelers).[13]

The market shares (percentages) of passenger vehicle firms and concentration index are depicted below in the table 5.5.2.

Table 5.5.2

Market Shares (percentage) of PVs Firms and its Concentration Index (HHI)

Year	HML	M&M	MSI	FORD	GMI	HSC	HMI	HHI
1998-99	10.48	27.16	52.22	1.20	1.49	4.07	3.38	0.36
1999-00	10.20	22.26	48.64	2.37	1.16	3.35	12.02	0.31
2000-01	8.54	20.98	44.43	5.15	2.51	3.51	14.88	0.28
2001-02	5.89	19.23	45.10	5.19	3.90	4.15	16.54	0.28
2002-03	4.92	20.56	42.06	4.78	4.96	4.48	18.25	0.26
2003-04	3.11	21.33	40.30	4.86	3.51	5.73	21.16	0.26
2004-05	3.86	21.12	37.21	4.50	5.00	7.23	21.08	0.24
2005-06	1.36	22.80	37.18	4.43	4.84	7.52	21.87	0.25
2006-07	1.62	22.58	35.08	5.41	4.86	9.63	20.81	0.23
2007-08	1.45	22.16	36.14	4.98	6.15	8.31	20.80	0.24
2008-09	1.13	21.75	34.69	4.96	4.66	6.31	26.49	0.25

Sources: CMIE, Prowess data base, 2009.

Note: Hirschman Herfindahl Index = $\sum S_i^2$ where s_i is the share of the ith firm in total sales,

M&M: Mahindra and Mahindra Ltd., HML: Hindustan Motors Ltd., MSI: Maruti Suzuki India Ltd, Ford India Ltd., GMI: General Motor India Ltd., HSC: Honda Siel Cars Ltd., HYMI: Hyundai Motors India Ltd. JVs: Joint Ventures.

The market share of sales by passenger vehicles firms like Hindustan Motor, Mahindra and Mahindra, and Maruti Suzuki decreased over the period. But the market shares of sales by passenger vehicle firms like Ford, General Motor, Honda Siel Cars, and Hyundai Motor increased over the period of time. This is due to the entry into the Indian market. The passenger car segment with the highest untapped growth potential saw the most hectic activities from the foreign automotive firms. By mid-1990s, several foreign players had entered into the Indian passenger car market by mainly setting up JVs with the local firms - General Motors with HML (1994), Honda Motors with Siel Ltd. (1995), Ford with M&M

[13] IBEF (2008): "Automotive market & opportunities", India Brand Equity Foundation, New Delhi. India Brand Equity Foundation (IBEF) is a public-private partnership between the Ministry of Commerce & Industry, Government of India and the Confederation of Indian Industry. It aims to effectively present the India business perspective and leverage business partnerships in a globalising market-place.

(1996) and Hyundai with a 100%-owned subsidiary (1996). The concentration index of passenger vehicle sector declined over the period of time. The market concentration is lower over the period that leads higher competitive the behaviour of firms. Higher competitive behaviour results in a decline in market power (i.e., higher social efficiency). Maruti Suzuki is the largest car producer in India and completely monopolizes the production of multi-purpose vehicles. While Mahindra holds largest share for the utility vehicles. Hyundai and Tata Motor come as second and third car producers in India. Mahindra and Mahindra, and Maruti Suzuki lead in Indian Passenger vehicle firms.

5.6. Determinants of Change in Market Shares

Government of India took major decision to liberalise the economy and de-licensed the whole Indian automobile industry in 1993. On the technology front, the liberalisation concerning foreign technology agreements and foreign collaborations infused world-class technology into the industry. Auto policy-2002 comprises several policy decisions that aim at making the Indian automotive industry globally competitive and for raising its contribution to the economy. The government has encouraged efforts for latest foreign technology assimilation and indigenised design and development. Fiscal incentives as well as institutional support have been provided for encouraging industry R&D efforts. Much of this asymmetry could be used to explain inter-firm variation in market share changes. The influence is in the form of both a product and a process effect.[14] Moreover, as discussed earlier, entry of firms with the latest technology configuration brought a change in the market share of the existing firms. The competitiveness of a firm is defined in terms of the rate of change in market share. It is therefore appropriate to use the rate of change in market shares of firms as a measure of competitiveness. This study attempts to examine the factors that brought about this change in the market share. The empirical specification of the testable model being:

$$RMS = f (SIZE, VI, RDI, MKI, LRI\ MCI, AGE, FE, SKILL)$$

Where RMS is the rate of change in market share defined as

[14] Product effect refers to the technological levels, quality and reliability of the vehicles, whereas process effect represents the ability of the firms to reduce their costs through learning curves and also bring about process innovations.

$$RMS = \frac{MS_t - MS_{t-1}}{MS_{t-1}}$$

where MS-market share defined in terms of the annual sales turnover of a firm to that of the total sectoral sales; SIZE-size of the firm measured by the log value of annual sales turnover; VI-degree of vertical integration defined by value added as a proportion of annual sales turnover; R&D-R&D intensity measured by research and development expenditure as a proportion of sales; MKI-embodied technology imports measured by value of imports of capital goods as a proportion of sales; LRI: disembodied technology imports measured by lumpsum and royalty payments as a proportion of sales; MCI-imports of components measured by the value of imports of components as a proportion of sales; AGE-age of the firm measured by depreciation as a ratio of gross block; SKILL- Skill content of the work-force defined by the wages and salaries paid to the highly paid staff as a proportion of the total wage bill of the firm; The data set contains firm level data for 7 automobile manufacturing companies for the period 1991–1992 to 2008-2009. For the empirical analysis, the observations for 18 years from 1990–1991 to 2008–2009 were pooled. This study attempts to examine the factors that brought about this change in the market share during two policy regimes: 'liberalisation policy' (1991-92 to 2000-01) and 'auto policy-2002' (2001-02 to 2008-09). The study uses fixed effect model to analyse the determinants of competitiveness in the dependent variable, namely, the rate of change in market share. The results of the empirical analysis are presented in table 5.6.1

Table 5.6.1

Fixed Effects Estimation of Determinants of Rate of Change in Market Share

Liberalisation Policy (1991-92 to 2000-2001)		Auto Policy (2001-02 to 2008-2009)	
Variables	Coefficients	Variables	Coefficients
Constant (C)	21.739 (1.48)	Constant (C)	-40.692 (2.12)**
D(Firm Size)	77.807 (3.56)*	Firm size (-1)	153.246 (7.16)*
D(VI)	0.995 (1.38)	VI	-0.227 (0.35)
RDI(-1)	3.063 (0.49)	RDI (-1)	-3.555 (1.38)
MKI(1)	1.332 (1.69)***	MKI	4.029 (2.66)*
LRI	-1.223 (0.26)	LRI	-5.424 (1.78)***
MCI(-1)	-1.444 (2.71)*	MCI	0.736 (1.74)***
D(AGE)	-0.601(0.58)	AGE	0.121 (0.28)
D(FE)	64.745 (1.14)	FE (-1)	-0.358 (0.79)
SKILL(-1)	-0.322 (1.89)***	SKILL	0.407 (1.75)***
R^2	0.38	R^2	0.82
F	1.81	F	10.22
NOBS	77	NOBS	56
No of Firms	7	No of Firms	7

Notes: Figures in the parentheses indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %. D indicates the first difference level respectively.
RMS: Rate of change in market share [in terms of sales].

5.6.1. Fixed Effect Results of Market Share Analysis

As hypothesised, the difference in the role played by technology variables between the two policy regimes is also well highlighted by the results. However, with liberalisation of restrictions on entry, capacity creation, product diversification and technology imports, firms were allowed to bring about technological paradigm shifts. These paradigm shifts have been facilitated by intra-firm transfers of technology through equity participation, imports of technology from the market and imports of capital goods. Paradigm shifts enable the firms to operate on a different technology frontier with which they can produce new and differentiated products. During the liberalisation period, the results supported the view that the import of capital (MKI) goods emerged significant with a positive coefficient. In the era of liberalisation, the tariff structure for auto-related imports also underwent reduction. The tariff rate for capital goods also underwent similar reductions in 1996. An important policy decision was the relaxations on imports of capital goods and

technology. Foreign equity influences the growth of market share positively, but not statistically significant. R & D activity influenced the growth of market share positively. In-house R&D is also now directed by many firms to locate their technology imports. Whereas the R&D intensity, had a positive sign, turned out statistically insignificant. In-house R&D turned out insignificant because it, on its own, would also be inadequate to bring about trajectory shifts. Indian automobile companies spend a low amount on R&D as a percentage of sales. Most companies spend a part of their sales, less than 1%, on R&D. We find that the R&D expenditures vary with firm size. This result supports the contention that in a more liberal regime firms would prefer to import technologies to accomplish paradigm shifts. Indian automobile companies spend a low amount on R&D as a percentage of sales.

But product improvements through the import of components (MCI) also emerged significant with a negative coefficient. Imports of components could enable a firm to enjoy certain quality advantages. Prior to the introduction of the liberalisation policy, imports of components were used by the firms as a source of technological upgradation of their product. With liberalisation one would expect the imports of components to rise. However, the role of components import in determining the competitiveness of firms need not increase. In 1997, the Ministry of Industry in its policy for automotive industry placed import of capital goods and auto-components under Open General License (OGL), but regulated the import of automotive vehicles in CBU form or in SKD/CKD condition.[15]

During auto policy period, import of capital goods (MKI) and import components (MCI) emerged very important in the determination of RMS. They influence growth of market share positively. However, with liberalisation and relaxation of restrictions on imports of technology (embodied and disembodied), firms preferred to import the designs to produce the technologically upgraded component rather than the component itself. The imports of components were relatively not uncommon in this sector in India and firms used this as an alternative to indigenous technological development. Since April 2001, the quantitative

[15] Ranawat, Mahipat and Rajnish Tiwari (2009) "*Influence of Government Policies on Industry Development: The Case of India's Automotive Industry*" Wp. No. 57, Hamburg University of Technology, Institute of Technology and Innovation Management, p. 34.

restrictions on imports were therefore effectively removed. Further, the cost-effective and quality auto-components produced in India are increasingly gaining acceptance in international markets. There is an increasing trend in the number of Indian auto-component firms getting integrated into the global supply chains of automobile and auto-component majors worldwide. During auto policy period, R&D influences the growth of market share negatively, but it is not statistically significant. During auto policy period, most firms have increased R&D expenses compared to liberalisation period. Although the R and D activity of some of these firms have also gone up during this period, it may still not be adequate enough to result in improving the growth prospects. We expect that R&D expenditure may be sensitive to growth in growing firms while at the same time it is more constant in the case of declining firms. Auto policy is a long term programme. R&D activity, according to this study, appears to have long-term implications for growth.

The coefficient of firm size is highly significant during both the policy regimes. It influences growth of market share positively. There seems to be a positive relationship between size of the firm and rate of change in market share. Siddharthan et al. (1994) argued that size is a catchall variable that could capture effects of multinationality, technological capabilities, age, capital intensity and vertical integration advantages. If these variables were introduced separately, the inverse relationship would still hold true. The study finds a positive relationship between firm size and growth in the presence of these variables in the equation determining growth of market share. The relationship between firm size and competitiveness is a complex one. Siddharthan et al. (1994), after introducing technology and other related factors along with the size variable, found firm size to be unimportant in explaining growth of large Indian firms. Since competitiveness is measured in terms of rate of growth in market share, the result corresponds to that of the growth literature.

Age of the firm turned out insignificant with a negative value in liberalisation period. Since most of the old firms have a large market share, they may not be able to grow at a higher rate. Inability of the older firms to update their product in the liberalisation period could also be a possible explanation for this. Moreover, the learning effect seems to have been captured by the interaction factors themselves rather than the AGE. However, AGE emerging insignificant with a positive sign and a lower coefficient value in the auto policy

period imply that new firms are growing faster than the older ones. Moreover, age of the firm would also enable the firm to have an expertise in the manufacture of the product and thereby influence their ability to choose the mode and the nature of technology to be acquired from abroad. Accumulation of technology over a long period of learning process would also give the firm a comparative advantage over the new entrant. The study postulates a positive role for the AGE variable during this period. With a change in the policy and entry of new firms, the learning advantages of older firms have been more than matched by the enterprises holding foreign equity. These firms are, therefore, likely to have an edge over the older ones to grow.

Skill variable emerged significant with a negative coefficient during liberalisation period. It influences the growth of market share inversely. Accumulation of technological capabilities through learning by doing is also facilitated by the skilled manpower employed in a firm. The result of this effort could be in the form of both a product and process effect. Labour laws adversely impact competitiveness despite being a low labour cost economy. Skill variable emerged significant with a positive coefficient during auto policy period. Labour reforms, especially on flexibility in the regulations related to hire and fire policies, would in fact encourage recruitment of more permanent workers, which would have overall positive effect. It is also felt that a general improvement in availability of trained manpower and good infrastructure is required for the sustainable growth of the industry.

Vertical Integration (VI) emerged a positive coefficient, but not statistically significant during liberalisation period. The positive sign for the period could be due to the increase in the transaction cost advantage of vertical integration. The increase in the transaction cost is due to the decrease in the number of suppliers of components and parts. With liberalisation, however, foreign firms with an objective of capturing the market with technologically superior and guaranteed quality vehicles would choose to produce most of the components in-house. Vertical integration emerged negatively insignificant in the determination of RMS during the auto policy period. The negative sign for the auto policy period could be due to the decline in the transaction cost advantage of vertical integration. The decline in the transaction cost is due to the increase in the number of suppliers of components and parts. However, there could be large scale variation in vertical integration across firms within an industry.

Thus, it supports the argument that competitiveness depend crucially on shifts in technology paradigm and trajectories along with the degree of vertical integration, import of capital, and levels of product quality improvements, which are made possible by the auto policy in the automobile sector. Market share often is associated with profitability and thus many firms seek to increase their sales relative to competitors. Particularly intriguing is the fact that individual firm market share generally seems to dominate market concentration measures in explaining firm profit rates. The existence of such a relationship, particularly if there is a distinct breakpoint in the relationship, would be indicative of the benefits to firms achieving a large market share. It would provide a rationale for at least a temporary growth maximization strategy at the expense of profits.

5.7. Profitability Measures

Market share cannot by itself define competitiveness. A high market share may be achieved at the cost of low profit margins, where as a low market share may be accompanied by high profits. Profitability has been recognised as the main indicator of financial performance in the case of private sector. On the other hand, economic performance can be studied in terms of productivity, efficiency, technology and technical progress. For instance, studies on profitability have used size, market share, capital-output ratios, foreign ownership, technology imports, age, advertisement intensity, other entry barriers, etc. as explanatory variables. In turn, profitability ratios were used as explanatory variables along with some of the above, to understand the differences in growth, investment, pattern of financing, etc., implying simultaneity in their relationship.[16] However, profit behavior is most essential because different objectives of the firms have ultimately a bearing on profits which is the least imperfect measure of efficiency. An increasing level of profit, other things remaining the same, is an indicator of sound and successful business operations.

5.7.1. Profit ratios (Return on Sales)

The approach of the firm to these issues depends on its corporate strategy and objectives, but the data will reflect on objectives as well as actual performance. In such a scenario, profitability is another relevant indicator of competitiveness. There are many different

[16] Siddharthan, N.S., B.L. Pandit and R.N. Agarwal (1994), "Growth and Profit Behaviour of Large- Scale Indian Firms", *The Developing Economies*, Vol. XXXII, No. 2, pp. 188-209.

measures of profitability. Table 5.7.1.1 shows profits as a share of sales during the liberalisation periods since 1991 onwards. Three variations of profits are used.

Table 5.7.1.1
Profitability Ratios of Firms in the Liberalisation Policy Phase
(1991-92 to 2008-09)

Firms	PBT/Sales		PBIT/Sales		PBDIT/Sales	
	Mean	C.V	Mean	C.V	Mean	C.V
ALL	4.42	50.92	8.46	16.94	11.29	15.02
FML	1.92	341.57	3.56	191.11	8.48	82.61
M&M	6.78	51.07	9.09	27.20	11.66	18.04
TATA	4.63	101.71	8.37	39.45	11.52	20.93
HML	-4.01	-131.94	1.03	607.45	3.98	148.28
MSI	6.77	71.98	7.91	58.52	10.71	39.59
SML	2.11	177.22	3.83	84.06	4.45	67.89

Source: CMIE, Prowess data base
Notes: PBT - Profit before Tax net of PE&OI/Sales
PBIT - Profit before Interest and Tax net of PE&OI/Sales
PBIDT - Profit before Interest, Depreciation and Tax net of PE&OI/Sales
S. D. – Standard Deviation
C. V - Coefficient of Variation. (SD/Mean×100). ALL: Ashok Leyland Ltd, FML: Force Motors Ltd, SML: Swaraj Mazda Ltd, TATA: Tata Motors Ltd, HML: Hindustan Motors Ltd. M&M: Mahindra and Mahindra Ltd and MSI: Maruti Suzuki Ltd.

Table 5.7.1.1 shows profits as a share of sales.[17] Three variations of profits in automobile firms are used- as explained in the table. The preferred measure is gross profits to sales. These three profit measures find that the profitability ratio of Mahindra and Mahindra is higher than all companies (average over 1992-2009 is 11.66, 9.09 and 6.78 percent) and it is the most profitabile company among the entire passenger and as well as commercial vehicle firms. Overall, Mahindra and Mahindra company is seen to be the most profitable company, whatever indicators are used. First, in terms of profits to sales measures of M&M, shows that gross profits to sales went up to over 14.62 percent in the 1999-2000, but declined somewhat after 2000 (average over 1991-92 to 2008-2009 is 11.66). Profitability ratios of commercial and multiutility vehicles firms are explained in appendix 3 and 3.1. This decline is very marked in 2001 if we look at the PBIT and PBT measures

[17] Sales exclude excise duty since this often varies across firms and also over time; it also excludes 'other income of the firm, such as income from financial assets. Gross fixed assets exclude capital work in progress.

owing to a steep increase in depreciation and interest because of heavy investments in M&M's. The gross profit to sales measure finds that Maruti Suzuki India is the next best profitable company to Mahindra and Mahindra (average over 1992-2009 is 6.78 percent)

Next in line, in terms of the gross profit to sales measure is Tata Motor, whose ratio is generally higher than that of the other three commercial vehicle companies (average over 1992-2009 is 4.63 percent). In terms of the PBDIT to sales measure of Tata Motors, whose ratio is generally higher than that of the other three commercial vehicle companies (average over 1992-2009 is 11.52 percent). However, since Tata Motor's interest and depreciation charges are usually proportionately higher than for others. The gross profit to sales measure finds that Tata Motor has outperformed its rival Ashok Leyland. The both PBDIT and PBT measures find that Tata is the most profitable company among the commercial vehicle firms. Between Ashok Leyland and Tata Motor, the former has outperformed its rival in terms of PBIT measure. This is because Tata Motor's profitability (particularly PBIT) has been declining steadily since 1995, although there has been a recovery from 2003 to 2007. In 2003, especially a substantial increase in the number of vehicles sold improved the capacity utilisation and profitability.

The coefficient of variation in different profit measures of commercial and passenger vehicle firms is shown in table 5.7.1.1. Between Mahindra and Mahindra, Ashok Leyland, Tata Motor and Maruti Suzuki , Mahindra and Mahindra clearly has managed to have substantially lower variations in its profit ratios during the liberalisation periods from 1991-92 to 2008-2009 due to the relative steadiness of the utility vehicles market, M&M's dominant product line. But between Ashok Leyland and Tata Motor, the former has clearly managed to have substantially lower variations in its profit ratios. MSI also has managed to have substantially lower variations in its profit ratios after M&M among the entire commercial and passenger vehicle firms. The profitability ratios of eight firms in liberalisation policy period during the (1991-92 to 2000-2001) are shown in table 5.7.1.2.

Table 5.7.1.2
Profitability ratios of firms in Liberalisation Policy Period
(1991-92 to 2000-01)

Firms	PBT/Sales		PBIT/Sales		PBDIT/Sales	
	Mean	C.V	Mean	C.V	Mean	C.V
ALL	3.23	65.03	9.18	13.67	12.27	8.94
FML	1.91	218.09	3.59	109.44	9.48	39.41
M&M	6.06	57.45	9.24	28.89	11.81	20.23
TATA	3.62	146.77	9.09	42.67	12.54	21.15
HML	-0.77	-542.43	5.53	58.31	7.96	38.34
MSI	6.04	88.55	7.78	66.46	10.32	48.03
SML	0.003	124467.9	2.31	153.99	3.07	109.33
DMI	-0.84	-842.54	-9.11	-86.61	5.96	106.06

Source: CMIE, Prowess data Base, 2009.
Notes: PBT - Profit before Tax net of PE&OI/Sales
PBIT - Profit before Interest and Tax net of PE&OI/Sales
PBIDT - Profit before Interest, Depreciation and Tax net of PE&OI/Sales
S. D – Standard Deviation
C.V - Coefficient of Variation (SD/Mean×100).
DMI: Daewoo Motors India Ltd.

It shows profits as a share of sales during the liberalisation policy period. The preferred measure is gross profits to sales. It finds that Mahindra and Mahindra is the most profitability company among the entire Passenger and as well as commercial vehicle firms. Maruti Suzuki India is the next best profitable company after Mahindra and Mahindra Company. Next in line, in terms of the gross profit to sales measure is Tata Motor, whose ratio is generally higher than that of the other three commercial vehicle companies i.e. Swaraj Mazda, Force Motor, and Ashok Leyland. The PBT Measure finds that the profitability ratio of Hindustan Motor, Daewoo Motor, and even Swaraj Mazda is erratic (average over -0.77, -0.84 and 0.003). Table 5.7.1.2 also shows that the coefficient of variation of the different profit measures of seven firms. Among Mahindra and Mahindra, Ashok Leyland, Tata Motor, and Maruti Suzuki, the first one has clearly managed to have substantially lower variations in its profit ratios during the liberalisation policy periods from 1991-92 to 2000-2001. MSI also has managed to have substantially lower variations in its profit ratios after Mahindra and Mahindra among the entire commercial and

passenger vehicle firms. The profitability ratios of firms in 'auto policy' period (2001-2002 to 2008-2009) is shown below in table 5.7.1.3

Table 5.7.1.3

Profitability ratios of firms in the Auto Policy period
(2001-02 to 2008-09)

Firms	PBT/Sales		PBIT/Sales		PBDIT/Sales	
	Mean	C.V	Mean	C.V	Mean	C.V
ALL	5.92	24.22	7.57	15.15	10.07	15.31
FML	1.92	475.65	3.52	273.34	7.24	136.80
M&M	7.68	44.86	8.90	26.61	11.47	15.91
TATA	5.61	64.11	7.46	31.17	10.25	12.96
HML	-8.03	-42.12	-4.57	-93.29	-0.98	-473.45
MSI	7.68	56.99	8.05	51.94	11.20	30.38
SML	4.74	28.14	5.75	21.47	6.18	20.22
FMI	-3.02	-100.65	0.18	1296.2	4.82	55.47
GMI	6.91	183.91	4.76	182.1	7.52	100.99
HSCI	6.85	25.44	7.15	15.35	10.52	7.75
HYMI	7.16	36.14	6.91	37.25	10.99	25.91

Source: CMIE, Prowess data base, 2009.
Notes: PBT - Profit before Tax net of PE&OI/Sales
PBIT - Profit before Interest and Tax net of PE&OI/Sales
PBIDT - Profit before Interest, Depreciation and Tax net of PE&OI/Sales
S. D – Standard Deviation; C.V - Coefficient of Variation. (SD/Mean×100). DMI: Daewoo Motors India Ltd., FORD: Ford Motors India Ltd., GMI: General Motor India Ltd., HSC: Honda Siel Cars Ltd., HYMI: Hyundai Motors India Ltd.

