TRADE REFORMS: TOTAL FACTOR PRODUCTIVITY AND PROFITABILITY OF MANUFACTURING SECTORS IN PAKISTAN

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Abstract

The effect of Pakistan's trade liberalization on total factor productivity and profitability is empirically investigated over a period of 15 years. Total factor productivity is measured for eight major sectors separately and TFP parameter estimates are derived for each sub sector individually. Parameters are estimated by following Levisohn& Petrin (2003) method which takes into account the simultaneity bias inherent in a particular level of total factor productivity and selection of inputs for a panel data set covering a period 1980-95. Technical efficiency is also measured for the same panel data and time period for four major sectors by stochastic production frontier time varying model, in order to complement the estimation of total factor productivity. Price cost margins are also measured for all the sectors to indicate the profitability of the sectors.

In the second stage estimation total factor productivity and time varying technical efficiency estimates are related to a variety of trade related variables in the presence of sector specific variables which serve as control variables. The empirical results are mixed. A positive relationship between productivity and liberalization had been hypothesised but the evidence is not unanimously supportive of a positive relationship. Price cost margins are also empirically related to trade variables, plus some structural and sector specific variables. The results are informative about the effect that trade related policies have been exerting on the profitability of the sectors. Restrictive trade policies appear to have shaped a particular industrial structure which seems to limit the effect of trade liberalization policies on the price cost margins.

The overall evidence suggests that trade liberalization reforms have no substantial effect on total factor productivity of the manufacturing sectors. This is due to the absence of enabling environment caused by non implementation of complementary reforms in education, infrastructure and competitive policies aimed at discouraging the monopoly powers. There is need for further research to conduct the same analysis with firm level data using entry and exit rates and relate the total factor productivity, turnover and trade liberalization in order to arrive at a definitive conclusion about the role of entry barriers that crept into the manufacturing industries by either deliberate policy making or through by products of trade protection.

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Introduction

Trade protection by insulating domestic producers from international competition can permit slack performance. The absence of competitive pressure reduces the need to exert effort to reduce costs and increase productivity and efficiency. Trade restrictions can act as entry barriers and enhance other barriers, which help to create and sustain market power for domestic producers. Academic research shows that trade liberalization disciplines producers by introducing international competition and so creates new incentives for productive effort.

Three sources of gains in total factor productivity following trade liberalization have been identified. 1. Increases in total factor productivity occur due to technological improvements which are more easily accessible in the form of imports and spill-over effects of interaction with international producers. 2. Improvements in X-efficiency due to changes in production methods, better organization of work places, management-worker relations and elimination of waste. 3. Adjustment of resources from the less productive to the more productive producers because less efficient producers are forced out of market. However such reallocation effect depends not just on trade policies but also on market structure and ease of entry and exit.

This thesis seeks to quantify total factor productivity for manufacturing industries of Pakistan, a country that pursued the development of strong manufacturing industries by the implementation of high trade protection. The policy objectives were to help infant industries and enable them to compete in export markets. As a consequence some manufacturing sectors exhibited high growth rates in the initial phase of protection and the first stage was successfully completed when selected sectors, with comparative advantage in indigenous raw materials, entered into exporting. Ever since, export activity has been concentrated mainly in

Textile sector producing low value added items, while domestic industries have concentrated production in consumer goods with little diversification of the structure of manufactures. There has been a long period of high protection through various non-tariff barriers, extremely high tariffs, and the promotion of exports by means of fiscal and trade incentives. However, the professed objectives failed to materialise as industry has not emerged as a dynamic and buoyant branch of economic activity.

Pakistan has followed trade liberalizing reforms since 1960. It presents an interesting case because the periods of trade can be characterised sometimes being consistent though gradually paced while at others as unplanned and extremely slow. To limit the transitional costs reforms were never fast, as the manufacturing sector was not thought to be able to withstand the strong competition it would face in the event of the complete removal of protection.

Analyzing changes in the level of total factor productivity during the process of reforms presents an opportunity to evaluate the contribution of trade policies towards changes in the performance of industrial sectors. As trade reforms have been gradual it is difficult to make before and after comparisons of total factor productivity. In such a setting of gradual change of the trade regime the changes in total factor productivity have to be studied over the period of reforms.