Table 5.7.1.3 shows profits as a share of sales during the auto policy period. The preferred measure is gross profits to sales. While these three profit measures find that the profitability ratio of Mahindra and Mahindra is higher than all the companies (average over 2001-02 to 2008-09 is 7.68, 8.90 and 11.47 percent) and Mahindra and Mahindra is the most profitabile company among the entire passenger and as well as commercial vehicle firms. The gross profit to sales measure finds that both Mahindra and Mahindra and Maruti Suzuki companies are the profitable (average over 7.68) among the passenger and commercial vehicle sector. If we compare between Tata Motor and Ashok Leyland the latter has outperformed its rival in terms of three profit measures. It is very interesting to see that the Swaraj Mazda has performed well in terms of three profit measures during this 'auto policy' period. The joint venture companies like General Motor India, Honda Siel Car India and Hyundai Motor India, except Ford Motor India have performed well in terms

of three profitability measures during this period. Table 5.7.1.3 also shows the coefficient of variation of the different profit measures of firms. Among Mahindra and Mahindra, Ashok Leyland, Tata Motor and Maruti Suzuki, the first one has clearly managed to have substantially lower variations in its profit ratios during this period from 2001-2002 to 2008-2009. But between Ashok Leyland and Tata Motor, the former has clearly outperformed to have substantially lower variations in its profit ratios. Maruti Suzuki Company has also managed to have substantially lower variations in its profit ratios in terms of three profit measures among the entire passenger vehicle firms during the 'auto policy' period. It is also very interesting to see that Honda Siel Cars India and Hyundai Motor India have substantially lower variations in its profit ratios in terms of three profit measures among the entire joint venture firms in passenger vehicle sector during the 'auto policy' period.

5.7.2. Profit Ratios (Return on capital)

Return on sales and return on capital are widely used measures of profitability. The profit rates measured by sales will give a short term perspective of profitability because sales are annual flows. On the other hand, the return on capital will give us long term perspective of profitability. Return on invested capital is a financial measure that quantifies how well a company generates cash flow relative to the capital it has invested in its business. Return on Capital is a measuring tool that measures the efficiency and profitability of capital investments undertaken by a corporation. A firm acquires capital assets to help makes its business operations more efficient, cut down on costs and realize greater profits or acquire more market share. Return on capital ratio also indicates whether the company is earning sufficient revenues and profits in order to make the best use of its capital assets. It is expressed in the form of a percentage, and the higher the percentage, the better. With its entire problem, it is still necessary to consider the return on capital, fixed assets in this study.

This study shows profits as a share of gross fixed asset during the liberalisation phase from 1991-92 to 2008-09. Three variations of profits in commercial and passenger vehicle firms are used- as explained in the appendix (3.3). The preferred measure is gross profits to gross fixed asset. These three profit measures find that the profitability ratio of Swaraj Mazda company is higher than all. It is the most profitable company among the entire passenger

and as well as commercial vehicle firms. Overall, Swaraj Mazda is seen to be by far the most profitable company, whatever the indicator used. Swaraj Mazda has outperformed to have substantially higher in its profit ratios among all the firms. This has clearly managed to have substantially lower variations in its profit ratios during the liberalisation phase from 1991-92 to 2008-2009. Maruti Suzuki Company is the second company which has performed well. Maruti Suzuki India is the second best profitable company after Swaraj Mazda in three profit measures among the passenger and commercial vehicle sector. If we compare between Tata Motor and Ashok Leyland, the former has outperformed its rival in terms of three profit measures. The three profitability measures find that the profitability ratio of Hindustan Motor Company is lower than all companies.

These three profit measures find that the profitability ratio of SML is higher than all companies is the most profitability company among the entire passenger and as well as commercial vehicle firms during the 'auto policy' period as explained in the appendix 3.3.2. If we compare between Tata Motor and Ashok Leyland, the first one has outperformed its rival in terms of three profit measures. The three profitability measures find that the profitability ratio of Hindustan Motor is very lower than all companies. It is very interesting to see that the Swaraj Mazda has performed well in terms of three profit measures during this 'auto policy period'. Mahindra and Mahindra and Maruti Suzuki also managed to have substantially lower variations in its profit ratios during the 'auto policy' period. But between Ashok Leyland and Tata Motor, the latter has clearly outperformed to have substantially lower variations in its profit ratios. Mahindra and Mahindra has also managed to have substantially lower variations in its profit ratios during the 'auto policy' period due to the relative steadiness of the Utility vehicles market, Mahindra and Mahindra's dominant product line. Among the joint venture companies like General Motor India, Honda Siel Cars India, Hyundai Motor India, and Ford Motor India, both Hyundai Motor and Honda Siel Car India managed to have substantially lower variations in its profit ratios during the 'auto policy' period.

5.7.3. Productivity Ratios

Yet another indicator of competitiveness is provided by different indicators of productivity of inputs. Perhaps the best-known index in the automobile industry is production per man. We have weighted the subsidiary production of all firms on the basis of their value relative

to the main product. This study shows value added as a share of net fixed asset, expenditure on employees and total expenditure on bought in components and raw materials. The preferred measure is value added to net fixed asset, expenditure on employees and total expenditure on bought in components and raw materials during the liberalisation period is explained more interestingly. Three variations of productivity ratios in commercial and passenger vehicle firms used are explained in appendix 3.4. If we use the ratio of value added to expenditure on employees (VA/VL) ratio, firms with lower costs per employee would be better off in comparison. Force Motor, Hindustan Motor and Mahindra and Mahindra have the lowest average costs per employee, while Maruti Suzuki has the highest owing to higher salaries and perhaps to high over-time payments resulting from over-utilization of rated capacity. Per rupee of expenditure on labour, Swaraj Mazda's value added is the highest almost throughout the period. However, in most cases improvements in the value of output have not kept pace with increases in expenditure, which could be a reflection of the increased competitive pressures facing all the firms. Thus, VA/VL declines in the 1994s for all firms except for Swaraj Mazda and Mahindra and Mahindra. VA/NFA declines in the 1994 for all firms, and for Mahindra and Mahindra and Force Motor's decline begin in 1995.[18] VA/TC is less clear-cut, although there has been no increase in this ratio over this period for all firms (the decline implying that cost of materials rose faster than value of output).[19] Swaraj Mazda's higher per rupee of labour expenditure is owing to lower average personal expenditure (including all benefits). This implies that although Swaraj Mazda employees have a high productivity, it is not high enough to compensate for their higher wages vis-à-vis Force Motor. Per unit of fixed assets, Swaraj Mazda has the highest value added. Between Tata Motor and Ashok Leyland, Tata produces more vehicles per employee if we correct for its higher vertical integration. Ashok Leyland usually exceeds Tata in terms of VA/VL, but Tata Motor exceeds it by narrow margin in terms of VA/TC and VA/NFA. Thus, Ashok Leyland's average employee productivity is higher, but material productivity, and capital productivity is lower over the period.

[18] Since fixed assets are the most vulnerable to a decline in demand, the demand bottleneck of the 1994s shows up prominently in these ratios.

[19] VA/TC=(Q-TC)TC=(Q/TC)-1 where Q is value of output, TC is bought in materials

5.8. Profitability and Competitiveness

Our implicit assumption in relating profitability to competitiveness has been that a more profitable firm is more efficient, via lower costs and or better products that ensure higher prices. Unfortunately higher prices can also result from monopoly power, and from excess demand (in the 1970s and early 1980s) and it becomes difficult to separate these effects from those of lower costs and better products. On the other hand, Hindustan Motor's profitability is quite low, Tata Motor outperforms its rival Ashok Leyland as well as Force Motors and Swaraj Mazda Ltd. With growing demand for (LCVs and Jeeps) more steadily, the returns on capital for Swaraj Mazda and Tata Motor are usually higher than for Ashok Leyland and Force Motor during the liberalisation period. Thus in terms of profit margin on sales Tata Motor and Ashok Leyland are usually higher than for Force Motor and Swaraj Mazda during the liberalisation period. Similarly in the PVs sector, Mahindra and Mahindra is unarguably a highly profitable firm, making efficient use of its asset and enjoying comfortable margins on sales. Thus in terms of profits, M&M is the most competitive firm, followed by Maruti Suzuki and Hindustan Motor Company. Thus, comparisons based on sales margins are relatively less favourable to the CVs firms as compared to the PVs firms than those based on return on capital. Only Mahindra and Mahindra, Maruti Suzuki, and Tata Motor perform consistently when judged by either set of measures.

5.9. Summary

This chapter examines the impact of liberalisation policy started in India since 1991 and competitiveness of Indian automobile firms. Further to this Indian government came with Automotive Mission Plan (2006-2016) to promote and grow the automotive sector with a mission of making auto sector to contribute to the Indian economy and globally competitive. The domestic market competitiveness includes an analysis of market shares, profitability and productivity ratios, and performance. The Herfindahl-Hirschman Index is used as an indicator of the amount of competition among firms**.** Indian automobile industry has been registering a healthy positive growth in terms of its production and sales as well over the period of study. But, both production and sales are registering negative growth

rate in 2007-2008. It shows the domestic sales, industry volumes and export performance from the year 1999-00 to 2008-09 are increasing on a steady rate. Export of production has also increased over the period of study. India's production of passenger cars and commercial vehicles reached a new record of 29.8 percent in 2002-03, 30.1 percent in 2003-04 and 24 percent in 2005-06. This section considers the global spread of vehicle sales and production. The improvement in exports shows the growing capability of the Indian automobile industry to meet the international norms and standards, and increasing acceptance of automobiles manufactured from India in the global market. Trend car sales are increasing at a rapid pace in China and India. The automobile industry has been affected by the economic downturn. The downturn in the automobile industry in late 2008 was deep and highly synchronised. Looking for market structure, the firms like Tata motor and Ashok Leyland are the dominant in Indian Commercial vehicle industry. Tata Motors is the largest medium and heavy commercial vehicle manufacturer. In commercial vehicle Market, Tata Motors dominates over 70% of the Indian commercial vehicle market. Ashok Leyland dominates over 21% market share of Indian CV market. But the market concentration is higher over the period that leads less competitive the behaviour of firms. Less competitive behaviour results more market power (i.e., lower social efficiency). The commercial vehicle industry is still highly rivalrous oligopoly.

Similarly, for market structure, the overall market shares of Indian passenger vehicle firms are declining and joint venture of foreign firms are increasing over the period of time. Maruti Suzuki is the largest car producer in India and completely monopolizes the production of multi-purpose vehicles. While Mahindra holds largest share for the utility vehicles. Hyundai and Tata Motor come as second and third car producers in India. Mahindra and Mahindra, and Maruti Suzuki lead in Indian Passenger vehicle firms. The market concentration of PVs is declining over the period that leads higher competitive the behaviour of firms and results decline in market power (i.e., higher social efficiency). This transformed the previously oligopolistic car segment into one of the most competitive sector in the industry. The commercial vehicle industry is more concentrated than passenger vehicle industry.

This study has attempted to analyse the determinants of competitiveness in the Indian automobile industry during two policy regimes: 'liberalisation policy' (1991-92 to 2000-

01) and 'auto policy-2002' (2001-02 to 2008-09). It is argued that asymmetry among firms in terms of technology acquisition explain much of the firm level differences in competitiveness. The fixed effect results find that major variables capturing technological paradigm and trajectory shifts emerged very important in the determination of competitiveness. In the liberalisation phase, the results supported the view that the firm size and import of capital goods influence growth of market share positively. Firm size comes up with a positively significant for the liberalisation period. Skill content of the work-force emerged significant with a negative coefficient. Labour laws adversely impact competitiveness despite being a low labour cost economy. During the auto policy regime, the firm size, import of capital goods and import of components emerged very important in the determination of rate of change in market share of firms in the automobile industry. Product improvements through imports of components turned out to be a very important factor in the determination of RMS in the 'auto policy' phase. R & D activity emerged significant and influenced growth negatively. R&D activity, according to this study, appears to have long-term implications for growth. Therefore, policy efforts to encourage R&D and some concentration of size of the domestic firms in the industry may be more desirable than passively liberalisation policy. Skill content of the work-force emerged significant with a positive coefficient. Labour reforms, especially on flexibility in the regulations related to hire and fire policies, would in fact encourage recruitment of more permanent workers, which would have overall positive effect.

The profitability is another relevant indicator of competitiveness. The coefficient of variation of the different profit measures (return on sales) shows that the firms like Mahindra and Mahindra, Ashok Leyland, Tata Motor, and Maruti Suzuki have clearly managed to have substantially lower variations in its profit ratios during liberalisation period from 1991-1992 to 2008-2009. Overall, Mahindra and Mahindra Company is seen to be the most profitable company among the entire passenger and as well as commercial vehicle firms due to the relative steadiness of the utility vehicles market, Mahindra and Mahindra's dominant product line. The firms like Force Motor, Hindustan Motor, and Swaraj Mazda have large variations in its profit ratios during the same period. Maruti Suzuki is the profitable company after Mahindra and Mahindra in terms of three profit

measures. Tata Motor has outperformed its rival Ashok Leyland in terms of three profit measures.

Chapter VI

Analysis of Productivity Growth Performance of Indian Automobile Industry

Chapter VI

Analysis of Productivity Growth Performance of Indian Automobile Industry

6.1. Introduction

Competitiveness depends on the capacity and the speed of the industry to innovate and upgrade. The most important indices of competitiveness are productivity of both labour and capital. The motor vehicle manufacturing industry requires significant level of capital investment. The level of capital intensity is high and labour intensity is medium. Labour input is required in the manufacturing, assembly, and finishing processes. The level of technology change is high and rate of change in technology is medium. Investment in technology by producers has been on the rise. A greater emphasis is required on the development of the factors like innovation which can ensure competitiveness on a long term basis. Increased competition in the output market puts pressure on producers to improve. Increased competition in factor markets and inputs increases the ability of producers to compete. This success in meeting the challenges of competition and increasing productivity is determined by the balance between the two. This in turn determines the aggregate short term and medium term impact on total factor productivity and growth. A more comprehensive and integrated view of market reforms was formulated in the nineties, with wider and deeper reforms initiated in 1991-92 (Virmani (2002b,[1] 2004a[2]).

The overall effect of these reforms was to greatly increase the degree of domestic competition in the economy, contrary to what Rodrik and Subramanian (2004)[3] have asserted. Economic reforms during the eighties attacked two major failings of the earlier policy regime: domestic controls on production and investment and external trade controls

[1] Arvind Virmani (2002b), "A New Development Paradigm: Employment, Entitlement and Empowerment", *Economic and Political Weekly*, Vol. 37, pp. No. 22, pp. 2145-2154.

[2] Arvind Virmani (2004a), "*Accelerating Growth and Poverty Reduction: A Policy Framework for India's Development*", Academic Foundation, New Delhi.

[3] Dani Rodrik and Arvind Subramanian (2004), "*From 'Hindu Growth' to Productivity Surge: The Mystery of the Indian Growth Transition*", IMF Working Paper/04/77.

and distortions. Starting from 1980-81 there was a gradual liberalisation of controls on prices, production, distribution and investment. With the introduction of economic reforms in 1991, Indian industries have witnessed profound changes in the basic parameters governing its structure and functioning. Since 1991, India has adopted the policies of trade liberalisation and significant changes have been made in industrial policies through various reform programs. The Indian government started to implement a wide range of economic reforms on various fronts to make domestic industries more efficient and internationally competitive. Relaxing of licensing rule, reduction in tariff rates, removal of restriction on import of raw materials and technology, price decontrol, rationalization of customs and excise duty, enhancement of the limit of foreign equity participation etc are among those which have been introduced. Over the years several measures were undertaken by them for boosting up the industrial productivity. These were adopted along with changes in technology-import policy, foreign direct investment policy, to make Indian industrial sector more efficient and productive, technologically sounder and an able competitor in the world market.

However, the situation is gradually changing since 1991 due to the introduction of trade and import liberalisation policies by Government of India. One of the many objectives of trade liberalisation in India has been to enhance industrial productivity and input-use efficiency. Greater and cheaper access to imported technology, capital goods, intermediate goods and global capital, relaxing constraints on various input use and technology choices, increased domestic and international competitive pressures by bringing in technological dynamism in industries. Trade reforms aimed at exposing Indian firms to global markets will compel them to produce better quality goods. Removal of import restrictions and currency transactions will enable them to import better quality materials, components and technology. FDI inflows will have technology and productivity spillover effects and would improve the productivity of Indian firms. As a result of changes in trade policies, Indian manufacturers find themselves threatened by both domestic and foreign competition.

However, to accelerate industrial growth rate, the government is taking various policy initiatives supported by continuous reforms in different areas including foreign direct investment policy, EXIM policy, infrastructure development, information technology and

financial sectors to help industry improve its efficiency, productivity and international competitiveness. Under these circumstances, there emerges a need for measurement of total factor productivity (TFP) and identification of the factors that account for productivity changes. Theoretically, favorable effects of import liberalisation on total factor productivity (TFPG) of industrial productivity are supported. Though, there exists very little quantitative evidence in support of this argument, we would like to take up this issue in our future exercise. The object is to compare the growth rate in TFP in Indian industries in the 1990s, i.e. the post-reform period, with that in the 1980s, i.e. the pre-reform period. Given that the main object of liberalisation was to improve industrial productivity, it is appropriate to ask how far liberalisation has contributed to the better productivity performance of Indian automobile industry in the post-reform period. This chapter addresses this issue.

This chapter discusses an analytical framework and tests empirically whether liberalisation reforms improve productivity growth in Indian automobile industry. Therefore, this study is an attempt to measure the total factor productivity growth and assesses the impact of liberalisation on TFPG in order to have a clear insight into whether liberalisation has significantly contributed to TFPG. This chapter seeks to examine the productivity performance in terms of partial factor productivity and total factor productivity growth for the entire period. It analyses the trends in productivity performance in the automobile manufacturing sector at a level of aggregation with a view to understanding the productivity phenomenon over time and across industries. The role of productivity growth in generating growth in the automobile manufacturing sector is also explored. Productivity growth is recognised as a key feature of economic dynamism today. These problems can be resolved by analysing total factor productivity growth which identifies the contribution to an increase in output of influences other than increases in the factor inputs. Total factor productivity growth encompasses the effect not only of technical progress but also of better utilisation of capacities, learning-by-doing, improved skills of labour etc. it is therefore a composite measure of technological change and changes in the efficiency with which known technology is applied to production. This has been analysed by examining different productivity indicators like labour productivity, capital productivity and total factor

productivity. The trends in the partial productivity indices are also estimated with respect to individual factor inputs. The translog measure of total factor productivity growth is used in this study. We first define this measure and spell out the data base on which the estimates are built. The estimates of TFPG are used to derive and analyse the long-term trends in TFPG for manufacturing. The trends in the partial productivity indices with respect to individual factors include the effect of capital-deepening in the context of capital accumulation in a growing economy. At the aggregate level of manufacturing, growth accounting estimates and production function estimates of TFPG are available for a number of developing economies. The conceptual issues associated with the problems of aggregation, valuation of capital, underutilisation of capital and changing quality of labour in the specification of a production function have been extensively discussed in the literature. The changes in total factor productivity obtained through the growth accounting method reflect the composite effect of all factors, other than the increases in labour and capital, on the increases in value added.

6.2. Data Sources and Methodology

The analysis explained in this chapter mainly based on the secondary data. The basic source of data used for the productivity estimates is the Annual Survey of Industries (Central Statistical Organisation, Government of India) for the period 1974-75 to 2008-09. The basic data are available in different units and for different time periods. Data regarding employment, capital and value added at the aggregate level are used for the productivity estimates is the Annual Survey of Industries (Central Statistical Organisation) from 1973-74 to 2008-09. The study has only concentrated on three digit classification which required some important adjustments. The industrial classification system changed in the year 1973-74. The second change took place in 1989-90. The third change took place in 1997-1998. The data used in this analysis have been arranged consistently. Till the year 1988-89, the industry group motor vehicles and parts (374) included data on heavy motor vehicles and coach work (called 373 in the new series). But, 374 referred to data on manufacturers of motor cars and other motor vehicles principally designed for the transport of less than 10 persons. The old series has been adjusted using the share of 373 and 374 in the new series included the data on motor vehicles till the 1997-1998 (NIC-1987 Codes: 373 and 374).

Similarly, after 1998-1999, the data have been adjusted accordingly to the concordance table published by the CSO to reclassify the data according to NIC classification 1998 code. Analysis of data from 1999-99 to 2007-08 has been done for the following sectors: Automobile manufacturing (NIC-1998 Code: 341): Passenger cars, Multi-Utility, Vehicles, Commercial Vehicles, Buses, Coaches and Tractors. The Fourth change took place in 2008-2009. This was used for the year 2008-2009 in accordance to the concordance table published by the CSO to reclassify the data according to the NIC classification 2008 code. NIC code 291 includes the manufacturer of motor vehicles. The basic variables for the estimation of the yearly TFP growth rates are gross output, capital stock and labour. To arrive at the measures of output and inputs in real terms, suitable deflators for the variables are constructed. All the values involved in this analysis are computed at 1993-94 constant prices. Price deflators have been used to derive the trends adjusted for price changes.

We have taken net value added as the measure of output. The value added series is deflated by the wholesale price indices of motor vehicles. Wages and salaries paid to the employees as labour input. The labour value is deflated by the consumer price index of industrial workers. Net fixed capital stock at constant prices has been taken as the measure of capital input. The deflating series for capital is calculated from the wholesale price indices of the machinery and transport equipment at 1993-94 prices and are obtained from Ministry of Commerce and Industry, Government of India. The measurement of capital stock is the most complex of all input measurements. It should be noted that there is hardly any universally accepted way of measuring capital stock. It is desirable to have an estimate of net capital stock for economic analysis if a fairly reasonable measure of true economic depreciation can be found out. Different economists have tried to solve these problems differently and provided various measures of capital stock.[4] In measuring capital input, the use of undeflated book-values amounts is inaccurate and the book value series is deflated by a price index.

[4] Bibekananda Raychaudhuri (1996), "Measurement of Capital Stock in Indian Industries", *Economic and Political Weekly*, Vol. 31, No. 21, pp. M2-M6

However, the perpetual inventory method is a preferred mode of measuring capital inputs.[5] Capital series for productivity analysis have been generated by using perpetual inventory accumulation method. The capital stock at any year is calculated as:

$$K_t = K_0 + \sum_{t=1}^{T} I_t$$

Where I_t is investment in year t and K_0 is capital stock for benchmark year i.e. 1973-74. Investment figures were obtained using the formula:

$$GI_t = (F_t - F_{t-1} + D_t) / R_t$$

where, F_t stands for net fixed capital in year 't'. F_{t-1} stands for previous year, D stands for depreciation. R stands for Wholesale prices index of machinery and transport equipment (base 1993-94=100) is used. GI is the gross investment at current prices. The gross investment series is deflated by wholesale price indices of the machinery and transport equipment.[6]

The overall assessment of the Indian automobile industry has been the question of its productivity growth. Growth stems from two sources: factor accumulation and productivity growth. The basic issue is the relative importance of each of these components. The concept of productivity used in this study is that of total factor productivity (TFP). Two important methodologies used in most studies on productivity growth have been growth accounting and the econometric estimation of production functions. TFP growth is the difference between the growth of output and the growth of a combination of all factor inputs, usually labour and capital. In general, improvements in TFP reflect the contribution to output as a result of the more efficient use of resources or the adoption of new production technologies. The objective of the growth accounting technique is to determine how much output growth is due to accumulation of inputs and how much can be attributed to technical progress. In other words, how much of the growth can be explained by movements along a production function and how much should be attributed to advances in technological and organisational competence. The relationship

[5] Sumit K. Majumdar (1996), "Fall and Rise of Productivity in Indian Industry: Has Economic Liberalisation Had an Impact?", *Economic and Political Weekly* Vol. 31, No. 30, pp M46-M53.

[6] Manpreet Kaur and Ravi Kiran (2008), "Indian Manufacturing Sector: Growth and Productivity under the New Policy Regime", *International Review of Business Research Papers*, Vol. 4 No.2 pp.136-150.

between the partial measures of labour and capital productivity and TFP growth is also examined to make explicit the conceptual links between them. It provides some empirical analysis based on the compiled data set to understand what drives TFP growth and to analyze the policy implications for sustained growth in the Indian automobile industry.

6.3. Technological Change and Productivity Trends

The economic development of a country is generally measured by the level of real Gross Domestic Product (GDP) per capita. Higher levels of real GDP per capita can be achieved through higher labour or capital productivity or higher level of utilization of the existing resources. The concept of productivity is based on the relationship between the quantity of goods and services produced and quantity of inputs utilised in turning out these goods and services.[7] Productivity is an indicator of the economic and technical efficiency with which given inputs is converted into output.[8] Increase in productivity, especially at the aggregate level, indicates a saving of real resources and a reduction in costs. If a competitive environment prevails it would result in increased supply and is likely to bring down prices.

6.3.1. Measurement of Productivity Indicators

Productivity is a marginal contribution of a factor to the output growth of a product. If productivity is increasing in an economy; it means that its factor of production and commodity inputs are manifesting an increase in their output efficiency. Productivity is an indicator of the economic and technical efficiency with which given inputs are converted into output. The productivity improvements along with the increase in quantities of factors will also be contributing an additional source of output increase. Productivity increases when the growth in output is greater than the growth in input, or when the rate of growth of output minus the rate of growth of the composite input is positive. There are two measures of productivity namely, single factor productivity and total factor productivity (TFP).

In the production function method different parameters of productivity can be measured directly. It shows the relationship between the maximum output obtainable from a given

[7] S. Fabricant, (1973), "*A premier on productivity*", Prentice Hall of India, New Delhi.

[8] Dalbir-Alai (1987), "Trends in Productivity Growth across Large Scale Manufacturing Industries of India", *Indian Economic Review*, Vol. 22, pp. 151-175.

set of inputs, and the relationship among the inputs themselves in the existing state of technological knowledge. The efficiency of factors, the degree of economies of scale, the degree of capital intensity of a technology and how the factors can be substituted for each other, can be measured by estimating the parameters of the underlying production function. There are many different measures of productivity growth. The choice between them depends on the purpose of productivity measurement and, in many instances on the availability of data. Broadly, productivity measures can be classified as single-factor productivity measures (relating a measure of output to a single measure of input) or multi-factor productivity measures (relating a measure of output to a bundle of inputs). The need for studying productivity growth arises due to the intimate link between productivity growth and economic growth. Productivity is a relationship between production and the means of production. This relationship is articulated through the given technology of production. Productivity growth is crucially affected by technological change. Productivity growth is obviously preferable to growth due to increase in factor inputs, since the later might be subject to diminishing marginal return. Productivity growth is necessary not only to increase output but also to enhance competitiveness of a country. [9]

6.3.2. Annual Average Growth Rate of Productivity Measures

The estimation of factor productivity will be very useful to evaluate the variations in the performance of an industry over a period of time. The single factor productivity is calculated by dividing the total output by the quantity of an input. The main problem of using this measurement of productivity is that it ignores the fact that productivity of an input depends on level of other inputs used. This has been analysed by examining different productivity indicators like labour productivity, capital productivity and total factor productivity. Labour productivity is the ratio of value added to employment. This ratio yields average product of labour. Similarly, capital productivity ratio can be represented by the ratio of value added to capital. This yields the average product of capital. Capital intensity is the ratio of capital to employment. A rise in these ratios suggests an increase in

[9] Puran Mongia and Jayant Sathaye (1998) "*Productivity Growth and Technical Change in India's Energy Intensive Industries: A Survey*", Environmental Energy Technologies Division LBNL- 41840.

the productivity of that particular factor. Further, different partial productivity indices may display opposite trends in which case no judgement is possible about overall efficiency. If all the partial productivity indices have similar trends, then it might still be possible to draw inferences about the overall efficiency.[10] The TFP approach overcomes this problem by taking into account the levels of all the inputs used in the production of output. The estimates of TFPG are used to derive and analyse the long-term trends in TFPG for manufacturing. The changes in total factor productivity obtained through the growth accounting method reflect the composite effect of all factors, other than the increases in labour and capital, on the increases in value added. For the sake of comparability, measure in value terms is taken. The annual average growth rates of productivity measures are explained in the table 6.3.2.1 given below.

Table 6.3.2.1

Annual Average Growth Rates of Value Added, Capital and Employment and Productivity Trends in Indian Automobile Sector

Growth Rate	Pre-reform Period (1979-80 to 1990-91)	Post-reform Period (1991-92 to 2008-09)	Entire period 1979-80 to 2008-2009
Value Added	8.32	13.19	10.74
Capital	12.62	10.57	11.71
Employment	6.8	5.14	5.66
Capital Productivity	-3.05	2.17	0.26
Labour Productivity	2.15	6.91	5.11
Capital Intensity	5.97	13.21	10.55
TFPG	-0.55	-0.29	-0.39

Source: Calculations from Annual Survey of Industries (2000-01 to 2003-04), SIAM and ACMA Statistics.
Notes:
1. Labour productivity is the ratio of output in Rs. lakh at constant 1993-94 prices to employment
2. Capital intensity is the ratio of capital Rs. lakh at constant 1993-94 prices to employment
3. Capital productivity is the ratio of output to capital, both in Rs. lakh at constant 1993-94 prices

Table 6.3.2.1 depicts that overall long-term growth of 10.74 % in value added (output) in Indian automobile industry during 1979-80 to 2008-09 is associated with rapid growth of

[10] W. E. Salter (1966), "*Productivity and Technical Change*", Cambridge University Press (2nd edition), Cambridge.

capital (11.71 % per annum) and growth of labour (5.66% per annum). Comparing the annual growth rate of pre-reform period (1979-80 to 1990-91) with that of post-reform period (1991-92 to 2008-09), it is evident that there is an increase in the growth rate of value added from 8.32 % in pre-reform period to 13.19 % in post-reform period. Productivity of capital increased from -3.05 to 2.17 along with that of labour productivity, which increased from 2.15 to 6.91 during these two reform periods. Capital intensity increases at higher rate from 5.97% in pre-reform period to 13.21 % in post-reform period. After economic reforms took place in July, 1991, capital productivity and labour productivity show increasing trend. It is evident that the revival of growth in output in post 90s was not accompanied by adequate generation of employment in automobile sector. It is argued that capital-intensive techniques were adopted because of increase in real wage in 1980's and onward. Total factor productivity growth is higher during the post-liberalisation. These changes are reflective of an increase in the rate of growth of capital intensity. The growth rate of total factor productivity in pre-liberalisation phase is -0.55 percent and -0.29 per cent per annum in post-liberalisation phase. It is seen from the table that, the TFP estimates made in this study indicate a rise in the growth rate of TFP in Indian automobile manufacturing in the Post-reform period (1991-92 to 2008-09) as compared to the pre-reform period 1979-80 to 1990-91). Observing the growth path, it is apparent that TFP growth contribution is negative (-0.39%) across the entire time frame with the overall reduction in capital productivity, high wage rate and capital intensity technique. Therefore, growth in Indian automobile industry was fundamentally dominated by factor accumulation resulting input-driven growth. For instance, labour productivity can be augmented by simply raising the level of capital input - in other words, at the expense of capital productivity and vice versa.

Thus, increases in labour productivity may be due to improved efficiency and technological progress as well as more capital per unit of labour, and the two sets of influences do not operate independently of each other. Productivity of capital increased from -3.05 to 2.17 along with that of labour productivity, which increased from 2.15 to 6.91 during these two reform periods. Capital intensity increases at higher rate from 5.97% in pre-reform period to 13.21 % in post-reform period. Total factor productivity growth is

negative and associated with increasing growth rate in capital and declining growth rate of employment during post-reform period.

For instance, labour productivity can be augmented by simply raising the level of capital input - in other words, at the expense of capital productivity and vice versa. In the recent years, there has been a rapid transformation in the character of the automotive market, as a fast maturing organised, skill-intensive and knowledge driven activity. The main problem of using this measurement of productivity is that it ignores the fact that productivity of an input depends on level of other inputs used. The TFP approach overcomes this problem by taking into account the levels of all the inputs used in the production of output. At the aggregate level, the concept of total productivity is more relevant than the single factor productivities (i.e., labour or capital productivity). In a labour-surplus economy, with a relatively low wage structure, the prime emphasis would be on increasing the productivity of capital without hampering employment opportunities. On the other hand, in the developed countries, where there is a shortage of labour and a fast rising wage structure, the prime concern would be to increase labour productivity. This would help them to economise on the use of labour input in the production process.

6.3.3. Total Factor Productivity Growth (TFPG)

TFP is calculated in a growth-accounting procedure and according to a traditional Solow (1957) Cobb-Douglas function.[11] This measure is based on the general neo-classical production function. Within this model TFP is identified as shifts in technology if certain conditions are met. It assumes constant returns to scale, Hicks-neutral technical change, competitive equilibrium and factor rewards being determined by marginal products. Under these conditions, the growth of total factor productivity is the difference between the growth of value added and the rate of growth of total factor inputs.

In the neo-classical growth accounting framework, the growth of output is the sum total of the growth of capital accumulation, growth of labour and the growth of productivity or efficiency. Thus, for a given combination of factor inputs (capital and labour), the shifts in the production frontier are engendered by the improvements in productivity or efficiency.

[11] R.M. Solow (1957), Technical Change and the Aggregate Production Function, *The Review of Economic and Statistics*, Vol. 39, No. 3, pp. 312-320.

This study is based on growth accounting analysis of productivity performance of Indian automobile industry. In this study, we do not attempt to come up with a new interpretation of TFP. Instead, we attempt to better understand what TFP is by identifying factors that influence it. We do this by first reviewing the literature on growth accounting, then examining different approaches to the study of TFP. Growth accounting provides a structured framework for assessing the importance of the relative contributions of labour and capital inputs and TFP growth.[12] Basically, it involves decomposing the growth rate of output into the contributions of the growth of inputs (labour and capital) and the growth of TFP. Disembodied technological progress has been measured as TFP growth and is attributed to growth in output other than that due to growth in inputs. It is often referred to as managerial or efficiency factor. TFP measure is supposed to reflect the 'residual' or 'technical progress' that cannot be attributed to either of the two factors under the given assumptions of the model.[13] Since real data on output and input is available, TFP growth is estimated as a residual measuring 'everything and anything' of output growth that is not accounted for by input growth. It is important to note that in the above specification, technical progress is assumed to be totally "disembodied"; that is, all technical progress is assumed to be net of the effects of factor accumulation (Dowling and Summers, 1998).[14]

This spurred great interest in trying to obtain improved and more accurate productivity growth estimates, which is an ongoing task in the field of productivity measurement. For sustained output growth, TFP growth is essential, and hence TFP growth became synonymous with long term growth as it reflects the potential for growth. The growth accounting approach is based on the development of indices of output and input. The view is that productivity is an essential concept for analysis as well as policy orientation in the long term. Estimates of TFP growth are expected to provide an indication of change in output per unit of input. It should be noted here that the year-to-year specific TFP values might fluctuate; hence, TFP Growth (TFPG) is best considered in terms of productivity trends over a period of time. TFPG is obtained as difference between the rates of growth of

[12] In discussing the growth accounting methodology, the measure of TFP essentially refers to improvements in technology and efficiency, for simplicity of exposition.

[13] R.M. Solow, (1957), ibid.

[14] M. Dowling and P. Summers (1998). "Total Factor Productivity and Economic Growth – Issues for Asia", The *Economic Record*, 74, Issue 225, pp. 170-185.

real product and real factor input. TFP is the rate of technological change. Estimation of annual TFP growth of Indian automobile industry at aggregate level is presented in table 6.3.3.1.

Table 6.3.3.1
TFP Index and Annual Total Factor Productivity Growth Rates in Indian Automobile Industry: 1989-90 to 2007-2008

Pre-reform period (1979-80 to 1990-1991)			**Post-reform period (1991-92 to 2008-09)**		
Year	TFP Index	Growth Rate in TFP (%)	Year	TFP Index	Growth Rate in TFP (%)
1979-80	1		1991-92	0.91	-1.06
1980-81	0.93	-0.78	1992-93	0.89	-0.58
1981-82	0.92	0.97	1993-94	0.88	-0.08
1982-83	0.93	-0.15	1994-95	0.88	1.52
1983-84	0.93	-0.88	1995-96	0.89	2.76
1984-85	0.92	-0.77	1996-97	0.92	-1.67
1985-86	0.92	-1.42	1997-98	0.91	-0.87
1986-87	0.90	0.34	1998-99	0.89	-8.42
1987-88	0.91	-1.92	1999-00	0.82	0.71
1988-89	0.89	0.37	2000-01	0.82	-5.88
1989-90	0.89	0.02	2001-02	0.78	1.14
1990-91	0.89	0.44	2002-03	0.79	4.16
			2003-04	0.82	5.25
			2004-05	0.86	2.41
			2005-06	0.88	3.46
			2006-07	0.91	-1.96
			2007-08	0.89	-1.61
			2008-09	0.88	-4.52
Average		-0.55			-0.29

Source: Calculations from Annual Survey of Industries (2000-01 to 2003-04), SIAM and ACMA Statistics.

The estimates of TFP growth in Indian automobile manufacturing industry made in this study using the value-added function framework are presented in Table 6.3.3.1. The results

on Divisia Tornquist approximation on Indian automobile industry are shown in the form of index on total factor productivity and its growth rates. TFP growth rates are shown for the periods 1979-80 to 1990-91 and 1991-92 to 2008-2009. It is seen from the table that the estimated growth rate of TFP is -0.55 percent per annum for the period (1979-80 to 1990-1991) and -0.29 per cent per annum in (1991-92 to 2008-09). For the entire period 1979-80 to 2008-09, the estimate of growth rate of TFP in Indian automobile manufacturing sector is estimated at -0.39 percent per annum. Evidently, the TFP estimates indicate a significant growth in TFP in Indian manufacturing during post liberalisation period. This is consistent with the finding of an increase in the growth rate of TFP in the post-liberalisation period as compared to the pre-liberalisation at the aggregate manufacturing level.

As it is clear from the figures in the table, the Indian automobile industry shows negative productivity gain on TFP account over the study period. The analysis reveals that the growth rate in total factor productivity was significantly negative in the period 1996-1997 to 1998-1999. Again the industry also turned negative TFP growth rate in 2000-2001. This negative TFPG levels was followed by recovery in 2001-2002, which gathered momentum till 2005-2006 and again turned worse in 2006-2007. This phenomenon continued till the end of the study period with negative TFP growth rates.

TFP is a measure of all improvements in technology and increases in efficiency over long periods of time. Total Factor Productivity is defined as the ratio of output to weighted combination of inputs. The changes in TFP may take place due to a number of factors, such as improvements in the labour quality or greater utilization of capacity or advances in technical knowledge. All these factors contribute to the overall efficiency of factor use. If output were homogenous and if there was a single homogenous input, the estimation of TFP would have been straightforward. Figure 6.3.3.1 and 6.3.3.2 displays the graphical presentation of the TFP and TFPG estimates.

Fig: 6.3.3.1

Total Factor Productivity (TFP) in Indian Automobile Industry: 1990-200**9**

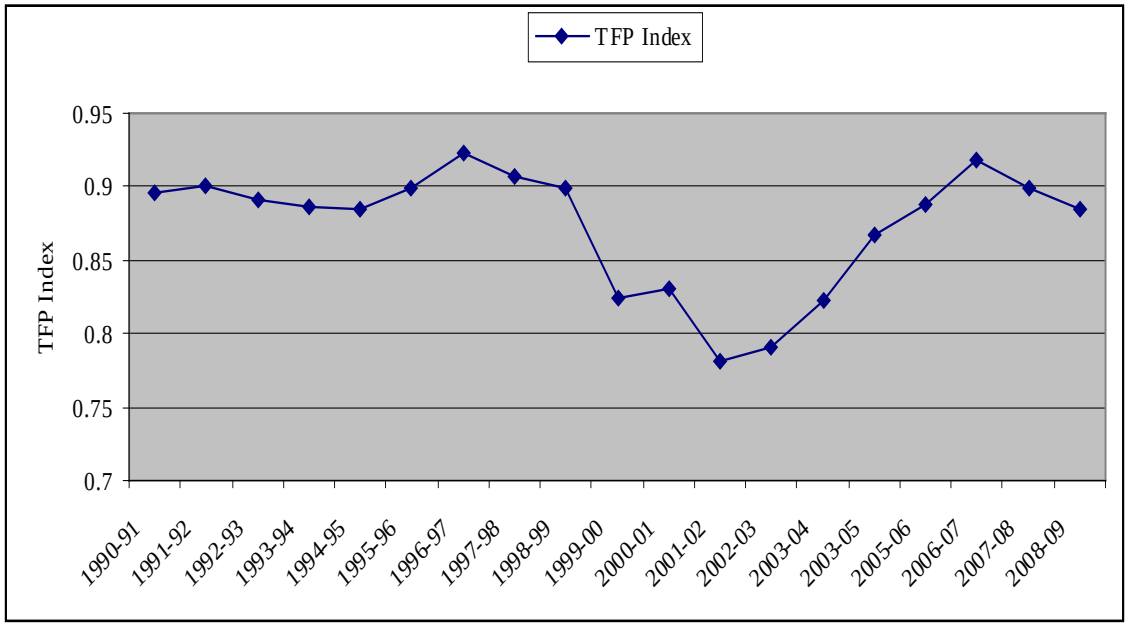
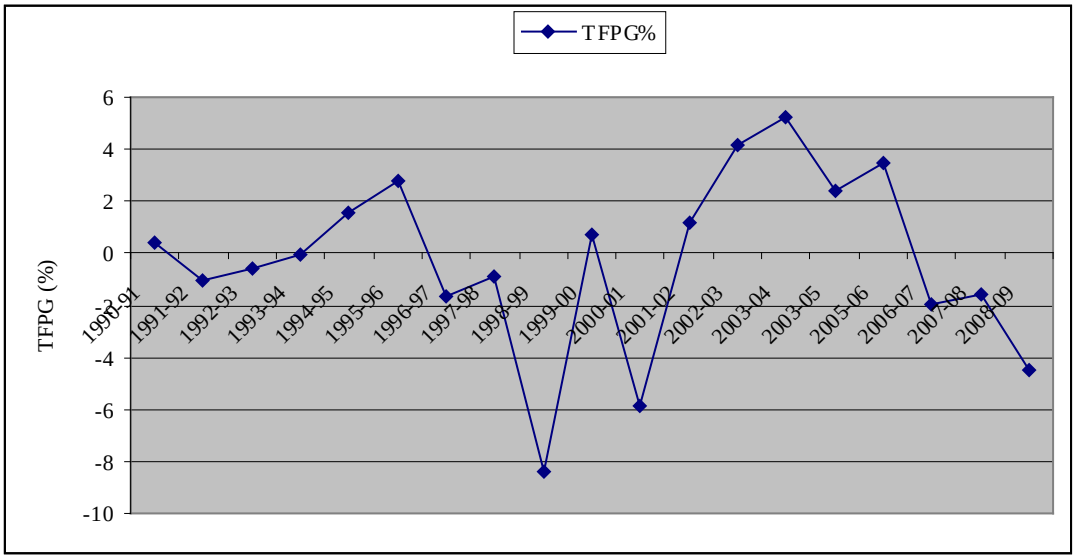


Fig: 6.3.3.2

Total Factor Productivity Growth (TFPG) in Indian Automobile Industry: 1990-2009



6.3.4. Trend Growth Rate in TFP

We explore the issue of the effect of liberalisation on the productivity growth in the Indian automobile manufacturing sector. It also makes the comparison of trend growth rate of TFP estimates before and after the 1991economic reforms. In order to test for change in TFPG over time, a TFP index is constructed from the yearly growth rates in TFP. Trend growth in total factor productivity (TFP) is unobserved. TFPG[15] mentioned in the proceeding section gives annual growth rates, which exhibit the year to year fluctuations. The trend growth rate is estimated from a semi-log equation. In order to arrive at a trend growth rate over the study period, the following relationship is estimated.

$$\ln TFP = \alpha + \beta t + \varepsilon t$$

Where, β is the coefficient of the trend growth. Where t represents time and e is the error term. The estimates of trend growth rate of TFP in Indian automobile sector are presented in Table 6.3.4.1.

Table 6.3.4.1

Trend Growth Rate in TFP

	Post-liberalisation period		Entire period	
Parameters	Estimates	t statistic	Estimates	t statistic
α	-0.114	5.11*	-0.032	2.47**
β	-0.001	1.21	-0.004	6.39*

Notes: Figures in the parentheses indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %.

Table 6.4.3.1 presents results on semi-log trend equation. The estimated trend growth rates in entire reform period and as well as post-reform periods are presented here. It shows the growth trends of TFP estimates of automobile industry. Over the entire period, 1973-74 to 2008-09, the estimated growth rate of TFP estimates of automobile sector is negative (-0.4 percent). The coefficient of TFP estimates is negative and highly significant over the period of study. The results suggest that the Indian automobile industry shows negative

[15] This expresses the TFPG as the difference between growth rate of output and weighted average of growth rates of inputs. The index derived above is also known as Divisia-Tornquist approximation. Net Value Added has been taken as the measure of output. To neutralise the effect of inflation, output data has been deflated by WPI for Motor Vehicles at 1993-94 prices. Net Fixed Capital has been deflated by WPI for Machinery and Equipments at 1993-94 prices.

productivity growth on TFP account over the period of time. Turning to the post-reform period the coefficient of TFP estimates is negative and not statistically significant.

6.4. Parametric Estimation of Total Factor Productivity Growth

Parametric approach consists in econometric estimation of production functions to infer contributions of different factors and of an autonomous increase in production over time, independent of inputs. This latter increase, which is a shift over time in the production function, can be more properly identified as technological progress. It is one of the factors underlying productivity growth. Below we give some commonly used specifications of production functions.

$$V_t = AL^{\alpha}K^{\beta} \tag{6.4.1}$$

Equation (6.4.1) does not measure the technical progress over a period of time i.e., increases in output which occur because of shifts in the production function resulting from technical progress. To introduce the aspect of technical progress, we assume,

$$A(t) = Ae^{\lambda t} \tag{6.4.2}$$

where A and λ are constant. Combining (6.4.1) and (6.4.2) we can write,

$$V_t = Ae^{\lambda t}L_t^{\alpha}K_t^{\beta} \tag{6.4.3}$$

Where, V, L, K and t refer to value added, labour, capital and time. α and β give factor shares respectively for labour and capital. A_0 describes initial conditions. Technological change takes place at a constant rate λ. It is assumed to be disembodied and Hicks-neutral, so that when there is a shift in the production function, K/L ratio remains unchanged at constant prices. A is simply the value of A(t) at time t=0. Partially differentiating (6.4.3) with respect to 't' yields,

$$\frac{\partial V_t}{\partial_t} = \lambda \cdot V_t$$

or

$$\frac{\partial V_t}{\partial_t} / V_t = \lambda$$

Thus λ measures the proportionate change in output per time period when input levels are held constant. It is therefore the proportionate change in output that occurs because of

technical progress. Transformation may be obtained by taking log of equation (6.4.3) which becomes,

$$\log V = a + \alpha \log L + \beta \log K + \lambda t \qquad (6.4.4)$$

The estimated value of λ provides a measure of technological progress, which is often identified with total factor productivity growth. Where A may be regarded as an efficiency parameter and coefficients α and β measure the partial elasticities of output with respect to labour and capital respectively. Further, the sum of α and β gives the information about returns to scale, that is, response of output to proportionate change in the inputs. α and β also represent the factor shares of the respective inputs.[16]

The literature on production function is replete with discussion on the measurement of variables which go into the Cobb-Douglas production function. The regression equation given above has been estimated by the ordinary least squares (OLS) method. Table 3 presents the results of regression analysis which is given below. Using the time series data from 1973-1974 to 2008-09 for automobile sector the equation (6.4.4) is estimated. Least squares regression of log output (value added) on a constant and the logarithm of labour and capital produce parameter estimates of a Cobb-Douglas production function. Knight et al. (1993) believe that technological improvements are often absorbed into the domestic economy via imported capital goods, and that efficiency of the productive sector is influenced largely by the level of government investment in the economy. For these reasons, they consider inclusion of openness and government variables crucial in the empirical analysis of economic growth.[17] In this study, we have brought the policy variables, which are represented by one dummy variables as exogenously determined and allowed the value added endogenous variable. In this study, we have taken one policy dummy variable which denotes the slope dummy variable obtained by multiplying the dummy factor [0 for all observations of total factor productivity prior to pre liberalisation (1975-1990) and 1 for the post liberalisation (1991-2009] by the respective variable. The study has included only one dummy variable i.e for post liberalisation impact of total

[16] S. Fabricant, (1973), "*A premier on productivity*", Prentice Hall of India, New Delhi.