Total factor productivity is evaluated in a two step procedure. In the first step, a production function is estimated by a semi-parametric procedure adapted from Levinsohn-Petrin (2003). The benefit of this technique is that it corrects for the simultaneity bias which can distort the calculation of total factor productivity due to correlation between the choice of production inputs and the unobserved level of productivity. In the second step, the total factor productivity estimates are related to trade related measures across the various sectors in the presence of sector specific control variables.

Total factor productivity is analysed using a panel data of manufacturing sector establishments covering a period of 1980-1995. Inter-sectoral comparisons of productivity are possible using the census of manufacturing industries. Census provides data for each sector disaggregated into sub sectors providing an opportunity to analyze the response of individual sub sectors within an industry and also across sectors .

Technical efficiency is estimated using a stochastic frontier production function following the same two step procedure. In the first step time varying technical efficiency parameters are derived. In the second step technical efficiency is regressed on the trade variables and sector specific factors. The purpose of computing technical efficiency is to measure the extent of X-inefficiency, such as weaknesses of management and organization of production methods. Total factor productivity includes both technological progress and technical efficiency, while technical efficiency refers only to the effort to improve production with a given technology. In the second step, the effect of changes in trade policies on technical efficiency is investigated for four major sectors.

To examine the effect of trade reforms on profitability, price cost margins are calculated for each sector. These are also regressed on the trade variables to test whether changes in trade policies have resulted in lowering the price cost margins. The literature suggests that international competition should squeeze profit margins.

This thesis makes a number of contributions. 1. The semi-parametric estimation of total factor productivity parameters accounts for the crucial problem of endogenously. 2. Total factor productivity for each sub-sector within an industry is computed to examine the variation in productivity across sectors and over time. 3. Various trade variables are used to explore the relationship between trade regime changes and total factor productivity. 4. Econometric studies of the manufacturing industry of Pakistan computing total factor productivity at the sectoral level are very few. 5. This thesis also makes the first attempt to calculate the technical efficiency for four sectors which are again correlated with the same trade variable. 6. Examination of variations in price cost margins of individual sectors with the objective to determine the effect of trade liberalization, in the presence of important sector and structural variables.

The thesis is composed of five chapters. **Chapter 1** explicitly describes the trade protectionist measures and how they have influenced the performance of the manufacturing sectors. It describes identifiable reform episodes, their characteristics and effectiveness. Various complementary issues related with trade liberalization are discussed. Chapters 2 to 5 contain the empirical work of the study. **Chapter 2** is mainly the literature review and discusses the methodology to measure total factor productivity, and computes total factor productivity for each sector. **Chapter 3** reviews the literature on total factor productivity and reform. It also provides a statistical description of the manufacturing sectors. The empirical work explores the relationship between total factor productivity and alternative trade measures. **Chapter 4** presents the literature review on technical efficiency frontier, and the relationship between trade liberalization and technical efficiency. The empirical part of this chapter contains the discussion of methodology, calculation of the time varying technical efficiency estimates for a panel of the four major sectors by stochastic frontier function and the analysis of the results. **Chapter 5** follows the same pattern and begins with the literature review on the association between price cost margins and trade policies and progresses to the empirical estimation of the price cost mark ups for each sector. Finally these mark ups are related with main trade measures in the presence of sector specific variables and a proxy for market structure of the industry.

The empirical research shows that the Levinsshon-Petrin methodology to estimate production function parameters and total factor productivity is preferable to other methods that do not account for endogeneity. Trade liberalization does not appear to have any effect on industrial productivity despite the fact that sophisticated econometric techniques were employed with alternative trade measures. Similarly technical efficiency is found to be positively influenced by trade reform in two out of four sectors, but this result holds true for only two out of five trade measured used. However the relationship between price cost margins and trade policies is emphatic and profound as it points towards a significant route through which trade policies are affecting the total factor productivity and profitability of the manufacturing. It appears that trade protection policies have engendered specific oligopolistic structures dominated by large sized producers, which seem to impede the realization of desirable outcomes of trade liberalization policies. Reallocation of resources from inefficient to efficient producers and pro competitive pressures for improving efficiency following trade liberalization have not occurred due to these structure which have to be modified in order to reap the domestic effects of trade reforms.