[17] M. Knight; N. Loayza and D. Villanueva (1993). "Testing the Neo-classical Theory of Economic Growth", *IMF Staff Papers,* Vol. 40, No. 3, pp. 512-541.

factor productivity growth on output growth in the framework. The following table provides the regression results of our estimating a Cobb-Douglas production function.

Table 6.4.1

OLS Results of Production Function
Dependent Variable: Output Growth (Value Added)

Variables	Coefficient	Standard Error
Constant	-1.05 (0.90)	1.16
λ (Technical Progress)	-0.01 (4.72)*	0.01
Fixed capital (FC)	0.63 (4.12)*	0.15
Labour (L)	0.59(3.42)*	0.17
D1	-0.15(1.67)***	0.09
AR(1)	0.62 (3.27.)*	0.18
R^2	90	
Adjusted R^2	0.88	
D.W. Statistics	1.82	

Notes: Figures in the parentheses indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %.

The estimate of the production function given in equation (6.6.4) above is presented in table 6.4.1. The regression results clearly show a significant negative relationship between output growth and TFP growth. λ measures the technical progress over the period of time i.e., increases in output which occurs because of shifts in the production function resulting from technical progress. Thus λ measures the proportionate change in output per time period when input levels are held constant. The coefficient of technical progress is negative and statistically significant at 1 percent level over the time period. The coefficient of the dummy variable for the post- liberalisation period is found to be negative, but statistically significant at 10 percent level. This variable is expected to capture the effect of liberalisation on TFPG in the post liberalisation phase. It suggests that the TFPG contributes negatively to the output growth during the post-liberalisation period.

From table 6.4.1 we see that in the automobile sector for the period 1974-2008 the output elasticities of labour and capital were 0.59 and 0.63 respectively. In other words, over the period of study, holding the capital input constant, a one percent increase in the labour

input led on the average to about a 0.59 percent increase in the output. Similarly, holding the labour input constant, a one percentage increase in the capital input led on the average to about a 0.63 percent decrease in the output. The coefficient of the capital is positive and statistically significant at the one per cent level. The coefficient of labour is positive statistically significant at the one per cent level. The results show significant positive relationship between output growth and input growth (labour and capital). From a purely statistical viewpoint, the estimated regression line fits the data quite well. The R^2 value of 0.84 means that about 84 percent of the variation in the output is explained by the labour and capital and technical progress. Thus the estimated function shows that value added is more responsive to labour and capital.

The sources of output growth are decomposed into two components: a component that is accounted for by the increase in factors of production and a component that is not accounted for by the increase in factors of production which is the residual after calculating the first component. The latter component actually represents the contribution of TFP growth. Therefore, it is true that increase in factor input is responsible for observed output growth and TFP contribution plays negligible role in enhancing output growth. Therefore, growth in Indian automobile industry was fundamentally dominated by factor accumulation resulting input-driven growth. The automobile industry whose industrial structures depends heavily on manufacturing activities and have higher capital-to-output ratios will generally tend to have lower rates of TFPG. TFPG is regressed on K /Y and GO (growth in GVA) and the relationship is shown in table 6.4.2:

Table 6.4.2

Regression Results on the Relationship between TFPG and K/Y and Growth of Value Added

Dependent Variable: Total Factor Productivity Growth

Variables	Coefficient	Standard Error
Constant	-0.955 (6.975)*	0.136
Growth in Value Added (GO)	0.057 (8.99)*	0.006
D (K/Y)	-0.191 (4.92)*	0.038
R^2	0.94	
Adjusted R^2	0.93	
D.W. Statistics	1.80	

Notes: Figures in the parentheses indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %.

The regression result suggests a negative and statistically significant relationship between TFPG and K/Y which implies that the low TFPG rate is correlated with high capital-to-output ratio and vice versa and relationship between TFPG and growth of value added is (GO) is found to be statistically significant. Capital output ratio has significantly negative impact on total factor productivity growth.

6.5. Determinants of TFP Growth

We discuss briefly to the analysis that of identifying the determinants of productivity growth in India and estimating their impact. Here, industry specific import or export penetration ratio as a measure of openness, effective exchange rate, inflation rate etc. are used as explicit measure of economic liberalisation. The real exchange rate is assumed to reflect the degree of import protection as well as the conventional elements of over/under valuation. We believe that this variable captures the effective protection to Indian industry/ restriction on access to technology better than independent indices of tariff rate and QRs, because of the complex mix of import controls, quantity restrictions and tariffs that prevailed in India. Investment in machinery captures the effect of embodied technological change emphasised by De Long and Summers (1991[18], 1992[19]). The basic empirical framework employed in this study is based on a simple model of TFP:

$$TFP_t = \alpha + X_{it}\beta + u_t \qquad (6.5.1)$$

where TFP refers to total factor productivity growth. X_i refers to the vector of determinants of TFP and u_t is the error term. In order to understand the impact of liberalisation on TFPG more precisely, the above equation is elaborated as follows:

$$TFPG = \alpha_1 + \beta_1 GO + \beta_2 REER + \beta_3 INFL + \beta_4 IFM + \beta_5 TOT + \beta_6 DUMLIB + u_t \quad (6.5.2)$$

TFPG refers to total factor productivity growth. GO refers to the growth of output. REER is the real effective exchange rate of Indian rupee with base year 1933-94=100 and

[18] J. Bradford DeLong and Lawrence Summers (1991), "Equipment Investment and Economic Growth" ,*Quarterly Journal of Economics*, Vol. 106, pp. 445-502.

[19] J Bradford DeLong and Lawrence Summers (1992), "Equipment Investment and Economic Growth: How Strong is the Nexus", *Brooking Papeers in Economic Activity*, Vol. 2, pp. 157-99.

inflation is defined as the change in the change in the consumer price index that are taken from the Hand Book of Statistics on Indian Economy. Terms of trade implies volume index of imports expressed as percentage of volume index of exports also collected from the Hand Book of Statistics on Indian Economy. IFM is the ratio of recent investment in fixed machinery (used as proxy of technology acquisition) to the existing fixed capital stock. DUMLIB is the dummy variable of the post liberalisation period (taking value one for 1991- 92 and onward and zero for earlier years). Table 6.5.1 presents the results of regression analysis.

Table 6.5.1
Regression Results on Determinants of Productivity Growth
Dependent Variable: TFPG

Determinants	Coefficient	Std. Error
C (Constant)	2.786 (1.79)***	1.556
G	0.081 (26.70)*	0.003
REER	-0.011(1.37)	0.008
INFL	0.018 (1.07)	0.017
IFM	-0.0791 (5.45)*	0.014
TOT	-0.018 (2.18)*	0.008
DUMLIB	-0.666 (2.01)**	0.331
AR(1)	-0.358 (1.81)***	0.197
R2	0.961	
D.W. Stat	1.985	

Notes: Figures in the parentheses indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %.
TFPG: Total Factor Productivity Growth; GO: Growth rate of output; REER: real effective exchange rate; INFL: Inflation; IFM: Investment in Fixed Machinery (used as proxy of technology acquisition); TOT: Terms of trade; DUMLIB= dummy variable for post-reform period.

Table 6.5.1 presents the results of regression analysis of determinants of TFPG. The regression results clearly show a significant positive relationship between output growth and TFP growth. The coefficient of the output growth is positive and highly statistically significant at the one per cent level in this equation. The estimated elasticity of TFP growth with respect to output growth is about 0.08. The coefficient of real effective exchange rate (REER) is found to be negative. It is not statistically significant. Real effective exchange rate has a negative impact on productivity growth as is expected. The real exchange rate depreciated thereafter till the mid 1980's. In the 1980s the depreciating real exchange rate

along with falling capital goods prices resulted in accelerating TFPG. Compared to the 1980s the depreciation in the real exchange rate during the 1990s has been minimal and this is one of the reasons for the plateauing of TFPG. It is indicative that decrease in real effective exchange rate should increase the demand for traded industries output by stimulating export via-a vis enhance TFP growth. This is so because a depreciation of exchange rate (a decline in REER) will counter the effects of tariff reduction.

Investment in machinery captures the effect of embodied technological change emphasised by De Long and Summers (1991, 1992). Consequently the share of machinery in fixed investment has risen constantly during the market reform period, even though it has plateaued out since the late 1990s. As technology embodied in new machinery and equipment is an important determinant of productivity, this has played a significant role in the recovery of TFPG during the 1980s. Growth in investment in fixed machinery has significant negative impact on total factor productivity growth. IFM is the ratio of recent investment in fixed machinery (used as proxy of technology acquisition) to the existing fixed capital stock. The coefficient of the investment ratio is found to be negative and statistically significant at the one per cent level. A negative relationship of this variable with TFP growth is expected, because the higher the share of recently made investments in capital stock, the greater should be the adverse effect of on productivity. Consequent to the introduction of policy reforms, there is an excess of investment as many investors try to test the market and establish themselves. This can lead to excess investment and a decline in capacity utilisation, which will show up as a decline in measured TFPG growth in the sector. An improvement in the investment climate and reduction in investment risk will lead to a step jump in investment from the old constrained equilibrium to the new free equilibrium.

Role of inflation in growth is controversial among theorists and policy makers on several occasions which are beyond the scope of our study. We have used inflation as a determinant in the model to capture the stability of the economy which is hypothesized as necessary for TFP growth. Developing economies signal the impact of money illusion which is why inflation is needed to be included as macro-economic determinant of TFP growth. It is a fact that inflation adds to economic growth by generating employment in a

sense that the positive relation of inflation and TFP can be expected. But, our result shows that it holds statistically insignificant. The coefficient of the dummy variable for the post-liberalisation period (DUMLIB) is found to be negative, but statistically significant. This variable is expected to capture the net effect of all factors connected with economic reforms other than those directly included in the equation. Any differences between the pre- and post reform periods unconnected with the reforms also get reflected in the coefficient of DUMLIB. Since a statistically significant coefficient is found, it may be inferred that these group of factors did not on balance have an adverse effect on productivity growth in Indian automobile manufacturing.

6.6. Summary

This chapter is an attempt to study the impact of liberalisation and economic reforms on the productivity performance in automobile industry. The liberalisation process was to expose firms to international competition and force them to introduce new methods of production, import quality inputs, capital equipment or technology and compel them to improve their efficiency. This study is an analytical-descriptive account of the existing studies on productivity and technical change. This study discusses an analytical framework and tests empirically whether liberalisation reforms since 1991-2009 improve productivity growth in Indian automobile industry. This study seeks to measure productivity performance of the Indian automobile industry in terms of total factor productivity growth for the entire period, 1975 to 2009. Therefore, this study is an attempt to measure the total factor productivity growth and assesses the impact of liberalisation on TFPG to have a clear insight into whether liberalisation has significantly contributed to TFPG. It is important to note that this study has considered the gross value added (GVA) instead of the value of gross output because the use of GVA avoids the effects of variations in the quality of raw materials. The growth accounting method implicitly assumes a well behaved neoclassical production function that facilitates the decomposition of the sources of growth. The TFP in the growth accounting method is the residual between the growth in GVA and the weighted sum of the growth of the primary factors of production i.e. labour and capital. The most important dynamic gains have come from removal of extreme policy

distortions in the forms of bans, controls and restrictions on production, Investment and import of capital and intermediate goods (including raw materials).

Based on the findings of this study on TFP growth in Indian manufacturing as well as the evidence presented in this chapter, it seems it would be right to conclude that there has been an increasee, not decrease, in the growth rate of TFP in Indian automobile manufacturing in the post-reform period. This means, however, that reforms have a favorable effect on industrial productivity. The sluggish growth or negative growth of TFPG in Indian automobile industry during pre-liberalisation period is mainly attributable to the restrictive trade policies though several other growth constraining factors might be playing some roles. The results of this study suggest that specific policies should be implemented in order to improve efficiency as well as technical progress, thus ultimately facilitating long-run productivity growth. The economic reforms of 1991 were helpful to most industries by increasing access to foreign technology and cheaper capital goods & raw materials. The relationship is different not only with respect to sign condition but also to the extent to which the factors can influence TFPG. All the observations, in turn, place the need for formulating industry-specific policies for enhancing total factor productivity growth of Indian automobile sector.

As India's economy still remains highly protected compared to other large developing economies establishing this link may have important implications for future trade reforms and growth prospects. Specifically the appropriate relationship between trade-related factors and factor productivity is very important in the context of recent policies of reforms. The need for undertaking industry-specific policies for promoting productivity growth is thus highlighted. AMP is a long term road map to promote the industry's growth. Emphasis on R&D activities is one of the main focus of 'auto policy and appears to have long-term implications for industry growth. It can be suggested that there is a need to promote R&D efforts in the Indian manufacturing sector. So that it may survive in the newly emerging era of globalisation and liberalisation. For sustained output growth, TFP growth is essential and therefore, TFP growth became synonymous with long-term growth as it reflects the potential for growth. The measure of TFP essentially refers to improvements in technology and efficiency. In terms of future applied research directions

on Indian context, the plant level data sets would be more informative in decision-making process.

Chapter VII

Summary and Conclusion

Chapter VII

Summary and Conclusion

7.1. Introduction

The overall effect of liberalisation reforms represented a fundamental change in India's development policy. The market reforms that appear to have had the strongest dynamic effects in India are those relating to production, investment and external controls. These are best understood through the prism of competition. The eighties were characterised by both a gradual reduction in quantitative restrictions and increase in tariffs. The nineties in contrast were marked by a broad array of reforms the effects of, which on aggregate growth were much more gradual. The scope and content of the reforms was much wider than in the eighties.

The liberalisation with regard to foreign investment had a significant influence on the Indian automotive industry. The foreign investment inducted into the industry transformed its dynamics. With a vision of establishing a globally competitive automotive industry in India and doubling its contribution to the economy by 2010, the Ministry of Industry presented for the first time a separate auto policy document in March 2002. Auto policy-2002 aims to promote integrated, phased, enduring and self-sustained growth of the Indian automotive industry. Further to this Indian government came with Automotive Mission Plan (2006-2016) to promote and grow the automotive sector with a mission of making auto sector to contribute to the Indian economy and globally competitive. This policy recognizes the need to provide direction to the growth and development of the automotive industry. This study is intended to check the relationship between the policy and growth of Indian automobile industry. This study considers several aspects of industry development, such as size, structure, investment, growth, performance, product variety, product quality, technology base, R&D, imports, exports and so on to comment upon the development of industry. The analysis of study has been carried out during the period 1990-1991 to 2008-2009 to explain the interface between policy, structure and growth of Indian automobile industry. The current structure of the industry is the result of a long process of structural

change. The thesis consists of seven chapters including the introduction and the present chapter.

The first chapter deals with introduction to the thesis, objectives, hypotheses, research questions, research gaps, importance and relevance of the study that contributed to knowledge. The introduction chapter has brought the researchable issues and presented the objectives of the study. This chapter highlights the importance of studying the liberalisation, growth and competition of Indian automobile sector. Objectives of this study and methodology adopted are also discussed.

The second chapter discusses theoretical framework and reviews the relevant literature for major studies on liberalisation, growth performance and productivity growth and technical change of industry. It deals with literature review revealing research gaps traced for the purpose of fulfillment of the study's objectives. It gives an overview and review of government policies on development of industry. It also studies about the determinants dealing with growth and profitability analysis of Indian automobile industry. This chapter considers the role of the automobile industry in the current cycle. It describes the previous evidences on structure of industry, market structure and liberalisation and growth performance of Indian automobile industry. We point that the substantial body of theoretical and empirical studies have examined the relative persistence of contemporaneous on various factors. Income and price are the major variables determining the demand for automobiles. It is crucial to state that the target of the Indian automobile industry is domestic demand. The impact of the determinants on growth has not remained constant over the years but has changed during the process of liberalisation. The role of technology depends on the technological regime in which the firm operates. In a licensed regime, firms with foreign equity grow faster because of better access to resources and technology. In a deregulated regime, import of capital goods has been the technology-related variable that triggered growth. In a liberal regime, growth is positively influenced by the intra-firm technology transfer. Technology factors to play a crucial role in determining the growth of firms. Thus growth is mainly technology driven. Liberalisation of foreign investment has increased competition through the entry of foreign firms into the domestic market. Competitiveness in a de-regulated regime would, however, depend upon the ability of the firm to bring about technological paradigm shifts. New firms which

depended on intra-firm transfer of technology and firms with in-house R&D efforts, to accomplish paradigm shifts, appear more successful. Further, in a liberal regime, advantages of vertical integration over sub-contracting also appear to be important in the determination of competitiveness. The reforms of the '80s' reforms focused on increasing profitability of the existing firms by easing capacity restriction and reducing corporate taxes among other things. The reforms of 90s allowed more competition and paved a way for entry of new domestic firms and MNCs in Indian industries. Technological change can be influenced by a country's openness to trade. Productivity growth appears to be directly linked with production of tradable goods. Although there exists voluminous empirical research work regarding nexus between trade liberalisation and factor productivity growth, overviews on the link between liberalisation and total factor productivity growth (TFPG) find inadequate evidence on this issue; it is important issue and debates are still unsettled.

The third chapter provides basic concepts related to the studies and models dealing with structure of the industry, productivity, market size, growth and profitability. Details regarding the theoretical framework and methodology are provided in chapter. It discusses the theoretical model and describes the estimation procedure. This concerns consumer demand theory, growth, competitive analysis, and forecasting to understand trends in the automobile industry. It follows Bresnahan's (1987) hypothesis that supply-side factors must have been responsible for the unusual pattern. The demand for automobiles is modeled from a discrete choice framework of consumer. In Bresnahan's model, consumers are differentiated over a continuous (one-dimensional) scale of preferences for car quality. This chapter focuses on the methods of automobile demand estimation to analyse the factors that influence it. The structure of demand links the evolution of individual firm's activities and capabilities with the evolution of competition. The variables that capture the extent of market competition-related indices in each product market are market shares and Herfindahl indices which are being used in the present study. Market imperfections are typically examined by using the Hirschman-Herfindahl index (HHI). The Herfindahl index, also known as Herfindahl-Hirschman Index or HHI, is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. For given market demand conditions, the neoclassical expectation is that a higher market share (M) yields the firm higher profitability. Firms differ widely with respect to size, structure,

production activity and specialization under different objectives such as survival, growth, stability and profit maximization. Tobin's q is less commonly used as a measure of performance than either a rate of return or a price cost margin. Various productivity measures can be computed, depending on treating of inputs and outputs. Total factor (or mullti-factor) productivity ratios are computed in terms of value-added approach. Here, two major approaches are used to measure TFP i.e. growth accounting approach and production function approach. Total factor productivity (TFP) in this study has been measured by using three different methods such as of Kendrick index, Solow index and Divisia index.

The fourth chapter examines the impact of economic liberaliation since 1991in terms of performances of firms in Indian automobile industry. Indian automobile industry is the main beneficiary of the liberalisation process. Another most prominent policy is the 'auto policy'. The auto policy has spelt out the direction of growth for the auto sector in India and addresses most concerns of the automobile sector, including promotion of R&D, alternative fuel vehicles through appropriate long term fiscal structure and low emission fuel auto technologies and availability of appropriate auto fuels. This chapter is intended to check the relationship between the liberalisation policy and growth of Indian automobile industry.

The automotive industry in India has witnessed an impressive growth since the country's economic liberalisation. The Indian automotive industry has been growing strongly over the last decade. All vehicle segments of Indian automobile industry have registered impressive growth. The production of passenger vehicle and commercial vehicle segment's size are 1839 and 417 thousand units in 2008-2009. The production of automobiles is declining trend in 2008-2009. It is recovered in 2009-2010. Overall, the entire period, 1990-1991 to 2008-2009, the estimated growth rate of commercial vehicles output is 3.1 percent and the estimated growth rate of passenger vehicle output is 5.4 percent. The long term growth prospects for the industry remain closely linked to the development of road infrastructure, growth in gross domestic product (GDP) and industrial production. The industry follows the path by which these two goes and good performance of GDP and IIP results in higher demand for CVs. The automobile vehicles production are increasing at a faster rate during the 'auto policy' period (2002-2009) compared to its liberalisation

period. But the growth of production of these whole vehicle segments from 2007 to 2009 looks declining trend. So the growth of the whole automobile industry is negative in 2007-2008 and positive in 2009 onwards. Capacity utilization of all automobile companies is also declining during the same period. The production activity is likely to be impacted in the year 2008-09 also due to slowdown in demand and associated challenges in domestic and international markets. However in spite of such credentials, the commercial vehicles segment has probably grown at the most sedate pace since the delicensing of Indian auto industry in 1991. The demand for passenger vehicles is growing. The Indian automotive industry is dominated by two-wheelers.

Domestic sales of automobiles in India have followed an increasing trend over the past few years, except a marginal dip in sales in the year 2007-08. Both Ashok Leyland and Tata Motor operate in the heavy commercial vehicles segment of the automobile industry and have long experience of being in this business. Similarly, Maruti Suzuki and Mahindra and Mahindra operate in the passenger cars and utility vehicles segments and have long experience of being in this business. The growth rate of Hindustan Motor is negative and its variability is very large. Because it is a very old firm and continues in the same product line.

Other major concerns are higher domestic inflation and increases in fuel prices have a negative impact on demand for automobiles. Wholesale price of automobiles was almost identical to the WPI of all commodities, till 1996-97. Since 1996-97, WPI of all commodities have risen at a lower rate than that of automobiles, and the gap between these two WPIs have become conspicuously wide by 2007-08. After 2000-01, WPIs of trucks and buses have been rising at a higher rate than cars and motorcycles but at a lower rate than the index for all commodities.

The factors contributing to the increased demand of automobiles are price index of automobiles, fuel price, interest rate and gdp percapita. In order to examine the impact of these factors, the analysis of demand determinants of growth has been carried out during the time period (1991-92 to 2008-09). The regression results find that the price of fuel is not the main factor in commercial vehicle sector (CVs). But the price of fuel is the main factor in passenger vehicle sector (PVs) influencing auto demand in India. The lending rate and income is the prime determinant influencing the automobile demand in India.

Automobiles led to strong demand due to signs of revival in economy and increasing trend in hiring especially in IT sector and cheaper bank credit. This work examines the correlation between the hike in fuel prices, lending rate, and GDP per capita with India's automobile sales. The error correction model results find that there is a long term relationship between sales growth and gross domestic product per capita. The error correction term in the estimated equation is highly significant and has correct sign. In the long-term, sales growth depends on GDP per capita. In addition, the results also show that the changes in fuel price and the rate of interest are significantly negative impact on both PVs and CVs sales growth in the short run.

Consequent to liberalissation, the arrival of new and contemporary models, easy availability of finance at low rate of interest with comfortable repayment options, and price discounts offered by the dealers and manufacturers appear to have stimulated the demand for vehicles and consequently growth of the industry. The Indian automobile industry is going through a phase of rapid change and high growth. The prime objective of this study is to examine the effect of technology acquisition on the growth and development of Indian automobile Industry. In order to examine the impact of entry and transfer of new technology, the analysis of determinants of growth has been carried out during two policy periods namely liberalisation policy, (1991-92 to 2000-01) and 'auto policy (2001-02 to 2008-09). This study uses the fixed effect model to analyse the determinants of growth function. The fixed effect results broadly indicate that technological factors play an important role in determining the growth of firms in this industry.

During the liberalisation regime, import of capital goods (IMCAP) and disembodied technology (IMTECH) influence growth positively. Technology embodied in new machinery and equipment, and technology disembodied in lumpsum and royalty payments are important determinant for growth. R&D influences negatively. During the liberalisation period, most firms show quite declining trend in terms of R&D intensities. Indian automobile companies spend a very low amount on R&D. Most companies spend a part of their sales, less than 1%, on R&D. Thus, their R&D intensities (R&D spending as a percentage of total sales) declined. We find that the R&D expenditures vary with firm size. Therefore, the effect of R&D expenditures on firm growth varies with firm size. R&D activity, according to this study, appears to have long-term implications for growth.

Investment in machinery captures the effect of embodied technological change which is visible from 1991-92 onwards. Consequently the share of machinery in fixed investment has risen constantly during the market reform period. The important policy decision was the relaxation of imports of capital goods and technology. Availability of imported capital goods improves access to embodied technology and thus provides the means to compete. Auto policies, however, seems to have changed the role played by these technological factors. IMCAP emerged significant with a positive sign. The import of disembodied technology influences growth negatively. FE influences growth positively. In both these regimes, technological factors play an important role in determining the growth of firms in this industry. Thus growth is mainly technology driven. The level of technology change is high. The rate of change in technology is medium. Investment in technology by producers has been on the rise. Overall, Liberalisation in economic policies, however, seems to have changed the role played by these technological factors. The nature and direction of the effect of technology variables are governed largely by the technological regime in which a firm operates.

The results also confirm a positive relationship between profits and growth. Profit influences growth positively. The profitability of automobile manufacturers has been rising over the years, mainly due to rising demand and growth of Indian middle class. Capital intensity has also turned out to be significant with negative coefficient in liberalisation regime. It influences growth negatively. Capital intensity has also turned out to be significant with positive coefficient in auto policy regime. The relationship between growth and vertical integration (VI) is negative and significant during the liberalisation policy regime and positive and significant during auto policy regime. The relationship between age of the firm and growth is negative and not statistically significant during liberalisation regime. But age of the firm emerged significant with a negative sign during auto policy regime.

The goal of the firm is to cause its sales to grow as rapidly as possible subject to the constraints imposed by the growth of demand, growth of capacity and the availability of finance for investment. Profit is an important indicator of the financial performance of an industry. The value of Tobin's q has remained more than unity throughout the period of all the companies. Overall, the values of Tobin' q shows a rising trend for all companies.

During liberalisation regime, the results of fixed effect model suggest that profitability (as measured by Tobin's q) in the automobile sector tended to improve with diversification and age of the firm. But profitability tends to decline with size of the firm and capacity utilisation. The age factor is found very important. Thus profitability has mainly increased through experience of the older firms. However, older firms might show better performance than the new firms on account of better skill and experience in the business line. However, the role of firm size in explaining profitability is a complex one and the empirical evidence in this regard is a mixed one. Therefore it is difficult to find a definite sign to the coefficient of size variable. Smaller the firm size, higher is the tendency to diversify. The criterion of risk reduction is more relevant to small/marginal firms whose risk bearing ability is very low. The converse is also true as firm size increases, i.e., large firms tend to specialise. Capacity utilisation is inversely related with profitability of firms. But, if the firm is operating at full capacity, an increase in output must be preceded by an increase in capacity resulting in lower profitability. It suggests that profitability increase in sales when there is an idle capacity, but decrease in sales when firm approached full capacity. During the auto policy regime profitability (as measured by Tobin's q as mentioned in chapter IV) in the automobile sector, tended to improve with import of technology, capacity utilization and age of the firms. But profitability tends to decline with size of the firm.

The fifth chapter examines the impact of liberalisation policy started in India since 1991 and competitiveness of Indian automobile firms. In this chapter, we analysed various aspects of the domestic-market competitiveness of the chosen firms. Market share is one of the relevant indicators of competitiveness. Profit ratios and productivity ratios have been recognised as the main indicators of competitiveness of financial performance of firms. Indian automobile industry has been registering a healthy positive growth in terms of its production and sales as well over the period of study. But, both production and sales have registered negative growth rate (2.11% and 4.63%) in 2007-2008. It shows the domestic sales, industry volumes and export performance from the year 1999-00 to 2008-09 are increasing on a steady rate. Export of production has also increased over the period of study. If we look all the three parameters, viz., production, domestic sales and exports, they have registered a continuous growth in the last few years, except the year 2007-08.

India's production of passenger cars and commercial vehicles reached a new record and spread globally of 29.8 percent in 2002-03, 30.1 percent in 2003-04 and 24 percent in 2005-06. The automobile industry was affected by the economic downturn. Car sales declined markedly in almost all OECD countries, from 2007 to January 2008. Markets are close to saturation in many advanced economies. Trend car sales are increasing at a rapid pace in China and India. As a result, the Indian government has paid special attention to the investment and growth within the industry.

Looking for market structure, the firms like Tata motor and Ashok Leyland are the dominant firms in Indian Commercial vehicle industry. Market share is one of the relevant indicators of competitiveness. Tata Motors is the largest medium and heavy commercial vehicle manufacturer. In commercial vehicle Market, Tata Motors secured over 70% of the Indian commercial vehicle market. Ashok Leyland dominates over 21% market share of Indian CV market. But the market concentration is higher over the period that leads less competitive the behaviour of firms. Less competitive behaviour of firms results more market power (i.e., lower social efficiency). The commercial vehicle industry is still highly rivalrous oligopoly. Similarly for market structure, the overall market shares of Indian passenger vehicle firms are declining and joint venture of foreign firms are increasing over the period of time. In PVs sector, the firms like Mahindra and Mahindra and Maruti Suzuki India are the leading firms in Indian passenger vehicle industry. The market concentration of PVs is declining over the period that leads higher competitive the behaviour of firms and results decline in market power. The market for automotive vehicles in India, which had earlier been virtually a seller's market, was transformed into a buyer's market. The commercial vehicle industry is more concentrated industry than passenger vehicle industry. This study attempts to analyse the factors that brought about this change in the market share during two policy regimes, 'liberalisation policy' (1991-92 to 2000-01) and 'auto policy-2002' (2001-02 to 2008-09). The study uses fixed effect model to analyse the determinants of competitiveness in the dependent variable, namely, the rate of change in market share. The fixed effect results find that major variables capturing technological paradigm and trajectory shifts emerged very important in the determination of competitiveness. As hypothesised, the difference in the role played by technology variables between the two policy regimes is also well highlighted by the results. In the liberalisation

phase, the results supported the view that the firm size and import of capital goods (MKI) are very significant in determining the growth rate of market share. Import of disembodied technology (LRI) emerged insignificant with a negative coefficient. But product improvements through the import of components (MCI) and skill content of the work-force have influenced negatively on growth rate of market share. With liberalisation one would expect the imports of components to rise. However, the role of components import in determining the competitiveness of firms need not increase. Accumulation of technological capabilities through learning by doing is also facilitated by the skilled manpower employed in a firm. Labour laws adversely impact competitiveness despite being a low labour cost economy. R & D activity and foreign equity (FE) emerged insignificant with positive coefficients. They influence growth of market share positively. Most companies spend a part of their sales, less than 1%, on R&D. R&D turned out insignificant because it, on its own, would also be inadequate to bring about trajectory shifts. This result supports the contention that in a more liberal regime firms would prefer to import technologies to accomplish paradigm shifts.

During auto policy period, the firm size, import of capital goods, and import components have significantly positive impact on growth rate of market share. During the auto policy regime, the firm size, the import of capital goods, and import of components emerged very important in the determination of rate of change in market share of firms in the automobile industry. R & D activity emerged insignificant with negative coefficient. It influences growth of market share negatively. R&D activity, according to this study, appears to have long-term implications for growth. Although the R and D activity of some of these firms have also gone up during this period, it may still not be adequate enough to result in improving the growth prospects. Product improvements through imports of components turned out to be a very important factor in the determination of RMS in the 'auto policy' phase. Therefore, policy efforts to encourage R&D and some concentration of size of the domestic firms in the industry may be more desirable.

Firm size comes up with a positively significant for the liberalisation period and negatively significant during auto policy period. Age of the firm turned out to be positively significant during liberalistion policy regime and negatively significant during auto policy regime. Vertical integration emerged positive coefficient and not significant in the determination of

RMS during the liberalisation period. Vertical integration is negatively significant during auto policy regime. Market share often is associated with profitability and thus many firms seek to increase their sales relative to competitors.

Profitability is another relevant indicator of competitiveness. The firms like Mahindra and Mahindra, Ashok Leyland, Tata Motor, and Maruti Suzuki have clearly managed to have substantially lower variations in its profit ratios during liberalisation period from 1991-1992 to 2008-2009. Overall, Mahindra and Mahindra Company is seen to be the most profitable company among the entire passenger and as well as commercial vehicle firms due to the relative steadiness of the utility vehicles market, Mahindra and Mahindra's dominant product line. The firms like Force Motor, Hindustan Motor, and Swaraj Mazda have large variations in its profit ratios during the same period.

The sixth chapter seeks to measure productivity performance in terms of total factor productivity (TFP) changes in Indian automobile industry and identifying the factors, which account for productivity changes. TFP is calculated in a growth-accounting procedure and according to a traditional Solow (1957) Cobb-Douglas function. This measure is based on the general neo-classical production function. Within this model TFP is identified as shifts in technology if certain conditions are met. It assumes constant returns to scale, Hicks-neutral technical change, competitive equilibrium and factor rewards being determined by marginal products. In the neo-classical growth accounting framework, the growth of output is the sum total of the growth of capital accumulation, growth of labour and the growth of productivity or efficiency.

Both capital productivity and labour productivity show increasing trend after economic reforms took place in July, 1991. Thus, increases in labour productivity may be due to improved efficiency and technological progress as well as more capital per unit of labour. The growth of value added, labour, and capital show increasing trend. It is seen from the TFP estimates in this study indicate a rise in the growth rate of TFP in Indian automobile manufacturing in the Post-reform period (1991-92 to 2008-09) as compared to the pre-reform period 1979-80 to 1990-91). Theoretically, favorable effects of liberalisation on TFPG of industrial productivity are supported. Based on this study on TFP growth in Indian automobile manufacturing as well as the evidence presented in this study, it seems it would be right to conclude that there has been an increasee, not decrease, in the growth

rate of TFP in Indian automobile manufacturing in the post-reform period. This means, however, that reforms have a favorable effect on industrial productivity. This means, however, that reforms have a favorable effect on industrial productivity. The sluggish growth or negative growth of TFPG in Indian automobile industry during pre-liberalisation period is mainly attributable to the restrictive trade policies though several other growth constraining factors might be playing some roles.

But the Indian automobile industry shows negative productivity growth on TFPG account over the study period. It suggests that the TFPG contributes negatively to the output growth during the post-liberalisation period. Therefore, it is true that increase in factor input is responsible for observed output growth and TFP contribution plays negligible role in enhancing output growth. It is recognised that the growth in Indian automobile industry is still fundamentally dominated by factor accumulation resulting input-driven growth rather than technical change. The regression results clearly show a significant negative relationship TFP growth and output growth.

In this study, we do not try to come up with a new interpretation of TFP. Instead, we attempt to better understand what TFP is by identifying factors that influence it. Growth in investment in fixed machinery has significant negative impact on total factor productivity growth. Technological improvements are often absorbed into the domestic economy via imported capital goods, and that efficiency of the productive sector is influenced largely by the level of government investment in the economy. For these reasons, they consider inclusion of openness and government variables crucial in the empirical analysis of economic growth. A negative relationship of this variable with TFP growth is expected, because the higher the share of recently made investments in capital stock, the greater should be the adverse effect of on productivity. Consequent to the introduction of policy reforms, there is an excess of investment as many investors try to test the market and establish themselves. This can lead to excess investment and a decline in capacity utilisation, which will show up as a decline in measured TFPG growth in the sector. The automobile industry whose industrial structures depends heavily on manufacturing activities and have higher capital-to-output ratios will generally tend to have lower rates of TFPG. Real effective exchange rate has a negative impact on productivity growth as is expected. The real exchange rate depreciated thereafter till the mid 1980's. In the 1980s

the depreciating real exchange rate along with falling capital goods prices resulted in accelerating TFPG. Compared to the 1980s the depreciation in the real exchange rate during the 1990s has been minimal and this is one of the reasons for the plateauing of TFPG. The results of this study suggest that specific policies should be implemented in order to improve efficiency as well as technical progress, thus ultimately facilitating long-run productivity growth. The economic reforms of 1991 were helpful to most industries by increasing access to foreign technology and cheaper capital goods and raw materials. The relationship is different not only with respect to sign condition but also to the extent to which the factors can influence TFPG. All the observations, in turn, place the need for formulating industry-specific policies for enhancing total factor productivity growth of Indian automobile sector. But finally, the results show significant decrease in productivity growth over the period of time. The output growth could not be enhanced by continuous input growth in the long run due to the nature of diminishing returns for input use. For sustained output growth, TFP growth is essential and therefore, TFP growth became synonymous with long-term growth as it reflects the potential for growth.

7.2. Policy Implications and Suggestions

With every major shift in policies made by the Indian government, the automotive industry has come out stronger and better. The structural reforms like delicensing of whole auto segments, abolition of the need for MRTP clearances, automatic approval for FDI up to 51% equity, droping phased manufacturing prgrammes for new and existing units and relaxation in import of capital goods and technology benefited the automotive industry over a longer term. But the short-term stabilisation measures adopted by the government to counter the crisis adversely affected the industry's growth. As an immediate short term measures to improve the country's balance-of-payments situation, the government discouraged the consumption of oil by imposing a surcharge on petroleum products. It also imposed a heavy excise duty on selling price of all the automobiles. Additionally, in order to reduce the trade deficit the rupee was devalued and the auxiliary customs duty was increased. On the other hand, the tariff structure for auto-related imports also should be reduced to bring the industry into the normal situation. The tariff rate for capital goods should go similar reductions. The excise duties on other vehicle segments should become

rationalised. On the demand side, the overall hike in fuel prices and the credit squeeze to curb the inflation stifled the demand for automobiles in the country.

The national automotive industry requires government policies at both the macroeconomic as well as microeconomic levels which promote the development of automotive production and sales. In most countries, the level of automotive production is closely correlated to domestic or regional automotive sales. Also the level of automotive sales and production is closely related to disposable income levels, interest rates and finance availability, consumer confidence and other factors influenced by macro economic policies. Production in particular often has long lead times, so consistent and predictable economic progress is important. Therefore, national macroeconomic and monetary policies which produce stability and consistency in GDP per capita growth are generally very significant factors affecting the level of automotive sales and production.

The Indian government has recently begun to play a key role in the development of the automotive industry through its collaboration with the industry in the Automotive Mission Plan (AMP). The AMP sets development goals for the automotive industry for the years 2006 to 2016. The Government of India is promoting National Automotive Testing and R&D Infrastructure Project (NATRIP) to support the growth of the auto industry in India. This policy confirms the government's intention on harmonizing the regulatory standards with the rest of the world. Indian automotive regulations are closely aligned to the ECE (Economic Commission of Europe) regulations. It has formulated an appropriate auto fuel policy to ensure availability of adequate amount of appropriate fuel to meet emission norms. AMP is a long term road map to promote the industry's growth. Emphasis on R&D activities is one of the main focus of 'Automotive policy'. It promotes large and growing domestic demand. Demand growth expected to be around 10 % CAGR making India one of the fastest growing markets. It has proven product development capabilities to develop complete vehicles and systems. Companies can leverage India's acknowledged leadership in the IT industry. Continuity in reforms and stable economic policies, India targets to emerge as the "manufacturing hub" for small cars.

We know that eventually and probably some time relatively soon, oil availability will become a problem. We know too the industry is responding to this challenge. As India's economy continues to grow at a rapid pace, the automobile industry will be a key

beneficiary. The main factors behind such growth are the increasing affluence of the average consumer, overall GDP growth, the arrival of ultra-low-cost cars, and the increasing maturity of Indian original equipment manufacturers (OEMs). However, India's path to mass motorization will be very different from that of developed countries; it must first develop the new technologies, business models, and government policies that will pave the way to increased automobile penetration. Other challenges—for example, the current global economic crisis and high commodity prices—may slow down the country in the short term, but they will not be able to stop it.

7.3. The Need for Further Research

India holds huge potential in the automobile sector owing to its technological, cost and manpower advantage. No wonder, it has become a centre of attraction for most of the global automobile players. The future of the automotive market is far from being saturated. It has tremendous scope for volume growth. India's ranking in the world motor vehicle production is not unimpressive. The future prospect of this industry both the domestic and international market would be growing at a rapid pace in terms of its products and services. According to the Society of Indian Automobile Manufacturers (SIAM), the industry currently contributes about 5% of the GDP and it is targeted to grow fivefold by 2016 and account for a geographically diversification.

It is also important to study the inflow of capital and how it influences the automobile industry. It will be interesting to know the impact of the foreign capital on the growth and employment generation of the Indian automobile industry. It is very important to compare Indian automobile industry with that of other competitive countries and to see what their advantages are in comparison with Indian industry. Employment is always a major factor when measuring the significance of any economic activity. The automotive industry, on account of its backward and forward linkages, is a significant generator of employment - both direct and indirect. The automotive industry also promises significant employment opportunities. Large number of workers, both skilled and unskilled, will be required to sustain increased level of production. Thus steps are needed to ensure that demand - supply gap, both quantitative and qualitative, in terms of human resources, does not arise.

The liberalisation process is found to have its negative impact on total factor productivity growth. Consolidation is the urgent need to achieve higher scale of operation in order to

compete efficiently in liberalized regime as well as to face global challenges. At future applied research directions on Indian context, regional level study with plant level data sets would be more informative in decision-making process.

The automotive industry with its deep backward and forward linkages in the economy has been identified by the Government of India as an important industry with a high potential to increase the share of manufacturing in gross domestic product, exports and employment (GOI 2006b). Without an automotive industry it is impossible to develop an efficient steel business, a plastics industry or a glass sector-other central foundations of economic progress. It would be helpful to analyse further on how this industry influence the other sectors of the economy in the micro and macro level.

The future challenges for Indian automobile industry in achieving the targets defined in the AMP (2006-2016). Interventions envisaged are required at two levels i.e. industry and government. This could be overcome through a long-term and stable policy regime that will support the industry to fulfil its' potential. Attaining vision 2016 for the automotive sector in India is a goal for both government and industry to strive for. Given the commitment of the government of India, and the fundamental competitiveness of the Indian automotive industry, achieving the targets defined in the 'Automotive Mission Plan' is a doable challenge.

As India's economy still remains highly protected compared to other large developing economies establishing this link between trade liberalisation and productivity growth may have important implications for future trade reforms and growth prospects. Specifically the appropriate relationship between trade-related factors and factor productivity is very important in the context of recent policies of reforms. The need for undertaking industry-specific policies for promoting productivity growth is thus highlighted. Emphasis on R&D activities is one of the main focuses of 'auto policy' and appears to have long-term implications for industry growth. It can be suggested that there is a need to promote R&D efforts in the Indian manufacturing sector. So that it may survive in the newly emerging era of globalization and liberalisation.

Indian automobile industry is still too small to influence the world market. The Indian automotive industry is still young, populated with several indigenous players, and positioned for explosive growth. The analysis above gives the optimistic view about the

industry and the overall industry shows a positive growth which recommends the investors to keep a good watch on the major players to benefit in terms of returns on their investments. The global recession has had a dampener effect on the growth of the industry, but market experts believe it is only a short term phenomenon and are confident of the industry bouncing back. It heralded the coming to age of the Indian automobile industry.

Finally and most importantly, the government policies have significantly influenced the development of India's automotive industry. Therefore, government policies shall continue to play an important role in the future development of the industry with their effect on demand and factor conditions. The need for undertaking industry-specific policies for promoting productivity growth is thus highlighted. This paper makes several important contributions to the empirical literature on liberalisation using the case of India to examine the link and causality between trade reform and productivity growth. As India's economy still remains highly protected compared to other large developing economies, establishing this link may have important implications for future trade reforms and growth prospects.

In conclusion, it is suggested that aggregate growth strategies through stimulation of domestic demand, access to global market, and investment in new emerging growth areas are required for propelling a higher growth rate. This study is one of the detail attempts to analyse the interface between liberalisation policy and its impact on growth, competition and productivity of Indian automobile industry. It contributes to the study of Indian industry by widening of the empirical analysis. It has been modified to take into account both the critiques of the early 1980s and 1990s, as well as the difference between Indian and world automobile industry. In addition, I extend this analysis towards the consideration of several aspects of firm and industry performance. Finally, we have used the source of data and extensively processed it to make this analysis possible. The data gathered and the series computed and estimated are also likely to prove useful. By analysing the current trend of industry, we can say that being a developing economy, there is a lot of scope for growth and this industry still have to cross many levels.

Appendix

Appendix

Appendix 1.1: Indian Automobile Companies

The following companies are some of the notable Indian automobile manufacturers:

1. TATA Motors: Tata Motor, formerly known as TELCO, is the largest automobile manufacturer in India and commands more than 70% of the commercial vehicle market in India and has also increased its share of passenger vehicle market. It is the leader in commercial vehicles in each segment, and among the top three in passenger vehicles with winning products in the compact, midsize car and utility vehicle segments. Tata is focusing on new technologies and innovation to drive its business in India and internationally. In Jannuary 2008, Tata Motors unveiled its People's Car, the Tata Nano, a development which signifies a first for the global automobile industry. The Tata Nano has been subsequently launched as planned, in India in March 2009. Product: Indica, Indigo, Indigo Marina, Safari, Sumo, TL, and Tata Nano.

2. ALL: Ashok Leyland has been the technology leader in India's commercial vehicle industry, moulding the country's commercial vehicle profile by introducing technologies and product ideas that have gone on to become industry norms. The Company's name changed soon with equity participation by British Leyland and Ashok Leyland commenced manufacture of commercial vehicles in 1955. Today the company is the flagship of the Hinduja group, a British - based and Indian originated transnational conglomerate. Products: 18 seater to 82 seater 7.5 tonne to 49 tonne in haulage vehicles, special application vehicles, and diesel engine for industrial, marine and genset applications.

3. FML: Force Motor, formerly Bajaj Tempo, is a Pune-based manufacturer of a number of commercial vehicles. Recently the company has firmed up a joint venture with MAN AG of Germany. Products: Gas-cylinder carrier, copied from 3-wheel Vidal & Sohn Tempo-Werke (German) Hanseat; Matador, a version of Hanomag van and light-truck (1.5 tonne payload); Tempo-traveller, Indian version of Daimler-Benz T-1 transporter; Man-Force Trucks, licensed version of MANAG trucks; and UV's copied from Daimler-Benz.

4. SML: Established in 1983, Swaraj Mazda Limited, an India based automobile company, is owned by the Sumitomo Corporation of Japan and Punjab Tractors Limited of India, with a technical collaboration with Isuzu and Mazda of Japan. Production began in 1985. Swaraj Engines and Punjab Scooters are its associate companies. The Company manufactures Light Commercial Vehicles like Trucks, Buses, Ambulance, Police personnel carriers, water tankers and special vehicles.

5. HML: Hindustan Motor is one of the oldest Indian car manufacturers in India. It is part of the Birla Technical Services industrial group. It is perhaps best known for the Ambassador which has remained virtually unchanged for about 30 years. It is still very popular as a taxi and is widely used by Indian politicians. Hindustan Motor is committed to core values of quality, safety, environmental care and historic customer orientation. Products: it is the producer of the Ambassador car, widely used as taxicab and as a government limousine.

6. M&M: Mahindra &Mahindra is mainly engaged in the MUVs and Three Wheeler segments directly. The company competes in the LCVs segment through its joint venture subsidiary Mahindra Navistar Automotives Limited and in the PVs segment through another joint venture subsidiary Mahindra Renault. It presently manufactures Jeeps along with agricultural equipment and light trucks. Products: Bolero, Commander, CL, MaXX, Scorpio, and Mahindra and Mahindra Classic.

7. MSI: Maruti Suzki (formerly Maruti Udyog) was formed as a partnership between the Government of India and Suzuki of Japan. It brought India its first "affordable" car, the Maruti 800. It is the biggest car manufacturer in India and especially dominant in the small car sector. Then it brought out the Maruti 1000, made by Maruti Udyog was the first ever contemporary sedan-type car launched in India. Then the company replaced it with Esteem and from those days on a line of Suzuki cars rolled out in the Indian market. Products: 800, Omni, Alto, Gypsy, Swift, SX4, Wagon-R, Versa, Zen Estilo, GranVitara, and Swift Dzire.