CHAPTER 1

Trade liberalization and industrial sectors

1.1 Introduction

Trade policies in Pakistan have been used as a vehicle to direct the industrial sectors towards planned objectives. These objectives have historically remained the same, providing protection to the domestic import substituting industries and promoting the export oriented sectors. The instruments applied to carry out protection and promotion have rarely varied. Since 1950's, import substituting industries gained protection through non-tariff barriers, licences, quotas, and bans on imports. Tariffs were also used but principle instruments for more than three decades, 1950-1980, were quantitative restrictions. Tariffs during this period were high but served only revenue raising function. After the abolition of non-tariff barriers, tariffs started playing the dual function of protection and revenue.

Trade protection was enormous and complex due to multiple instruments used to implement protection. Manufacturing industries responded to the protectionist and promotional incentives favourably but the structure and nature of their initial response has persisted. Import substituting industries matured and progressed into export markets to start gaining export incentives. After this, there were no more industries entering into export activity and both import and export industries became heavily dependent on protectionist policies.

With the various instruments of protection for indigenous industries and promotion for export industries, attempts have been made in each period to introduce reforms and hence it is possible to identify episodes of liberalization. Despite efforts to reduce and eliminate quantitative restrictions and liberalize trade, it took 30 years to complete one phase of liberalization, replacing quantitative restrictions with tariffs. The reform measures were carried out in each successive government during these years but the intensity and pace of reform measures varied and periods of comprehensive reforms can be distinguished from inconsistent piecemeal reforms. Apart from the reform period in 1971 when swift measures were quickly implemented in a short span of time, other phases are characterised by very slow pace. The last phase of reforms is continuing and consists of rationalizing tariffs which requires a tricky balance due to the fiscal deficit and the revenue implications. The issues require detailed analysis to arrive at some judgement about the degree of success of reform measures. The composition of imports, exports, the structure of protection and complementary macroeconomic policies including the tax system and structure need also be examined in greater detail. This chapter deals with types of trade restrictions applied, the structure of protection, its consequences, various attempts to liberalize trade and their effectiveness.

1.2 Non-tariff Barriers

A distinction can be drawn between price and non price measures of trade protection prevalent in Pakistan. Non price measures included quotas, bans and licensing which persisted for three decades. Price measures comprise tariffs, import surcharges and other import fees. Both kinds of measures influence foreign trade and resource allocation through their effect on domestic prices, but the effect on domestic prices caused by quantitative restrictions is profoundly high. Tariffs also cause increases in prices but these increases are easy to determine and document and less distortionary while those induced by licensing and quantitative restrictions are less easy to measure and more distortionary.

Both kinds of measures were simultaneously applied until the elimination of non tariff barriers implying that serious distortions as a result of these measures are expected to appear in the indigenous manufacturing industries. Moreover, the structure of protection also comprises many concessions intended to promote exports such as sales taxes and income tax rebates on exports, tax exemptions and concessionary export finance.

As the historical and initial conditions of a country matter, so analyzing the trade policies from the early period is relevant. Until the elimination of non tariff barriers, the tariffs were mostly redundant as non-tariff barriers were the determining factor of protection driving a wedge between domestic and world prices. Licensing and quantitative restrictions used on imports, influenced the composition of imports and were a crucial factor in determining the profit margins of domestic producers. These protective measures created incentives for the domestic producers in those areas of industrial activity where the profit margins induced by protection were very high. This system of import licensing regulated by quotas determined the pattern of industrial production.

Import substitution functioned in its strictest form in 1960s with three kinds of import licensing systems: one controlling government imports, another controlling capital imports for private sector industry and one that controlled consumer goods, industrial raw materials and spare parts. The structure of imports was determined by the policy, giving lowest priority to consumer goods, particularly luxury items and high priority to raw materials, spare parts and machinery. There was a pronounced bias favouring domestic investment in consumer goods. Capital imports for industry were regulated in accordance with the sanctioning of investment in the industries listed in the industrial investment schedule. Licensing authorities ranked capital goods imports as relatively more important than intermediate or consumer goods and there was a strong bias towards capital goods imports.

Tariff structure was markedly cascaded and supported this non tariff protective structure. The lowest duties were levied on machinery and equipment, higher duties on unprocessed raw materials, higher still on processed raw materials and highest on non durable consumer good, particularly luxury goods. There were two categories of importers, commercial and industrial importers. Industrial importers could register as such if this investment has been sanctioned by other government agencies and import according to the ceilings based on the installed capacity of his manufacturing unit.