8. Ford Motor Company (FMC) is the world's second largest automotive company after general Motors. In 1995, FMC established a joint venture company with Mahindra and Mahindra (M&M) to assemble and distribute the Ford Escort, the company's first model to be showcased in India. The company was rechristened Ford India in 1999, following a change in equity holding, with Ford buying out a majority stake. Ford India is a part of Ford Motor Company's regional operating unit, Ford Asia Pacific (FAP). Product: Ford India sells Ikon in five variants viz. Ford Ikon, Ford Ikon NXT, Ford Ikon 1.3 CLXiNXT, Ford Ikon Sxi and Ford Ikon Flair.

9. General Motors India was formed in 1994 as 50:50 joint ventures between General Motors Corporation and C.K.Birla Group of Companies. Since then, it has been involved, through an association with Hindustan Motors, in the production of Trucks, cars, automatic gearboxes and off-highway equipment. Model: Opel Astra, Opel Corsa, Corsa Swing, Corsa Sail. GM India launched its first car model, the Opel Astra, 1996. The next model, Opel Corsa, was launched in 2000 and two variants of this model have been subsequently launched- Corsa Swing in 2001 and Corsa Sail in 2003. In, 2003, the company entered the MUV segment and launched the Chevrolet brand in India through the Forester. It also launched the Opel Vectra and Chevrolet Optra. Vectra and Forester were imported as CBUs while Optra was assembled in the Halol plant. In 2004, the company has launched another MUV model, the Tavera.

10. HYMI. Hyundai is a 100%-owned subsidiary (1996). Hyundai Motor India Limited is a wholly owned subsidiary of the Hyundai Motor Company in India. HMIL's first car, the Hyundai Santro was launched in 23 September 1998 and was a runaway success. HMIL presently markets 6 models of passenger cars across segments. The A2 segment includes the Santro, i10 and the i20, the A3 segment includes the Accent and the Verna, the A5 segment includes the Sonata Transform and the SUV segment includes the Santa Fe.

Appendix 1.2

List of Sample Companies

Sl. No.	Sectors /Companies	Economic Activity	NIC Code
	Commercial Vehicles		
1	ALL: Ashok Leyland Ltd.	LCVs, M&HCVs, buses	34102
2	FML: Force Motors Ltd.	MUVs and LCVs	34102
3	SML: Swaraj Mazda Ltd.	LCVs, M&HCVSs, buses	34102
4	Tata Motors Ltd	M/HCVs	34102
	Passenger Cars/MUVs		
5	HML: Hindustan Motors Ltd	Passenger Cars	34103
6	MSI: Maruti Suzuki India Ltd	Passenger Cars	34103
7	M&M: Mahindra and Mahindra	Utility Vehicles	34102
8	HMI: Hyundai Motors India Ltd	Passenger Cars	34103
9	HSC: Honda Siel Cars India ltd	Passenger Cars	34103
10	Ford India Pvt. Ltd.	Passenger cars	34103
11	General Motors India Pvt. Ltd.	Passenger cars	34103

Source: Prowess Database, Centre for Monitoring Indian Economy (CMIE), 2009.
MUVs: Multi utility vehicles
MPVS: Multi purpose vehicles;
LCVs: Light Commercial Vehicles and
M&HCVs: Medium and heavy commercial vehicles

Note: The basic data are available in different units and for different time period. Hence, adjustments for the data are essential for the estimation purposes and were carried out to suit the studies requirements. Keeping view the scope of the study, it is decided to include all the companies under automobile industry. But, due to several constraints such as non-availability of financial statements or non-working of a company in a particular etc., it is compelled to restrict the number of sample companies to 11. The companies under Automobile Industry are classified into three sectors namely; Commercial Vehicles (CVs), Passenger Cars and Multi-utility Vehicles and Two and Three wheelers. The data relate to firms assembling or producing cars and other four wheeled drives, Commercial Vehicles (CVs) and PVs. But the nature of the markets differs for these products.[1]For the purpose of the study, two sectors have not been selected. Out of 11 companies, four are under Commercial Vehicles, 7 under passenger cars and multi-utility vehicles.

[1] For example, while the cars and other four wheeled drives are mainly meant for personal use, the light, medium and heavy commercial vehicles (CVs) are used for commercial purposes

Appendix: 1.3

Classification of Automotive Vehicles in India

Vehicle Types		Segments
4-wheelers	Passenger Vehicles	Passenger Cars
		Utility Vehicles (UVs)
	Commercial Vehicles	Light Commercial Vehicles (LCVs)
		Medium Commercial Vehicles (MCVs)
		Heavy Commercial Vehicles (HCVs)
3-Wheelers		Passenger Carriers
		Goods Carriers
2-Wheelers		Scooters
		Motorcycles
		Mopeds
		Electric 2-wheelers

Appendix 2.1

Capacity Utilisation of Indian Automobile Firms

Year	ALL (M/HCVs)	EML (LCVs)	HML (Cars)	M&M (Jeeps)	MSI (Cars)	SML (CVs)	TATA (CVs)	FML
1990-91	90.84	80.83	41.93	71.43	94.68		28.71	
1991-92		70.67	26.73	74.03	93.21		24.66	
1992-93	67.02	47.5	36.42	89.86	98.57	56	24.68	
1993-94	86.51	57	43.15	102.41	121.62	56	32.17	76.2
1994-95	83.32	80.17	56.91	75.04	99.07	70.2	46.57	80.13
1995-96	87.03	98.17	61.09	82.62	107.5	90	40.19	93.43
1996-97	90.52	55.25	55.22	73.4	131.54	80.2	43.95	14.58
1997-98	63.84	44.58	49.11	62.3	138.66	58.6	23.3	10.51
1998-99	52.5	43.25	31.64	57.57	93	57.6	17.09	5.04
1999-00	71.54	57.92	41.67	62.51	113.91	80.2	23.13	8.71
2000-01	66.3	53.25	40.25	49.87	98.43	104.2	16.57	6
2001-02	62.74	40.5	32.23	38.96	100.85	85.33	17.99	3.76
2002-03	67.3	53.92	32.06	41.81	101.85	105.5	23.78	6.8
2003-04	96.54	33.18	22.53	48.8	134.14	107.83	26.68	14.18
2004-05	79.42	30.54	28.08	55.13	152.87	113.83	26.91	11.38
2005-06	83.15	21.42	17.61	56.19	162.28	93.17	24.54	13.6
2006-07	98.93	23.32	21.68	47.51	147.4	82.33	27.14	13.69
2007-08	98.99	13.71	19.46	44.68	148.85	75.17	22.82	21.4
2008-09	53.78	13.71	14.32	63.49	148.99	75.17	22.82	

Source: CMIE, Prowess database

Capacity utilization= production/installed capacity
ALL: Ashok Leyland Ltd., EML: Eicher Motors Ltd., FML: Force Motors Ltd., SML: Swaraj Mazda Ltd., Tata Motors Ltd., HML: Hindustan Motors Ltd., MSI: Maruti Suzuki India Ltd, M&M: Mahindra and Mahindra Ltd

Appendix 2.2

Sales Growth (%) of Automobile Manufacturers in India (Rs. Crore)

Firms	ALL	FML	SML	TATA	M&M	MSI	HML
1990-91	6.81	13.02	20.20	31.24	10.58	27.36	3.96
1991-92	11.98	11.38	-26.10	20.91	19.88	28.36	-4.84
1992-93	-7.70	21.77	8.51	-4.91	21.87	11.90	14.73
1993-94	24.68	50.30	27.33	23.20	14.79	30.19	26.22
1994-95	26.56	8.20	28.52	55.56	21.80	48.43	12.28
1995-96	33.05	23.29	24.25	38.56	36.49	54.07	23.17
1996-97	23.08	0.19	2.38	27.92	26.53	20.39	3.29
1997-98	-17.62	-9.46	-8.85	-28.07	13.52	6.72	3.52
1998-99	1.66	-11.94	-9.75	-10.08	2.61	-5.06	21.85
1999-00	27.35	23.96	39.42	36.38	5.33	19.72	25.04
2000-01	-0.27	-9.39	27.18	-8.17	-0.99	-4.02	-12.01
2001-02	1.02	2.54	24.14	9.22	-7.99	1.87	-30.73
2002-03	15.78	31.05	25.21	22.75	14.32	-0.30	-10.81
2003-04	27.24	34.49	29.06	43.37	30.87	20.91	-20.14
2004-05	22.84	-10.05	24.58	32.93	29.99	21.19	62.65
2005-06	26.33	8.72	4.16	15.94	21.19	12.16	-60.40
2006-07	37.31	5.22	-2.21	32.26	21.15	15.42	45.81
2007-08	7.97	-4.47	10.57	4.63	15.81	21.56	5.72
2008-09	-25.73	-18.48	-20.85	-12.09	12.70	10.25	-10.45

Source: CMIE, Prowess Database, 2009.
ALL: Ashok Leyland Ltd, FML: Force Motors Ltd, SML: Swaraj Mazda Ltd, TATA: Tata Motors Ltd, HML: Hindustan Motors Ltd. M&M: Mahindra and Mahindra Ltd and MSI: Maruti Suzuki Ltd. Growth (G) - Growth of sales (G) was measured as (St-St-1)/St-1 where St represents the sales turnover during the time period t.

Appendix 2.2.1

R&D Intensity (%) of Firms during Liberalisation Period

Year	ALL	FML	SML	Tata	HML	M&M	MSI	DMI
1991-92	0.00	0.00	0.00	0.00	0.50	0.16	0.00	0.00
1992-93	0.00	2.05	0.00	0.00	0.57	0.21	0.00	0.23
1993-94	0.48	2.09	0.00	0.00	0.43	0.25	0.34	0.25
1994-95	0.52	1.92	0.00	1.37	0.45	0.26	0.21	0.06
1995-96	0.91	1.75	0.43	1.45	0.42	0.23	0.24	0.04
1996-97	0.09	1.53	0.42	1.69	0.41	1.17	0.20	0.64
1997-98	0.62	1.29	0.46	2.11	0.64	0.70	0.35	16.82
1998-99	0.55	1.56	0.51	1.64	0.67	0.90	0.39	3.29
1999-00	0.39	1.01	0.22	1.24	0.65	1.07	0.34	0.95
2000-01	0.86	0.85	0.46	1.14	0.34	1.29	0.50	0.59

Source: CMIE, Prowess Database, 2009.
ALL: Ashok Leyland Ltd; FML: Force Motors Ltd; SML: Swaraj Mazda Ltd; TATA: Tata Motors Ltd; HML: Hindustan Motors Ltd.; M&M: Mahindra and Mahindra Ltd.; MSI: Maruti Suzuki Ltd. and DMI**:** Daewoo Motors India Ltd.

Appendix 2.2.2

R&D Intensity (%) of Firms Auto Policy Period

Year	ALL	FML	SML	Tata	HML	M&M	MSI	HYM	HSC	FORD
2001-02	0.93	2.18	0.38	1.07	0.51	1.75	0.51	0.24	0.03	0.19
2002-03	0.97	2.28	0.50	1.35	0.59	1.65	0.31	0.41	0.10	0.42
2003-04	1.22	2.32	0.51	1.00	0.87	1.47	0.35	0.11	0.48	0.66
2004-05	1.88	2.80	0.34	1.95	0.52	1.44	0.49	0.04	0.16	1.23
2005-06	1.69	5.20	0.13	2.03	0.38	1.51	0.44	0.03	0.06	1.16
2006-07	1.84	3.51	0.22	2.57	0.25	1.48	0.37	0.02	0.06	0.93
2007-08	2.20	2.60	0.71	3.69	0.38	1.89	0.30	0.02	0.06	1.10
2008-09	3.89	1.53	1.54	5.18	0.49	3.52	0.39	0.02	0.05	1.27

Source: CMIE, Prowess Database, 2009.
ALL: Ashok Leyland Ltd; FML: Force Motors Ltd; SML: Swaraj Mazda Ltd; TATA: Tata Motors Ltd; HML: Hindustan Motors Ltd.; M&M: Mahindra and Mahindra Ltd.; MSI: Maruti Suzuki Ltd.; DMI**:** Daewoo Motors India Ltd; FORD: Ford Motors India Ltd., GMI: General Motor India Ltd., HSC: Honda Siel Cars Ltd., HYMI: Hyundai Motors India Ltd.

Appendix 2.3

Wholesale Price Index of Automobiles at 1993-94 Prices

Year	All	Motor vehicles	Cars	Buses	Trucks	Machinery & Equipment	Fuel	CPI of IW
1989-90	66.9	75.5	79.0	88.5	78.1	69.0	59.7	38.96
1990-91	73.7	84.1	84.2	91.3	83.6	78.7	67.0	43.47
1991-92	83.9	91.9	89.5	94.2	89.0	89.1	75.8	49.32
1992-93	92.3	94.8	94.7	97.1	94.5	92.6	86.5	54.05
1993-94	100.0	100.0	100.0	100.0	100.0	100.0	100.0	58.11
1994-95	112.6	106.9	118.5	100.8	113.8	110.1	108.9	63.96
1995-96	121.6	116.7	120.6	102.8	117.1	114.7	114.5	70.50
1996-97	127.2	124.5	126.8	110.4	127.1	117.6	126.4	77.03
1997-98	132.8	129.3	131.3	113.4	130.1	119.0	143.8	82.43
1998-99	140.7	133.4	134.9	113.4	134.2	120.8	148.5	93.24
1999-00	145.3	137.6	134.8	113.4	143.1	120.2	162.0	96.40
2000-01	155.7	146.1	143.3	133.5	151.2	128.5	208.1	100.00
2001-02	161.3	149.2	148.8	143.7	151.6	130.0	226.7	104.28
2002-03	166.8	149.4	139.9	143.7	159.3	132.0	239.2	108.56
2003-04	175.9	149.9	131.7	149.5	159.6	137.7	254.5	112.61
2004-05	187.3	157.4	135.4	172.2	167.0	146.1	280.2	117.12
2005-06	195.5	162.7	138.8	173.7	168.9	150.0	306.7	101.80
2006-07	206.1	165.3	136.3	173.7	171.1	155.4	323.9	130.41
2007-08	215.9	169.6	138.6	182.8	178.4	160.8	327.2	125.00
2008-09	233.9	178.2	137.8	195.3	193.9	166.2	351.3	133.00

Source: Calculations from Ministry of Statistics and Programme Implementation, and RBI Bulletin, Handbook of Statistics on Indian Economy, September 15, 2010

Table 2.3.1
Growth Rate of WPI of Automobiles, WPI of All Commodities and GDP Per-capita

Year	Growth of WPI of Automobiles	Growth of ALL Commodities	Growth rate of WPI Fuel	GDP Per-capita
1973-74	6.538	10.038	18.619	2.208
1974-75	27.301	20.224	51.838	-1.057
1975-76	9.580	25.197	10.540	6.490
1976-77	-2.200	-1.086	5.292	-0.873
1977-78	2.307	2.081	1.516	5.097
1978-79	8.906	5.210	4.439	3.223
1979-80	24.379	0.000	15.693	-7.486
1980-81	15.730	17.115	25.150	4.803
1981-82	13.808	18.244	20.660	3.641
1982-83	3.254	9.328	6.500	0.598
1983-84	-1.071	4.900	5.634	5.616
1984-85	4.856	7.531	4.267	1.710
1985-86	15.457	6.472	10.656	1.954
1986-87	4.803	4.413	6.780	2.150
1987-88	6.607	5.821	3.391	1.301
1988-89	14.178	8.139	5.513	7.834
1989-90	12.135	7.456	3.571	3.938
1990-91	11.419	7.458	12.261	3.152
1991-92	9.335	10.260	13.197	-0.584
1992-93	3.063	13.738	14.121	3.431
1993-94	5.538	10.058	15.544	3.312
1994-95	6.869	8.352	8.900	4.290
1995-96	9.200	12.600	5.142	5.207
1996-97	6.684	7.993	10.393	5.920
1997-98	3.855	4.605	13.766	2.354
1998-99	3.171	4.403	3.268	4.621
1999-00	3.148	5.949	9.091	4.527
2000-01	6.177	3.269	28.457	2.510
2001-02	2.122	7.158	8.938	3.673
2002-03	0.134	3.597	5.514	2.263
2003-04	0.335	3.410	6.396	6.898
2004-05	5.003	5.456	10.098	5.791
2005-06	3.367	6.481	9.458	7.833
2006-07	1.598	4.378	5.608	8.183
2007-08	2.601	5.422	1.019	7.474
2008-09	5.071	4.755	7.366	5.220

Source: Calculations from Ministry of Statistics and Programme Implementation and RBI Handbook of Statistics on Indian Economy, September 15, 2010.

Appendix 2.4

Actual and Trend Car Sales OECD Countries 1995 – 2015
(Numbers of Cars in Millions)

Year	USA		Japan		Germany		France		Italy		United Kingdom		China		India	
	Actual Sales	Trend Sales	Actual sales	Trend sales	Actual sales	Trend sales	Actual sales	Trend sales	Actual sales	Trend sales	Actual sales	Trend sales	Actual sales	Trend sales	Actual sales	Trend sales
1996	15.13	16.02	4.67	4.15	3.64	3.42	2.13	1.79	1.73	2.26	2.03	2.14		0.93	0.45	0.46
1997	15.17	16.27	4.49	4.28	3.53	3.45	1.71	1.84	2.40	2.23	2.17	2.21		0.98	0.50	0.50
1998	15.57	16.31	4.09	4.38	3.74	3.47	1.94	1.92	2.38	2.22	2.25	2.27		0.99	0.47	0.57
1999	16.96	16.48	4.15	4.46	3.80	3.49	2.15	2.00	2.34	2.25	2.20	2.31		1.05	0.67	0.63
2000	17.40	16.71	4.26	4.53	3.38	3.56	2.13	2.09	2.42	2.33	2.22	2.37		1.36	0.70	0.69
2001	17.18	16.84	4.29	4.56	3.34	3.54	2.25	2.18	2.41	2.40	2.46	2.42		1.59	0.70	0.74
2002	16.81	17.32	4.44	4.61	3.25	3.55	2.15	2.19	2.28	2.40	2.56	2.45		2.09	0.77	0.82
2003	16.68	17.21	4.72	4.66	3.24	3.54	2.01	2.19	2.25	2.39	2.58	2.48		2.70	0.95	0.93
2004	16.91	17.28	4.77	4.70	3.27	3.54	2.01	2.22	2.26	2.41	2.57	2.51		3.15	1.20	1.08
2005	16.99	17.45	4.75	4.75	3.32	3.54	2.07	2.23	2.24	2.37	2.44	2.54	3.97	3.81	1.28	1.26
2006	16.56	17.49	4.64	4.78	3.47	3.53	2.00	2.24	2.33	2.34	2.34	2.55	5.15	4.89	1.51	1.48
2007	16.16	17.64	4.40	4.78	3.15	3.57	2.06	2.27	2.49	2.35	2.40	2.58	6.30	6.39	1.71	1.75
2008	13.22	17.78	4.23	4.78	3.09	3.57	2.05	2.27	2.16	2.32	2.13	2.58	6.75	7.84	1.87	2.00
2009	10.33	17.88	3.86	4.77	4.01	3.44	2.15	2.19	2.12	2.22	1.72	2.52	9.32	9.33	2.01	2.21
2010		18.03		4.75		3.43		2.19		2.22		2.51		11.43		2.51
2011		18.01		4.73		3.43		2.19		2.19		2.54		13.44		2.75
2012		18.18		4.70		3.46		2.23		2.22		2.58		15.77		3.04
2013		18.35		4.68		3.49		2.28		2.24		2.61		18.41		3.36
2015		18.52		4.65		3.51		2.32		2.26		2.64		21.38		3.72
2016		18.70		4.62		3.53		2.35		2.28		2.68		24.67		4.12

Source: OECD Calculation; Datastream; China Association of Automobile Manufacturers (CAAM)

Appendix 3

Profitability Ratios (%) on Sales of Commercial Vehicle Firms

Year	ALL			FML			SML			TATA		
	PBT/ Sales	PBIT/ Sales	PBIDT/ Sales	PBT/ Sales	PBIT/ Sales	PBIDT/ Sales	PBT/ Sales	PBIT/ Sales	PBIDT/ Sales	PBT/ Sales	PBIT/ Sales	PBIDT/ Sales
1990-91	4.26	7.55	10.14	4.53	7.08	12.39	1.91	4.07	4.8	9.38	12.65	14.81
1991-92	2.51	7.77	10.85	5.68	8.45	13.49	-6.57	-3.61	-2.46	7.04	11.66	13.81
1992-93	0.4	8.9	12.17	3.25	4.52	9.05	-6.06	-3.4	-2.32	1.3	9.41	12
1993-94	2.88	8.35	11.08	4.46	5.28	8.89	-2.33	-0.24	0.64	2.5	9.18	11.9
1994-95	4.56	9.4	11.97	4.67	5.35	8.98	0.27	2.29	2.98	8.23	11.64	13.87
1995-96	6.46	11.21	13.95	7.94	9.11	15.44	2.54	4.34	4.94	10.03	12.45	14.68
1996-97	6.22	11.56	14.24	2.34	4.38	13.1	2.6	5.63	6.2	10.09	12.87	15.21
1997-98	1.04	9.19	12.73	1.14	2.82	10.66	4.06	6.24	6.92	4.71	10.86	14.95
1998-99	1.04	8.14	11.84	-5.16	-3.12	4.58	1.69	4.44	5.3	-0.89	7.08	12.08
1999-00	3.42	8.64	11.82	-2.35	-0.53	5.59	1.59	3.25	3.91	-0.73	5.53	10.46
2000-01	3.77	8.7	12.11	-2.79	-0.31	5.04	2.24	4.11	4.66	-5.99	0.31	6.44
2001-02	4.92	9.24	12.76	0.27	2.22	6.95	2.98	4.56	5.02	-2.05	2.53	7.67
2002-03	5.4	7.98	11.27	4.15	4.89	8.18	5.12	5.69	6.18	4.58	6.69	10.11
2003-04	7.12	8.5	10.95	6.32	6.71	9.56	5.89	6.04	6.42	8.58	9.2	11.72
2004-05	7.15	7.66	10	0.47	0.65	3.77	5.57	6.04	6.42	8.18	8.58	10.67
2005-06	6.76	7.34	9.43	-4.67	-3.98	-0.05	3.56	4.5	4.88	8.71	9.27	11.5
2006-07	6.1	6.43	8.22	-4.88	-3.16	0.47	3.26	4.63	5.04	8.09	8.79	10.64
2007-08	6.95	7.84	9.74	-7.39	-4.25	-0.68	4.95	6.4	6.84	7.79	8.69	10.67
2008-09	3.02	5.58	8.26	21.13	25.09	29.78	6.64	8.17	8.64	3.33	5.98	9.04

Source: CMIE, Prowess database, PBT net of P&E/Sales, PBIT net of P&E/Sales, PBIT net of P&E/Sales, ALL: Ashok Leyland Ltd, FML: Force Motors Ltd, SML: Swaraj Mazda, and TATA: Tata Motor.

Appendix 3.1

Profitability Ratios (%) on Sales of Passenger Vehicle Firms

Year	HML			M&M			MSI		
	PBT/ Sales	PBIT/ Sales	PBIDT/ Sales	PBT/ Sales	PBIT/ Sales	PBIDT/ Sales	PBT/ Sales	PBIT/ Sales	PBIDT/ Sales
1990-91	-0.25	7.09	9.28	-0.22	5	7.6	3.29	6.4	7.9
1991-92	-5.9	4.18	7.14	-0.13	5.32	8.34	1.86	5.14	6.73
1992-93	-4.69	4.96	7.43	1.73	5.81	8.32	1.81	4.24	6.04
1993-94	1.84	8.66	11.29	5.78	9.14	11.43	4.88	7.52	10.21
1994-95	2.43	7.8	10.29	8.37	10.56	12.27	6.23	9.76	12.76
1995-96	4.03	8.08	10.09	9.86	11.59	13.18	10.44	12.48	14.84
1996-97	3.35	7.86	9.99	9.32	11.61	13.55	10.86	11.81	14.2
1997-98	3.33	8.53	10.62	8.11	11.06	13.8	14.34	14.93	17.24
1998-99	-2.21	3.91	6.19	6.86	10.45	13.49	9.83	10.44	12.96
1999-00	-3.16	2.34	4.72	8.17	11.5	14.62	3.58	4.2	7.16
2000-01	-6.76	-1.01	1.87	2.55	5.45	9.12	-3.4	-2.63	1.15
2001-02	-4.63	0.38	4.16	2.01	5.42	9.25	0.88	1.73	5.8
2002-03	-4.48	0.62	4.71	4.35	6.98	10.82	2.6	3.16	6.82
2003-04	11.79	-5.35	-0.56	7.02	8.33	11.16	5.99	6.38	11.25
2004-05	-4.84	-1.38	2.44	9.07	9.47	11.64	9.35	9.61	13.12
2005-06	-8.83	-7.23	-3.07	11.14	11.43	13.59	11.63	11.77	13.65
2006-07	-8.19	-6.12	-3.23	12.55	12.73	14.59	12.8	13.07	14.63
2007-08	-7.91	-5.56	-3.08	8.61	9.28	11.11	11.4	11.68	14.35
2008-09	-13.6	11.99	-9.28	6.7	7.61	9.6	6.79	7	10.02

Source: CMIE, Prowess Database,
PBT net of P&E/Sales, PBIT net of P&E/Sales, PBIDT net of P&E/Sales,
HML: Hindustan Motors Ltd. M&M: Mahindra and Mahindra Ltd and MSI: Maruti Suzuki Ltd.

Appendix 3.2

Profitability Ratios (%) on GFA and NFA of Commercial Vehicle Firms

Year	ALL			FML			SML			TATA		
	PBT/ GFA	PBIT/ GFA	PBIDT/ GFA	PBT/ GFA	PBIT/ GFA	PBIDT/ GFA	PBT/ GFA	PBIT/ GFA	PBIDT/ GFA	PBT/ GFA	PBIT/ GFA	PBIDT/ GFA
1990-91	0.11	0.20	0.27	0.09	0.14	0.25	0.12	0.25	0.29	0.23	0.31	0.37
1991-92	0.06	0.18	0.25	0.11	0.17	0.26	-0.29	-0.16	-0.11	0.17	0.29	0.34
1992-93	0.01	0.15	0.21	0.07	0.10	0.19	-0.28	-0.16	-0.11	0.02	0.18	0.22
1993-94	0.05	0.14	0.18	0.12	0.15	0.24	-0.13	-0.01	0.04	0.05	0.18	0.24
1994-95	0.08	0.17	0.21	0.12	0.14	0.23	0.02	0.16	0.21	0.21	0.30	0.35
1995-96	0.12	0.22	0.27	0.17	0.19	0.33	0.22	0.37	0.42	0.26	0.32	0.38
1996-97	0.13	0.23	0.29	0.04	0.07	0.22	0.21	0.46	0.50	0.26	0.33	0.39
1997-98	0.02	0.14	0.19	0.02	0.04	0.15	0.28	0.43	0.48	0.07	0.16	0.22
1998-99	0.01	0.12	0.17	-0.06	-0.04	0.05	0.10	0.27	0.32	-0.1	0.08	0.13
1999-00	0.06	0.15	0.21	-0.03	-0.01	0.07	0.13	0.26	0.32	-0.1	0.08	0.16
2000-01	0.06	0.14	0.20	-0.03	0.00	0.06	0.20	0.37	0.42	-0.1	0.00	0.09
2001-02	0.07	0.14	0.19	0.00	0.03	0.08	0.30	0.46	0.50	-0.1	0.04	0.11
2002-03	0.09	0.13	0.19	0.06	0.07	0.12	0.58	0.65	0.70	0.08	0.12	0.18
2003-04	0.15	0.17	0.22	0.11	0.12	0.17	0.82	0.84	0.90	0.21	0.22	0.29
2004-05	0.17	0.18	0.23	0.01	0.01	0.05	0.88	0.95	1.01	0.23	0.24	0.30
2005-06	0.18	0.19	0.25	-0.06	-0.05	0.00	0.54	0.68	0.74	0.23	0.24	0.30
2006-07	0.17	0.18	0.23	-0.06	-0.04	0.01	0.31	0.44	0.48	0.23	0.24	0.30
2007-08	0.18	0.20	0.25	-0.09	-0.05	-0.01	0.29	0.38	0.40	0.16	0.18	0.22
2008-09	0.03	0.06	0.09	0.20	0.23	0.28	0.01	0.16	0.19	0.05	0.08	0.12

Source: CMIE, Prowess Database, 2009. PBT net of P&E/GFA, PBIT net of P&E/Sales, PBIT net of P&E/Sales, ALL: Ashok Leyland Ltd, FML: Force Motors Ltd., SML: Swaraj Mazda Ltd.

Appendix 3.2.1

Profitability Ratios (%) on GFA and NFA of Commercial Vehicle Firms

	HML			M&M			MSI		
	PBT /GFA	PBIT /GFA	PBIDT /GFA	PBT /GFA	PBIT /GFA	PBIDT /GFA	PBT /GFA	PBIT /GFA	PBIDT /GFA
1990-91	0.00	0.12	0.15	0.00	0.11	0.17	0.13	0.25	0.31
1991-92	-0.08	0.06	0.09	0.00	0.14	0.21	0.08	0.21	0.28
1992-93	-0.07	0.07	0.11	0.05	0.17	0.24	0.06	0.13	0.19
1993-94	0.03	0.15	0.20	0.18	0.29	0.37	0.13	0.20	0.27
1994-95	0.05	0.15	0.20	0.27	0.34	0.40	0.22	0.34	0.44
1995-96	0.09	0.18	0.23	0.34	0.40	0.45	0.42	0.50	0.60
1996-97	0.08	0.18	0.23	0.29	0.36	0.42	0.49	0.53	0.64
1997-98	0.06	0.16	0.20	0.23	0.31	0.39	0.63	0.65	0.75
1998-99	-0.04	0.08	0.12	0.17	0.27	0.34	0.31	0.33	0.41
1999-00	-0.08	0.06	0.11	0.19	0.27	0.34	0.09	0.11	0.18
2000-01	-0.16	-0.02	0.04	0.05	0.10	0.17	-0.07	-0.06	0.02
2001-02	-0.08	0.01	0.07	0.03	0.09	0.15	0.02	0.04	0.12
2002-03	-0.06	0.01	0.07	0.08	0.13	0.20	0.05	0.06	0.14
2003-04	-0.13	-0.06	-0.01	0.16	0.19	0.26	0.14	0.15	0.27
2004-05	-0.14	-0.04	0.07	0.25	0.26	0.32	0.25	0.25	0.35
2005-06	-0.10	-0.08	-0.04	0.34	0.35	0.41	0.35	0.35	0.41
2006-07	-0.13	-0.10	-0.05	0.40	0.41	0.47	0.35	0.36	0.40
2007-08	-0.14	-0.10	-0.05	0.27	0.29	0.34	0.30	0.31	0.38
2008-09	-0.21	-0.19	-0.15	0.18	0.20	0.25	0.17	0.17	0.24

Source: CMIE, Prowess Database, PBT net of P&E/GFA, PBIT net of P&E/Sales, PBIT net of P&E/Sales, HML: Hindustan Motors Ltd. M&M: Mahindra and Mahindra Ltd, MSI: Maruti Suzuki India.

Appendix 3.2.2

Profitability Ratios (%) on NFA of Commercial Vehicle Firms

Year	ALL	FML	SML	TATA	HML	M&M	MSI
	PBIDT /NFA	PBIDT /NFA	PBIDT /NFA	PBIDT /NFA	PBIDT /NFA	PBIDT /NFA	PBIDT /NFA
1990-91	0.45	0.89	0.38	0.70	0.25	0.26	0.42
1991-92	0.40	0.99	-0.15	0.61	0.14	0.33	0.38
1992-93	0.32	0.77	-0.16	0.38	0.16	0.38	0.25
1993-94	0.26	0.96	0.06	0.39	0.31	0.64	0.35
1994-95	0.30	0.84	0.35	0.56	0.33	0.67	0.63
1995-96	0.38	0.87	0.74	0.57	0.39	0.68	0.88
1996-97	0.42	0.58	0.89	0.55	0.39	0.59	1.06
1997-98	0.28	0.49	0.87	0.30	0.31	0.54	1.39
1998-99	0.26	0.21	0.63	0.19	0.19	0.50	0.72
1999-00	0.33	0.32	0.67	0.23	0.19	0.51	0.28
2000-01	0.32	0.31	0.84	0.13	0.08	0.26	0.04
2001-02	0.33	0.44	1.00	0.19	0.13	0.24	0.21
2002-03	0.37	0.69	1.42	0.32	0.14	0.33	0.28
2003-04	0.46	0.88	1.93	0.55	-0.01	0.47	0.66
2004-05	0.49	0.26	2.21	0.58	0.17	0.60	0.92
2005-06	0.51	0.00	1.52	0.60	-0.08	0.81	1.16
2006-07	0.41	0.02	0.76	0.52	-0.14	0.88	0.88
2007-08	0.41	-0.02	0.52	0.33	-0.15	0.61	0.76
2008-09	0.13	0.78	0.25	0.18	-0.44	0.44	0.48

Source: Prowess Data Base, CMIE, 2009.

Appendix 3.3

Profitability Ratios of Firms in the Liberalisation Phase (1991-92 to 2008-09**)**

Firms	PBT/GFA		PBIT/GFA		PBIDT/GFA	
	Mean	C.V	Mean	C.V	Mean	C.V
ALL	9.07	65.33	16.08	24.57	21.29	20.46
FML	3.81	225.31	6.19	142.9	13.89	75.45
M&M	19.28	60.35	25.24	39.83	31.79	30.79
TATA	11.62	96.63	18.24	54.21	24.06	39.54
HML	-6.24	-143.86	2.78	396.6	8.01	134.5
MSI	22.08	82.41	25.85	71.01	33.91	55.98
SML	23.31	139.28	36.39	83.64	41.24	74.36

Source: CMIE, Prowess data base,
Notes: PBT - Profit before Tax net of PE&OI/GFA, PBIT - Profit before Interest and Tax net of PE&OI/GFA, PBIDT - Profit before Interest, Depreciation and Tax Net of PE&OI/GFA, S. D – Standard Deviation, C.V - Coefficient of Variation. (SD/Mean×100)

Appendix 3.3.1

Profitability Ratios of Firms during Liberalisation Policy Period
(1991-92-2000-2001)

Firms	PBT/GFA		PBIT/GFA		PBIDT/GFA	
	Mean	C.V	Mean	C.V	Mean	C.V
ALL	5.93	70.96	16.28	22.78	21.68	17.94
FML	5.19	149.9	8.01	99.81	18.06	51.95
M&M	17.68	63.91	26.38	37.35	33.26	28.04
TATA	9.39	129.3	19.12	59.58	25.10	43.08
HML	-1.17	-717.7	10.56	64.70	15.28	41.99
MSI	23.48	94.46	29.57	74.10	37.95	61.12
SML	4.59	458.1	19.97	116.8	24.96	93.23
DMI	-7.49	-171.6	2.03	473.9	5.67	172.8

Source: CMIE, prowess data base
Notes: PBT - Profit before Tax of PE&OI/GFA, PBIT- Profit before Interest and Tax of PE&OI/GFA, PBIDT - Profit before Interest, Depreciation and Tax of PE&OI/GFA, S.D. – Standard Deviation, C.V. - Coefficient of Variation. (SD/Mean×100)

Appendix 3.3.2

Profitability Ratios of Firms during the Auto Policy Period
(2001-02 to 2008-09)

Firms	PBT/GFA		PBIT/GFA		PBIDT/GFA	
	Mean	C.V	Mean	C.V	Mean	C.V
ALL	12.99	42.74	15.82	28.32	20.79	24.57
FML	2.08	467.71	3.93	251.3	8.67	113.8
M&M	21.28	58.79	23.82	45.32	29.95	35.64
TATA	14.41	69.56	17.14	48.16	22.75	35.68
HML	-12.57	-36.95	-6.94	-92.96	-1.06	-722.11
MSI	20.33	63.27	21.21	59.07	28.85	39.65
SML	46.69	62.95	56.91	45.91	61.59	44.04
FMIL	1.00	1020.7	0.72	453.1	7.03	57.41
HSCL	24.73	49.64	25.41	44.52	36.13	35.96
GMIL	2.08	247.87	0.30	1040.1	7.37	57.62
HYMIL	16.07	40.73	16.59	39.28	24.78	30.71

Source: CMIE, prowess data base
Notes: PBT - Profit before Tax of PE&OI/GFA, PBIT - Profit before Interest and Tax of PE&OI/GFA, PBIDT - Profit before Interest, Depreciation and Tax of PE&OI/GFA, S. D. – Standard Deviation, C.V - Coefficient of Variation. (SD/Mean×100)
FORD: Ford Motors India Ltd., GMI: General Motor India Ltd., HSC: Honda Siel Cars Ltd., HYMI: Hyundai Motors India Ltd.

Appendix 3.4

Productivity Ratio of Firms during the Liberalisation Phase 1991-2009

Firms	Overall Liberalisation policy period (1991-92 to 2008-09)					
	VA/NFA		VA/L		VA/TC	
	Mean	S.D	Mean	S.D	Mean	S.D
ALL	2.68.	0.92	12.44	2.5	1.40	0.11
FML	5.13.	2.09	8.64	2.44	1.39	0.12
M&M	3.61	0.94	9.38	2.71	1.51	0.05
TATA	2.78	0.98	11.93	3.42	1.42	0.08
HML	2.59	0.89	7.15	0.94	1.51	0.11
MSI	4.17	1.22	41.61	8.53	1.28	0.06
SML	13.57	7.39	24.72	6.66	1.19	0.14

Source: CMIE, Prowess Database
Notes: VA/NFA – Capital productivity, VA/VL- Labour Productivity, VA/TC- Material productivity, S. D. – Standard Deviation.

Appendix 3.5

Market Value of the Firm: Total Liabilities (Rs. Crore)

Year	ALL	FML	SML	TATA	HML	M&M	MSI
1990-91	639.2	140.17	57.95	1800.53	553.45	782.56	1030.08
1991-92	1021.2	162.61	53.66	2740.36	614.47	874.66	1021.98
1992-93	1157.24	188.61	49.79	3390.11	657.24	1005.31	1279.47
1993-94	1283.77	261.13	69.27	3401.16	678.7	1281.05	2107.35
1994-95	1944.2	336.37	79.46	4262.67	703.88	1529.44	3584.06
1995-96	2454.59	379.93	99.01	6109.91	762.5	1935.69	3426.79
1996-97	2893.83	436.02	113.73	8599.67	807.22	2840.13	2950.7
1997-98	2807.61	417.54	84.19	8940.32	998.13	3494.64	3596.89
1998-99	2468.72	388.81	99.18	10235.8	1283.64	3838.77	4239.42
1999-00	2551.57	391.67	109.82	8997.68	1165.78	3870.98	4874.2
2000-01	2652.9	370.38	142.75	8892.26	921.65	4129.77	5020.7
2001-02	2690.76	341.14	159.88	8126.01	804.39	4092.61	4819.1
2002-03	2437.89	376.97	177.71	8294.13	884.36	4036.07	5471.4
2003-04	2579.84	462.95	224.4	10192.57	693.68	3978.66	5743.7
2004-05	3404.9	478.52	344.09	13849.19	520.19	4947.52	6529.8
2005-06	3714.94	816.27	469.54	16192.1	470.82	5919.7	7700.4
2006-07	4519.93	835.64	438.47	19574.99	515.59	7990.87	10834.7
2007-08	5592.49	900.98	523.11	26126.29	446.21	10394.9	16123.1
2008-09	7925.54	798.36	547.24	38406.04	390.65	14505.98	17818.7

Source: Prowess Database, CMIE, 2009.

Appendix 3.5.1

Replacement Cost of Assets of Firms ((Rs. Crore)

Year	ALL	FML	SML	TATA	HML	M&M	MSI
1990-91	498.40	46.42	53.37	1346.31	468.91	659.91	917.79
1991-92	876.48	54.52	47.88	2268.02	496.07	755.13	883.80
1992-93	1034.95	62.19	43.00	2887.80	566.64	864.02	1209.38
1993-94	1230.58	117.51	61.27	2999.01	577.64	1109.70	1932.43
1994-95	1954.29	167.62	71.02	4022.66	607.69	1396.64	3416.52
1995-96	2479.59	203.58	80.95	6090.10	659.58	1878.32	3511.90
1996-97	2862.55	215.09	90.21	8864.38	677.84	2897.14	2789.71
1997-98	2761.93	125.21	67.08	9616.69	822.40	3607.32	3224.13
1998-99	2495.26	127.47	78.51	11243.51	1266.37	3956.62	3573.04
1999-00	2474.41	117.63	91.31	9673.48	1166.61	3923.90	5012.80
2000-01	2611.08	97.38	119.07	9559.40	897.77	4391.65	5418.99
2001-02	2585.98	93.18	135.08	8276.65	651.63	4338.45	4930.99
2002-03	2195.11	120.62	146.11	8077.96	759.15	4125.28	5084.45
2003-04	2271.44	164.15	191.69	9851.04	581.41	3948.42	4457.31
2004-05	3129.57	212.46	296.59	13730.55	436.12	4862.36	4926.61
2005-06	3373.33	653.88	423.02	16048.48	361.97	5759.71	6242.29
2006-07	4768.24	600.40	421.39	21451.47	414.83	8213.00	10267.35
2007-08	6400.22	647.28	557.02	33360.41	311.98	11086.89	17049.61
2008-09	11851.62	525.45	558.47	51536.34	319.50	16088.36	20486.77

Source: Calculation by Authors, Prowess Database, CMIE, 2009.

Appendix 4.1

OLS Estimation on Growth of Firms in Indian Automobile Sector

Variables	ALL	FML	SML	TATA	HML	M&M	MSI
Constant	0.796 (0.31)	-23.011 (2.11)**	-63.032 (0.83)	-13.46 (2.12)**	41.53 (1.47)	18.727 (2.51)**	-2.878 (2.73)*
S	-0.553 (2.18)**	-1.687 (2.77)*	0.072 (2.01)*	0.271 (0.48)	-0.116 (0.11)	-0.619 (4.22)*	-0.771 (2.83)*
AGE	0.212 (1.31)	0.075 (1.37)	-0.394 (1.11)	0.712 (1.12)	-0.382 (0.27)	0.531 (2.07)**	0.199 (2.09)**
CU	0.009 (3.92)*	-0.001 (0.56)	0.003 (0.71)	-0.005 (0.51)	0.008 (1.08)	-0.007 (4.36)*	-0.003 (1.71)***
VI	3.984 (1.81)***	14.035 (2.84)*	2.299 (1.06)	11.29 (2.41)**	16.47 (1.63)***	-5.675 (2.04)**	6.621 (3.95)*
Q	0.301 (0.33)	1.243 (1.472)	-13.11 (-2.45)*	0.134 (0.13)	2.418 (0.43)	0.122 (0.82)	0.363 (1.91)
XI	3.566 (2.21)*	14.118 (1.81)***	6.86 (1.22)	-3.937 (0.88)	-1.162 (0.25)	0.043 (1.84)***	-2.722 (2.71)*
LOANS	-0.206 (0.54)	-1.519 (2.05)**	-1.34 (1.33)	-0.999 (1.41)	-0.997 (0.44)	-1.163 (4.27)*	0.253 (0.41)
GRP	-0.117 (0.02)	-1.376 (1.472)	-6.38 (1.16)	-17.76 (1.91)**	-6.413 (1.11)	5.56 (4.34)*	0.122 (0.07)
DIV	-3.994 (1.93)**	15.315 (1.67)***	71.91 (0.92)	4.95 (2.04)**	-54.307 (1.66)***	-12.53 (2.01)***	1.157 (1.66)***
R-squared	0.89	0.81	0.75	0.73	0.96	0.91	0.86
F	7.68	3.81	2.78	2.16	2.69	9.35	5.78
DW	2.21	2.18	2.21	2.20	1.96	1.91	2.17

Notes: Figures in the parentheses indicates the *t*-values. Figures in the parentheses represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %. D indicates the first difference level respectively.

S: Firm Size, AGE: Age of the Plant, CU: Capacity Utilisation, VI: Vertical Integration, Loans: Borrowings of the firm, GRP: Gross Retain Profit, DIV: Diversification of Firms, G: Growth of Firms.

ALL: Ashok Leyland Ltd, FML: Force Motors Ltd, SML: Swaraj Mazda Ltd, TATA: Tata Motors Ltd, HML: Hindustan Motors Ltd. M&M: Mahindra and Mahindra Ltd and MSI: Maruti Suzuki Ltd.

Appendix 4.2

OLS Estimation on Profitability of Firms in Indian Automobile Sector
Dependent Variable: Tobin's q

Variables	ALL	FML	SML	TATA	HML	M&M	MSI
Constant	-2.413 (0.91)	8.695 (2.23)**	5.386471 (2.15)**	-4.685 (2.22)**	-22.269 (3.11)*	-14.662 (1.47)	-0.736 (0.75)
S	0.346 (1.28)	0.574 (2.66)*	0.437985 (2.72)*	0.849 (3.91)*	-0.311 (2.91)*	-0.229 (1.11)	-1.361 (4.93)*
AGE	0.006 (2.27)**	-0.049 (2.96)*	-0.030 (2.26)**	0.243 (1.33)	-0.297 (5.01)*	-0.559 (2.44)**	-0.221 (3.36)*
CU	5.208 (2.45)**	-0.001 (0.31)	-0.001 (2.68)*	-0.005 (1.54)	-0.001 (1.73)***	0.004 (2.15)**	0.006 (4.44)*
VI	0.765 (0.93)	-2.988 (1.31)	-2.731 (1.56)	1.169 (0.92)	-0.924 (2.74)*	5.864 (2.51)**	8.129 (4.31)*
XI	-1.357 (1.01)	-5.545 (1.93)**	-0.142 (0.05)	1.897 (1.03)	-0.394 (1.19)	0.024 (0.63)	-3.075 (2.82)*
LOANS	-0.255 (0.52)	0.664 (2.39)**	0.489 (2.45)**	1.058 (2.12)**	-0.364 (2.21)**	-0.382 (0.67)	-1.214 (2.31)**
GRP	5.163 (1.18)	0.594 (1.59)	0.695 (1.21)	-3.892 (1.12)	-0.577 (1.45)	3.773 (1.91)**	-0.925 (0.68)
DIV	-1.636 (0.63)	-7.162 (2.65)*	-3.81 (2.03)**	1.105 (1.49)	25.436 (3.28)[8]	12.66 (1.41)	1.115 (1.75)***
G	-0.573 (3.96)*	-0.099 (1.12)	-0.018 (0.25)	0.163 (1.19)	0.063 (2.33)*	-0.664 (2.11)*	0.098 (0.48)
R-squared	0.88	0.89	0.92	0.86	0.96	0.88	0.95
F	7.16	7.87	11.72	5.93	24.60	7.01	18.71
DW	1.97	2.12	2.19	2.15	1.96	2.15	2.14

Notes: Figures in the parentheses indicates the *t*-values which represent significant levels. *: Significant at 1 %, **: Significant at 5 % and ***: significant at 10 %. D indicates the first difference level respectively.

ALL: Ashok Leyland Ltd, FML: Force Motors Ltd, SML: Swaraj Mazda Ltd, TATA: Tata Motors Ltd, HML: Hindustan Motors Ltd. M&M: Mahindra and Mahindra Ltd and MSI: Maruti Suzuki Ltd
S: Firm Size, AGE: Age of the Plant, CU: Capacity Utilisation, VI: Vertical Integration, Loans: Borrowings of the firm, GRP: Gross Retain Profit, DIV: Diversification of Firms, G: Growth.