Licensing procedures were very complex until 1972 when they were considerably simplified with the change of government. Imports up to 1982-83 were licensed on the basis of free and tied list. Products on tied list could be imported from specified sources, by specified users or by public sector only. Products on free list could be imported from anywhere after obtaining a valid import license. Licenses were still required for both lists and issued in accordance with quota restrictions imposed by the government. In 1981 as many as 406 out of 435 products on free list were subject to quantitative restrictions. During the 1980s, the licensing system changed to a negative and restricted list. Products on the former cannot be imported into the country while those on the restricted list were subject to different restrictions including origin of imports, type of users, safety and health standards. The products not appearing on either list were freely importable.

The quantitative restrictions and licensing were still formidable enough to drive a wedge between domestic prices and international prices of comparable imported goods. The erstwhile importers became established industrialists with sanctioning of their investments and were able to buy imports at tariff inclusive import prices while the other producers who did not hold licenses had to pay a scarcity premium to commercial importers which exceeded duty paid prices by a wide margin. The average percentage mark up arose due to these binding quota restrictions and by definition it implied.

(The domestic market price - landed costs) / landed costs.

Landed costs here included c.i.f prices, import duty, sales taxes and other handling charges. The average mark up was about 60% in 1960s. With the changes in licensing, substantial mark ups still existed on imported goods during 1970s. The mark ups computed for 135 commodities in 1979 (Kamal et al 1981) revealed the binding nature of Non tariff barriers causing high scarcity premiums. The commodities covered in that survey included consumer, intermediate and capital goods. The average mark up on all products exceeded 30% while the scarcity premium on capital goods (42.9%) was highest followed by that on consumption goods (37.5%) and intermediate goods (25.6%).

Lewis (1970) indicates that licensing system was also characterised by 'banning' of certain commodities, which has the impact of increasing the degree of protection to competing industries by substantial amounts. The severity of import quota restrictions was calculated in Guisinger and Scully (1991) study for a period of 20 years, 1960-1982. The index of import restriction was computed from the objective information of import quota restrictions for 39 products, in consumer, intermediate and capital goods.

The scale runs from 1-5, 1 denotes the most liberal treatment applied to the goods appearing on the free list, open general licensing, and goods eligible for automatic licensing. These categories represent the most liberal treatment meted out to a particular sector or its import competing goods. Scale 5 represents the most binding import quota restrictions and is applied to the goods subjected to the tied list, negative list, restricted list, banned list and goods imported through Trading Corporation of Pakistan. According to this, consumer goods imports received most illiberal treatment followed by intermediate goods and least liberal treatment was accorded to capital goods imports until 1972. The gap in the degree of restrictiveness was narrow until 1972 but widened afterwards. From 1973 onwards until 1983, intermediate goods received the most liberal treatment and the severity of restrictions which stood at the value of 3.2 in 1972 has remained consistently 1.4 during 1973-82. By 1977, there was substantial decline in the import quota restrictions for capital goods which stood at 3.8 and 3.1 in 1970 and 1971 respectively but the value decreased to 1.80 in 1977. From 1978 until 1982 however, the scale has stayed at 2.3. Consumer goods imports have shown very nominal change in the protection by import quota restrictions, as they have been the most restricted category, for which the highest value stood at 4.4 during the early years 1970s, decreased to 3.3 in 1975 and persisted at this range for rest of the sample years.

Stringency of quota restrictions and gradual change over a period of 23 years for imports by economic category is depicted in table 1.1. The table shows the share of imports by economic categories and their corresponding mean values of quantitative restrictions taken from the study by Guisinger & Scully (1990). The share of intermediate goods imports have shown the consistently highest increase during 1970-83 and the quantitative restrictions for this category after 1972 hovers around 1.40 mean value except the year 1983 when there is marked increase to 2.80. Share of capital goods imports has been fluctuating, dominating nearly 35% of total imports and in some years even more until 1979 and after that a decline is apparent. The mean values of quantitative restrictions have increased in the late years of 1970s until 1983 when it decreased to 1.70.Consumer goods is the most restricted category with the share in total imports decreasing substantially in 980s while mean values of quantitative restrictions achieved the maximum reductions in 1973 and 1974 and after that has persisted around 3.30 .

Despite the fact that the intensity of import restrictions enormously declined apparent from the change from most illiberal to liberal treatment, many sectors were subject to high quantitative restrictions. Non-tariff barriers were principal determinant of protection and a binding constraint while tariffs only served the revenue raising function until 1980-81. Nominal protection rate which is useful to indicate the relative importance of quantitative restrictions and tariffs has been measured in two studies of Naqvi (1991) and Kemal (1994). Both the studies provide an excellent comparison of how much the extent of protection has decreased and evolved over a period of ten years 1980-81 and 1990-91 respectively.

Table 1.1

Index of quantitative restrictions and shares of imports by economic classification (1970-1983)

Year	Share of capital goods	QRs for capital goods	share of intermediate goods	QRs. Intermediate goods	consumer goods share	QRs. Consumer goods
1970	52.33	3.80	36.98	4.10	10.69	4.50
1971	42.40	3.10	34.85	3.90	22.75	4.40
1972	29.76	2.40	40.65	3.20	29.59	4.40
1973	29.49	1.70	46.67	1.40	23.84	2.30
1974	29.40	1.90	48.07	1.40	22.53	2.60
1975	34.98	1.30	43.83	1.40	21.19	3.30
1976	38.02	2.30	46.11	1.70	15.87	3.00
1977	33.49	1.80	46.54	1.40	19.97	3.30
1978	30.15	2.00	48.30	1.40	21.55	3.30
1979	35.54	2.30	48.48	1.40	15.98	3.50
1980	27.79	2.30	57.69	1.70	14.52	3.50
1981	29.43	2.30	56.44	1.40	14.13	3.30
1982	31.01	2.30	54.91	1.40	14.08	2.50
1983	31.83	1.70	54.16	2.80	14.01	3.30

Source : Guisinger & Scully (1990)

Two types of nominal protection rates, explicit and implicit rates, respectively denote the protection through import duties and the differential between domestic and world market prices. This differential is caused by various tariff and non tariff barriers and the extent to which either tariff or non tariff barriers are binding. It has been suggested that in case of binding quota restraints, implicit nominal protection rate is higher than that of explicit rate implying that domestic prices are higher than duty paid prices of comparable imported products. Tariffs in this case do not determine the level of protection, but serve only to raise revenue. If tariffs are binding, the explicit nominal protection is equal to implicit nominal protection rate and tariffs determine the level of protection. When explicit nominal protection rates are higher than implicit rates, prohibitively high tariffs block imports.

Comparison of both these nominal rates for 1980-81 and 1990-91 reveal that quantitative restrictions have undergone substantial reductions and in 1990-91 tariffs are the determining factors for providing protection to domestic industries. According to Naqvi (1991), in 34.4 percent industries, implicit nominal protection was higher than the explicit protection implying that quota restrictions were binding. In 1990-91 however only 2 percent industries show the higher implicit nominal rates indicating that quantitative restrictions were no longer playing a dominant role in determining the domestic prices. Tariffs were, however, prohibitively high in 1990 as the explicit nominal protection was higher than implicit rate in 71 percent industries as compared to 57.8 percent industries in 1980-81. In 26.3 percent industries in 1990-91 tariffs were a binding constraint, a case of explicit nominal protection being equal to implicit nominal protection rate, as opposed to only 7.8 percent industries in 1980-81. It is clear that focus had shifted to the use of tariffs as an instrument of protection.

1.2.1 Effective protection rates

As various forms of protection were used, implicit effective protection rates are required to demonstrate their relative effects. These measures depict the intensity and degree of implicit protection at a point in time. Two studies mentioned above, deserve the credit for computing the effective protection rates for manufacturing industries of Pakistan, one pertains to the year 1980 (Naqvi and Kemal 1991) and the other to the year 1992 (Kemal 1994). They amply demonstrate the relative change that has taken place in the structure of protection. Both clearly depict the enormous amount of protection provided to manufacturing industries until 1990. Naqvi (1991) dealt with 750 firms of 90 industries while Kemal (1994) conducted his survey for 1000 firms in 72 industries.

The effective protection rate is useful because it takes into account the effect of all incentives and summarizes the combined effect of diverse policy instruments used for protection or promotion of domestic industries. Naqvi and Kemal (1991) computed the implicit effective protection rates defined as 'percentage excess of value added at domestic prices over the value added at world prices' (Naqvi 1991, page 8) and is computed as :

$$IEPR = \frac{VAD - VAW}{VAW}$$

VAD equals value added at domestic prices and *VAW* equals value added at world prices. The procedure adopted to obtain values at world prices for this calculation works by deflating the domestic prices of goods in import substituting industries by the percentage excess of these prices over c & f prices of imported goods. In export sectors, export subsidies or taxes indicate the differences between domestic and world prices.