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Synopsis of the thesis submitted in partial fulfillment of the award of Ph.D. degree in Department of Economics

LIBERALISATION, GROWTH AND COMPETITIVENESS OF FIRMS: A STUDY OF INDIAN AUTOMOBILE INDUSTRY

BY
TOPHAN PATRA
05SEPH05

Under the Supervision of
Prof. J. MANOHAR RAO

Department of Economics
School of Social Sciences
University of Hyderabad
(P.O) Central University, Gachibowli
Hyderabad – 500 046
Andhra Pradesh
India

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Liberalisation, Growth and Competitiveness of Firms: A Study of Indian Automobile Industry

I. Introduction

The Indian automobile industry, one of the core sectors, has undergone changes with the advent of new business and manufacturing practices in the light of liberalisation and globalisation. The two waves of liberalisation in the 1980s and after 1991 have been associated with significant structural changes (Kaplinsky, R. 1997)[1]. The Indian automobile market has been heavily protected using various tools since 1985 as the industry is considered to be a key industry that would stimulate growth. With the introduction of economic reforms in 1991, Indian industries have witnessed profound changes in the basic parameters governing their structure and functioning. The 1990's brought about significant changes in the Indian automobile industry with respect to quality standards, degree of competition, and degree of product differentiation as a result of relaxed trade restrictions. It assigned central role to the market forces for organising economic activities and adopted a more liberal stance towards foreign trade and investment. These policy changes, collectively known as 'liberalisation of the Indian economy', had far-reaching implications.

The Indian automotive industry embarked a new journey in 1991 with delicensing of the sector and subsequent opening up for 50% FDI was allowed on an automatic basis. Being the pillar of Indian industry, with the support by the government both in financial and market wise, automobile industry seems to be formidable. The automobile manufacturing sector is characterized by a high cyclical growth patterns, high fixed cost and break-even point levels and an excessive number of participants. Barriers to entry into automobile manufacturing activity are formidable. Competition in this industry is increasing. The size of the domestic market which is relatively larger along with high competition has significantly rationalized the automotive industry. After globalisation the new automobile policy has focused on import of foreign technology and capital for sustainable competition in the domestic and as well as international markets. Liberalisation has also stipulated to elevate the level of foreign equity in the Indian automobile industry. This gave push up and easier access to foreign collaborations. With this new policy, investors from all over the globe looked India as a potential platform for foreign

[1] Kaplinsky Raphael (1997), "India's Industrial Development: An Interpretative Survey", *World Development,* Vol. 5, No. 5, pp. 681-694.

investments. Since then, India's trade has boomed and there has been sustained investment into industry by foreign players, bringing in not only foreign capital, but also international technology and know-how. There have also been indirect consequences of development, employment, efficiency and rising per-capita incomes.

Since then almost all global majors have set up their facilities in India taking the level of production in recent years. Following India's growing openness, the arrival of new and existing models, easy availability of finance at relatively low rate of interest and price discounts offered by the dealers and manufacturers, all have stirred the demand for vehicles and a strong growth of the Indian automobile industry. Interestingly, the level of trade exports in this sector in India has been medium and imports have been low. However, this is rapidly changing and both exports and imports are increasing. The demand determinants of the industry are factors like affordability, product innovation, infrastructure and price of fuel. The profitability of motor vehicle manufacturers has been rising over the past few years. The level of technology change in the motor vehicle industry has been high but the rate of change in technology has been medium. Investment in the technology by the producers has been high.

With a vision of establishing a globally competitive automotive industry in India and doubling its contribution to the economy by 2010, the Ministry of Industry presented for the first time a separate auto policy document in March 2002 known as 'Auto Policy 2002'.[2] Auto Policy 2002 allowed automatic approval of foreign equity investment upto 100% for the manufacture of automobiles and auto-components. Strong macroeconomic base of demand growth drivers along with convenient credit facilities have ensured rising demand for vehicles in the country. Suitable fiscal and financial incentives were planned for promoting industry R&D efforts. The Automotive Mission Plan 2006-2016 was released in 2006. The government aims to encourage growth, promote domestic competition and stimulate innovation with its policies.[3] The emphasis of reform has switched to institutions that will allow the market to perform more efficiently. The India government aims to create a policy environment that helps companies gain competitive advantage. Competitiveness depends on the capacity and the speed of the industry to innovate

[2] Government of India (2002), "*Auto Policy, March 2002*", Ministry of Heavy Industries and Public Enterprises, Department of Heavy Industry, New Delhi.

[3] Ministry of Heavy Industries and Public Enterprises (2006), "Automotive Mission Plan 2006-2016". The Automotive Mission Plan 2006-2016: A Mission for Development of Indian Automotive Industry, Development Council on Automobile and Ministry of Heavy Industries and Public Enterprises.

and upgrade. The most important indices of competitiveness are productivity of both labour and capital. The motor vehicle manufacturing industry requires significant level of capital investment. The level of capital intensity is high and labour intensity is medium. Labour input is required in the manufacturing, assembly, and finishing processes. A more comprehensive and integrated view of market reforms was formulated in the nineties, with wider and deeper reforms initiated in 1991-92 (Virmani (2002b,[4] 2004a[5]). The overall effect of these reforms was to greatly increase the degree of domestic competition in the economy, contrary to what Rodrik and Subramanian (2004)[6] have asserted.

II. Objectives of the Study

- This study examines the factors that are most likely to influence the Indian automobile demand.
- It attempts to analyse the determinants of growth of Indian automobile firms during two policy regimes, namely liberalisation (1991-92 to 2000-2001) and Auto Policy (2001-2002 to 2008-2009)
- It analyses the determinants of competitiveness of firms in the Indian automobile industry during the same period.
- It seeks to examine the productivity performance in terms of partial factor productivity and total factor productivity growth.

III. Review of Literature

This chapter reviews the past studies dealing with the brief history and structure of Indian and world automobile industry in the light of its current status. It provides similar or divergent relationships leading to a few hypotheses for further empirical testing. A brief review of few major studies on liberalisation, growth performance and productivity growth of industries are carried out making use of both time series and cross section data led to find out the research gaps for the purposes of this study. It traces research gaps to fetch requisite hypotheses, or research questions.

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[4] Arvind Virmani (2002b), "A New Development Paradigm: Employment, Entitlement and Empowerment", *Economic and Political Weekly*, Vol. 37, pp. No. 22, pp. 2145-2154.

[5] Arvind Virmani (2004a), "*Accelerating Growth and Poverty Reduction: A Policy Framework for India's Development*", Academic Foundation, New Delhi.

[6] Dani Rodrik and Arvind Subramanian (2004), "*From 'Hindu Growth' to Productivity Surge: The Mystery of the Indian Growth Transition*", IMF Working Paper/04/77.

Siddharthan, N.S. and K. Lal (2004)[7] show that not all firms have benefited from the liberalisation measures. There have been both gainers and losers. The impact of the determinants on growth has not remained constant over the years but has changed during the process of liberalisation. Agarwal, R. N. (1991)[8] finds that profitability has mainly increased through experience of the older firms. The older firms need to be encouraged to diversify into other product lines and to internalise production process through vertical integration to improve profitability and growth of the firms in the industry. Ranawat, M. and Rajnish Tiwari (2009)[9] attempted at identifying policies relevant to the development of India's automotive industry and at studying their impact on the industry's development. With every major shift in policies made by the Indian government, the automotive industry has come out stronger and better.

Narayanan, K. (2004)[10] studies the determinants of growth of Indian automobile firms during three different policy regimes, namely licensing (1980-81 to 1984-85), deregulation (1985-86 to 1990-91) and liberalisation (1991-92 to 1995- 96). In a licensed regime, firms with foreign equity grow faster because of better access to resources and technology. In a deregulated regime, import of capital goods has been the technology-related variable that triggered growth. In a liberal regime, growth is positively influenced by the intra-firm technology transfer. Narayanan, Another significant discussion on the concept of competitiveness of firms was published by ADB (2003)[11]. A firm's competitiveness can thus be examined as a function of factors such as its own resources, market power, behaviour toward rivals and other economic agents, capability to adapt to changing circumstances, capability to create new markets, and the institutional environment, largely provided by the government, including physical infrastructure and the quality of government policies. Competitiveness depends on the capacity and the speed of the industry to innovate and upgrade. The most important indices of competitiveness are productivity of both labour and capital. Although there exists voluminous empirical research

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[7] N.S. Siddharthan and K. Lal (2004), "Liberalisation, MNE and Productivity of Indian Enterprises", *Economic and Political Weekly*, Vol.39, No.4. pp. 448-452.

[8] R.N. Agarwal (1991), "Profitability and Growth in Indian Automobile Manufacturing Industry", *Indian Economic Review*, Vol. No. 1, XXVI, PP. 81-97.

[9] Mahipat Ranawat and Rajnish Tiwari (2009) "*Influence of Government Policies on Industry Development: The Case of India's Automotive Industry*" Hamburg University of Technology, Institute of Technology and Innovation Management, WP. No. 57, PP. 1-60.

[10] K. Narayanan (2004), "Technology Acquisition and Growth of Firms: Indian Automobile Sector under Changing Policy Regimes", *Economic and Political Weekly*, Vol. 39, No. 6, pp. 461-470.

[11] Asian Development Bank (2003), "Competitiveness in Developing Asia: Taking Advantage of Globalisation, Technology, and Competition in Part 3", Asian Development Outlook, Manila.

work regarding nexus between trade liberalisation and factor productivity growth, overviews on the link between liberalisation and TFPG find inadequate evidence on this issue; it is controversial issue and debates are still unsettled.

Grossman and Helpman (1991)[12] argue that technological change can be influenced by a country's openness to trade. Pradhan and Barik (1999)[13] noticed that on the whole, a decline trend of TFPG in Indian manufacturing sector both at aggregate and disaggregate levels. Das, D. K. (2004)[14] finds that there is no evidence of much change in total factor productivity growth following liberalisation of the regime initiated in the early 1990s. As in the 1980s, factor accumulation rather than productivity growth accounts for most of the output growth during this period. TFP growth in the 1990s is found to be lower than in the 1980s.

IV. Sample, Data Sources and Research Methodology

The analysis explained in this study is based on secondary data. The study includes data on production and sales have been taken by the two automotive associations, namely Society of Indian Automobile Manufacturers (SIAM) and Automotive Component Manufacturers Association (ACMA). The study used the data on world automobile production collected from OICA.[15] The data relate to firms that assemble or produce cars and other four wheeled drives, light commercial vehicles, and the heavy commercial vehicles. The nature of the markets is different for these products.[16] The main sources of the data used are from Centre for Monitoring of Indian Economy (CMIE). It provides information on all firms in the industry under study with regard to production, installed capacity, capacity utilisation, equity shares, rates of dividend, balance sheets, profit and loss account, financial ratios and the capital structure. The data set contains firm level data for 10 automobile manufacturing companies from 1991-1992 to 2008-2009. Data regarding employment, capital and value added at the aggregate level are used for the productivity estimates is the Annual Survey of Industries (Central Statistical Organisation) from

[12] G. Grossman and E. Helpman (1991), "*Innovation and Growth in the Global Economy*", Cambridge, MIT Press.

[13] G. Paradhan and K. Barik (1999), "Total Factor Productivity Growth in Developing Economics: A Study of Selected Industries in India", *Economic and Political Weekly,* pp. M92-M97.

[14] D. K. Das (2004), "Manufacturing Productivity under Varying Trade Regimes, 1980-2000", *Economic and Political Weekly*, Vol. 39, No. 5, pp. 423-433.

[15] OICA, the Organisation Internationale des Constructeurs d'Automobiles (OICA) commonly called the International Organisational of Motor Vehicle Manufacturers is a federation of automobile manufacturers.

[16] For example, while the cars and four wheeled drives are meant for personal use, light, medium and heavy commercial vehicles are all meant for commercial purposes.

1973-74 to 2008-09. The study has only concentrated on three digit classification which required some important adjustments.

In Chapter 2, a brief review of government policies with regard to automotive industry development was sketched. It describes the evidences on liberalisation impact on market structure, nature and growth performance of Indian automobile industry. We point that the substantial body of theoretical and empirical studies have examined the relative persistence of contemporaneous on various factors.

In Chapter 3, the basic concepts related to the studies and models dealing with structure of the industry, productivity, market size, growth and profitability are discussed. This chapter discusses the theoretical model and describes the estimation procedure. Specifically, determinants of automobile demand, growth, profitability, and productivity models are discussed.

In Chapter 4, an attempt is made to examine the factors that are most likely to influence the Indian automobile demand. We use the OLS model to run a regression analysis in order to develop the model for automobile demand in India for the period 1990-91 to 2008-2009. We estimated the error correction model for the time period 1990-91 to 2009-2010 for explaining the fall in automobile sales in the year 2008 and the effect of the improvement in financial conditions and the recovery in demand on short-term prospects for sales. The study analyses the determinants of the growth and profitability (as measured by Tobin's q) of firms in the Indian automobile industry during two policy regimes, namely, liberalisation policy (1990-91 to 2000-2001) and the 'Auto Policy' (2001-02 to 2008-2009). The study uses fixed effect estimations to analyse the determinants of growth of firms during these policy regimes.

In Chapter 5, we analyse various aspects of the domestic market competitiveness in the chosen firms. It includes an analysis of market shares, profitability and productivity ratios, and performance. The most frequently used measure is Hirschman-Herfindahl index of market concentration. The competitiveness of a firm is defined in terms of the rate of change in market share. This study attempts to examine the factors that brought about this change in the market share. The study uses fixed effect model to analyse the determinants of competitiveness in the dependent variable, namely, the rate of change in market share during two policy regimes: 'liberalisation policy' (1991-92 to 2000-01) and 'auto policy-2002' (2001-02 to 2008-09).

In Chaper 6, we tried to measure the measure productivity performance of the Indian automobile industry in terms of partial factor productivity and total factor productivity growth for the entire

reform period, 1980 to 2009. The estimation of factor productivity will be very useful to evaluate the variations in the performance of an industry over a period of time. This has been analysed by examining different productivity indicators like labour productivity, capital productivity and total factor productivity. TFP is calculated in a growth-accounting procedure and according to a traditional Solow (1957) Cobb-Douglas function.[17] This measure is based on the general neo-classical production function. Within this model TFP is identified as shifts in technology if certain conditions are met. It assumes constant returns to scale, Hicks-neutral technical change, competitive equilibrium and factor rewards being determined by marginal products.

It also makes the comparison of trend growth rate of TFP estimates before and after the 1991economic reforms. The literature on production function is replete with discussion on the measurement of variables which go into the Cobb-Douglas production function. Least squares regression of log output (value added) on a constant and the logarithm of labour and capital produce parameter estimates of a Cobb-Douglas production function. OLS model is applied to estimate the determinants of total factor productivity growth (TFPG).

V. Main Findings of the Study

The overall effect of liberalisation reforms represented a fundamental change in India's development policy. The eighties were characterised by both a gradual reduction in quantitative restrictions and increase in tariffs. The nineties in contrast were marked by a broad array of reforms the effects of, which on aggregate growth were much more gradual. The scope and content of the reforms was much wider than in the eighties. This study consists of seven chapters including the introduction and the present chapter.

The first chapter deals with introduction to the thesis, objectives, hypotheses, research questions, research gaps, importance and relevance of the study that contributed to knowledge. The introduction chapter has brought the researchable issues and presented the objectives of the study. This chapter highlights the importance of studying the liberalisation, growth and competition of Indian automobile sector.

This second chapter is about literature review in which core competitive issues are reviewed. This chapter draws the fact the relaxations of quantitative restrictions, technology acquisition, internal funds, availability of credit, business models and the influence of important government

[17] R.M. Solow (1957), Technical Change and the Aggregate Production Function, *The Review of Economic and Statistics*, Vol. 39, No. 3, pp. 312-320.

policies, and the role of oil prices and material costs were the main tools used to analyse growth and competitiveness of firms in the automobile market. This study also discusses Bresnahan's (1987) hypothesis that supply-side factors must have been responsible for the unusual pattern. The reforms of the '80s' reforms focused on increasing profitability of the existing firms by easing capacity restriction and reducing corporate taxes among other things. The reforms of 90s allowed more competition and paved a way for entry of new domestic firms and MNCs in Indian industries. Technological change can be influenced by a country's openness to trade. Productivity growth appears to be directly linked with production of tradable goods.

The third chapter provides basic concepts related to the studies and models dealing with structure of the industry, productivity, market size, growth and profitability. Details regarding the theoretical framework and methodology are provided in chapter. It discusses the theoretical model and describes the estimation procedure. This concerns consumer demand theory, growth, competitive analysis, and forecasting to understand trends in the automobile industry. It follows

The fourth chapter examines the impact of economic liberaliation since 1991in terms of growth and profitability performances of firms in Indian automobile industry. Indian automobile industry is the main beneficiary of the liberalisation process. The automotive industry in India has witnessed an impressive growth since the country's economic liberalisation. Overall, the entire period, 1990-1991 to 2008-2009, the estimated growth rate of commercial vehicles output is 3.1 percent, the estimated growth rate of passenger vehicle output is 5.4 percent and the automobile industry's output is 4.5 percent. Capacity utilization of all automobile companies is also declining during the same period. The production activity is likely to be impacted in the year 2008-09 also due to slowdown in demand and associated challenges in domestic and international markets.

The regression results of automobile demand function find that the price of fuel is not the main factor in commercial vehicle sector (CVs). But the price of fuel is the main factor in passenger vehicle sector (PVs) influencing auto demand in India. The lending rate and income is the prime determinant influencing the automobile demand in India. This study examines the correlation between the hike in fuel prices, lending rate, and GDP per capita with India's automobile sales. The error correction model results find that there is a long term relationship between sales growth and gross domestic product per capita. The error correction term in the estimated equation is highly significant and has correct sign. In the long-term, sales growth depends on

GDP per capita. In addition, the results also show that the changes in fuel price and the rate of interest are significantly negative impact on both PVs and CVs sales growth in the short run.

The fixed effect results broadly indicate that technological factors play an important role in determining the growth of firms in this industry.

During the liberalisation regime, import of capital goods (IMCAP) and disembodied technology (IMTECH) influence growth positively. Technology embodied in new machinery and equipment, and technology disembodied in lumpsum and royalty payments are important determinant for growth. Investment in machinery captures the effect of embodied technological change which is visible from 1991-92 onwards. Consequently the share of machinery in fixed investment has risen constantly during the market reform period. R&D influences negatively. During the liberalisation period, most firms show quite declining trend in terms of R&D intensities. We find that the R&D expenditures vary with firm size. Therefore, the effect of R&D expenditures on firm growth varies with firm size. R&D activity, according to this study, appears to have long-term implications for growth. The results also confirm a positive relationship between profits and growth. The profitability of automobile manufacturers has been rising over the years, mainly due to rising demand and growth of Indian middle class. Capital intensity has also turned out to be significant with negative coefficient in liberalisation regime. Auto policies, however, seems to have changed the role played by these technological factors. During this policy, import of capital goods, profits, and vertical integration are very important determinants of growth of firms. They influence positively. FE influences growth positively. In both these regimes, technological factors play an important role in determining the growth of firms in this industry. Thus growth is mainly technology driven. The level of technology change is high. The rate of change in technology is medium. Investment in technology by producers has been on the rise. Overall, Liberalisation in economic policies, however, seems to have changed the role played by these technological factors. The nature and direction of the effect of technology variables are governed largely by the technological regime in which a firm operates.

Profit is an important indicator of the financial performance of an industry. The value of Tobin's q has remained more than unity throughout the period of all the companies. Overall, the values of Tobin' q shows a rising trend for all companies. During liberalisation regime, the results of fixed effect model suggest that profitability (as measured by Tobin's q) in the automobile sector tended to improve with diversification and age of the firm. But profitability tends to decline with

size of the firm and capacity utilisation. During the auto policy regime profitability (as measured by Tobin's q as mentioned in chapter IV) in the automobile sector, tended to improve with import of technology, capacity utilization and age of the firms. But profitability tends to decline with size of the firm.

The fifth chapter examines the impact of liberalisation that started in India in 1991 has succeeded in bringing about a sustained growth in the automotive sector which, was triggered by enhanced competitiveness and relaxed restrictions prevailing in the Indian industry. In this chapter, we analysed various aspects of the domestic-market competitiveness of the chosen firms. Market share is one of the relevant indicators of competitiveness. Profit ratios and productivity ratios have been recognised as the main indicators of competitiveness of financial performance of firms. Indian automobile industry has been registering a healthy positive growth in terms of its production and sales as well over the period of study. If we look all the three parameters, viz., production, domestic sales and exports, they have registered a continuous growth in the last few years, except the year 2007-08. Looking for market share, the commercial vehicle industry is more concentrated industry than passenger vehicle industry. India’s production of passenger cars and commercial vehicles reached a new record and spread globally of 29.8 percent in 2002-03, 30.1 percent in 2003-04 and 24 percent in 2005-06. The automobile industry was affected by the economic downturn. Car sales declined markedly in almost all OECD countries, from 2007 to January 2008. Markets are close to saturation in many advanced economies.

In the liberalisation phase, the fixed effect results of market share analysis supported the view that the firm size and import of capital goods (MKI) are very significant in determining the growth rate of market share. Import of disembodied technology (LRI) emerged insignificant with a negative coefficient. But product improvements through the import of components (MCI) and skill content of the work-force have influenced negatively on growth rate of market share. During the auto policy regime, the firm size, the import of capital goods, and import of components emerged very important in the determination of rate of change in market share of firms in the automobile industry. R & D activity emerged insignificant with negative coefficient. It influences growth of market share negatively. R&D activity, according to this study, appears to have long-term implications for growth.

The sixth chapter seeks to measure productivity performance in terms of total factor productivity (TFP) changes in Indian automobile industry and identifying the factors, which account for

productivity changes. Both capital productivity and labour productivity show increasing trend after economic reforms took place in July, 1991. Thus, increases in labour productivity may be due to improved efficiency and technological progress as well as more capital per unit of labour. The growth of value added, labour, and capital show increasing trend. It is seen from the TFP estimates in this study indicate a rise in the growth rate of TFP in Indian automobile manufacturing in the Post-reform period (1991-92 to 2008-09) as compared to the pre-reform period 1979-80 to 1990-91). But the Indian automobile industry shows negative productivity growth on TFPG account over the study period. It suggests that the TFPG contributes negatively to the output growth during the post-liberalisation period. Therefore, it is true that increase in factor input is responsible for observed output growth and TFP contribution plays negligible role in enhancing output growth. It is recognised that the growth in Indian automobile industry is still fundamentally dominated by factor accumulation resulting input-driven growth rather than technical change. Growth in investment in fixed machinery has significant negative impact on total factor productivity growth. Technological improvements are often absorbed into the domestic economy via imported capital goods, and that efficiency of the productive sector is influenced largely by the level of government investment in the economy. . The automobile industry whose industrial structures depends heavily on manufacturing activities and have higher capital-to-output ratios will generally tend to have lower rates of TFPG. The output growth could not be enhanced by continuous input growth in the long run due to the nature of diminishing returns for input use. For sustained output growth, TFP growth is essential and therefore, TFP growth became synonymous with long-term growth as it reflects the potential for growth.

VI. Conclusion

With every major shift in policies made by the Indian government, the automotive industry has come out stronger and better. The structural reforms like delicensing of whole auto segments, abolition of the need for MRTP clearances, automatic approval for FDI up to 51% equity, dropping phased manufacturing programmes for new and existing units and relaxation in import of capital goods and technology benefited the automotive industry over a longer term. But the short-term stabilisation measures adopted by the government to counter the crisis adversely affected the industry's growth. As India's economy continues to grow at a rapid pace, the automobile industry will be a key beneficiary. The main factors behind such growth are the

increasing affluence of the average consumer, overall GDP growth, the arrival of ultra-low-cost cars, and the increasing maturity of Indian original equipment manufacturers (OEMs). Other challenges—for example, the current global economic crisis and high commodity prices—may slow down the country in the short term, but they will not be able to stop it.

In conclusion, it is suggested that aggregate growth strategies through stimulation of domestic demand, access to global market, and investment in new emerging growth areas are required for propelling a higher growth rate. This study is one of the detail attempts to analyse the interface between liberalisation policy and its impact on growth, competition and productivity of Indian automobile industry. By analysing the current trend of industry, we can say that being a developing economy, there is a lot of scope for growth and this industry still have to cross many levels.

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