Effective protection rates were calculated for a sample of 750 firms representing 90 industries and believed to contribute 25 percent to the value added in large scale manufacturing in the year 1980. The sample is assumed to be fairly representative of the manufacturing sectors as the survey included firm level data by type, size and location and in large industries 10% of the firms were taken into the sample.

The earlier study of Lewis and Guisinger (1971) showed that the intensity of protection increases with the stage of processing as the highest protection is accorded to finished goods, followed by intermediate goods and capital goods. The table below (Table 2.2) shows a comparison of the change in structure and degree of protection by stage of processing.

Table 1.2

Comparison of average effective protection rates by stage of processing:

Year	Average effective protection %	Finished goods %	Intermediate goods %	Capital goods %
1963-64	271	883	88	155
1980-81	66	26	235	10
1990-91	77	43	93	89

Source : Navy (1990), Kamal (1994), Lewis (1971)

The effective protection rate shows a cascading structure in 1963-64 but this cascading is not present in 1980-81 and 1990-91. Secondly, the average rate of protection considerably declined between 1963-64 and 1980-81 but increased further in 1990-91. In 1963-64, the protection to final finished goods was highest but in 1980 for both capital goods and finished goods the decrease in the rate of effective protection is very sharp. However for intermediate inputs, the protection more than doubled and hence the decrease for two other categories is neutralised by this heightened protection to intermediate inputs. The same structure prevails in 1990-91 as intermediate inputs are the most protected followed by capital goods while consumer goods are the least protected. The level of protection nearly doubled for finished and capital goods, from 26 in 1980-81 to 43 in 1990-91 for finished goods, and from 69 to 89 for capital goods respectively. Intensity of protection for intermediate goods drastically reduced from 235 in 1980-81 to 93 in 1990-91. The average level of effective rate of protection stood at 66 in 1980-81 but again increased in 1990 to 77. The change in intensity of protection was just a movement in protection form one category to the other as in the highest protection given to finished goods was replaced by higher input protection which contributed to reducing the overall average effective protection rate. On the contrary, decrease in intensity of input protection is not reflected in the reduction of overall average effective protection as the finished and capital goods showed a remarkably high increase in protection rates.

Both the studies of Naqvi (1991) and Kemal (1994) divided the firms in small medium and large and compared their rates of effective protection. The firms employing 10-50 employees are considered small, those employing 51-100 are termed medium while large firms employ 101 and above employees. All firms employing up to 10 employees are then excluded from the sample.

Table 1.3

Effective rate of protection by size of the firms

Year	Average	Small	Medium	Large
1980-81	66	38	86	51
1990-91	77	69	136	75

Medium sized firms received the highest effective protection, higher than the overall average in both the periods. Small firms are the least protected in 1980-81 and in 1990-91. The large sized establishments follow medium firms, but the level of their protection is lower than the overall average in 1980-81 but much closer to average in 1990-91. The intensity of protection in these individual size categories increased manifold over time. Medium sized firms are most effectively protected and this trend has persisted in these ten years (Table 1.3).

Comparison of effective protection rates according to these two studies by individual industries is presented in Appendix Table 1.1. Interpreting the values of effective protection rates requires an understanding of the distinction between positive protection, negative protection and negative value added at world market prices. If implicit effective protection rate is positive, the industry is said to be protected. If the value is less than zero and falls between 0 and -100, the industry is negatively protected. For values less than -100, value added at world market prices is said to be zero or negative and such industries represent the cases of extreme protection (Naqvi 1990).

Appendix Table 1.1 on effective protection rates for major sectors in 1980 and 1990 depicts the changes in the rate of protection. For some sectors the protection has enormously increased while for some others it has reduced or remained the same. In 1980-81 in food manufacturing sector, four sectors were negatively protected and they included hydrogenated vegetable oils, rice milling, wheat milling and beverages. Of these four, the degree of protection has undergone marked change for vegetable oils from negatively protected to extremely high rate of protection in 1990-91. For rice milling, the protection changed from negative to highly positive. For beverages there is no change and the sector is consistently negatively protected. For the rest of sectors in food group, level of protection increased tremendously, particularly for refined sugar, and tea blending. Refined sugar was enjoying moderate level of protection which was less than the overall average for manufacturing, experienced heightened protection.

In the textile sector, spinning received infinitely high protection in 1980 which reduced to moderate protection by 1990-91. Silk and artsilk textile was penalised in 1980-81 and the situation improved in 1990-91 with an increase in rate of protection above the average protection of the manufacturing industries. Carpets, knitting mills and wearing apparel received moderate protection in 1980-81, lower than the manufacturing average. However in 1990-91 wearing apparel received positive protection while for carpets the level of protection increased. Knitting mills also received higher than average protection in 1990-91. For spinning, weaving of cotton, narrow fabrics and made up textile goods, the rate of protection has decreased considerably. Jute textile was positively protected but by 1990-91 the protection level increased to an infinite degree.

Cement and cement products, printing and publishing were negatively protected in 1980-81 but by 1990 rates of effective protection turned highly positive. Paper board and products, iron and steel and sports equipment were highly protected sectors in 1980 but the rate of protection decreased considerably in 1990-91. In chemical, rubber and plastic most of the sectors experienced much higher rate of protection in 1990-91 as compared to 1980 and for some the protection reached an infinitely high rate, such as petroleum products, other rubber products, soaps and detergents. Drugs and pharmaceutical products received a higher rate of protection in 1990 and so too did fertilizer.

Sub sectors in metal products, machinery and equipment were not included in great detail in the 1990-91 survey as they were in 1980-81. In 1980-81, many of those included received moderate levels of protection, lower than the manufacturing average. Only five received positive high protection while just one enjoyed infinitely high protection. Three of the sectors, agricultural machinery, electrical transmission equipment and industrial electrical machinery were penalised. Of these three there was a change in protection for two in 1990-91 from negative to positive high rate of protection. Motor vehicles received moderate protection in 1980 but got infinite level of protection in 1990-91.

Of the total industries surveyed in 1980-81, 9 industries appeared with negative value added, 27 industries with high level of protection and 24 industries received moderate level of protection. Twenty two industries appeared to receive very low protection or negative treatment. In 1990-91, 11 industries representing 5.7 percent of the total number of industries appeared to experience extremely high level of protection causing negative value added. A very large proportion, 55.7% of the total industries received protection at a level higher than the average protection for manufacturing. Twenty percent of the industries, 14 sectors received moderate protection, the rate of protection is less than average.

Naqvi (1980) found that export oriented sectors were the most highly protected sector, more than the import substituting industries. The situation changed in 1990-91 with the export industries receiving the least protection while the import competing industries received the highest amount of protection. Non import competing industries were also protected in 1980 but in 1990 appeared to be negatively protected. Import competing industries received higher protection than those industries which are both export oriented and import competing. The initial move from import substitution to export oriented industries had taken place by 1980 and it was accomplished by export subsidies. It can be suggested from the lowest incidence of effective protection for export sectors in 1990-91 that export subsidies have been curtailed significantly.

It can be seen from the various studies conducted into the level of protection and the shares of imports by economic categories that the trade regime is undergoing gradual change. There has been a sea change in the average level of effective protection from 1960s until 1990. In its current stage, intermediate goods are the most highly protected by the combined effect of diverse policy instruments. This change in structure of protection away from consumer goods to intermediate goods took place in 1990-91. Another development that has occurred during this decade is the relatively greater reliance on the tariffs to provide protection and extinction of the non tariff barriers. The number of industries with binding tariff was negligible in 1980-81 but substantially increased in these ten years. By 1990-91 percentage of industries with binding quota restrictions, with implicit nominal protection rates higher than explicit rates, is negligible. In 1990s hence, tariffs can be said to determine the domestic prices and the degree of protection to indigenous industries.

1.3 Tariff and taxes

Tariffs served the dual functions of raising revenue and supporting other quantitative policy instruments protecting manufacturing industries. They were relatively more important and preferred source of raising revenue among other forms of indirect taxes such as sales and excise taxes. Over the years, during the process of dismantling non tariff barriers e.g. quota restrictions and licensing, tariffs started exerting greater influence on the incentive structure in Pakistan.

Tariff structure has remained cascaded with the higher rate imposed on higher stage of production at the consumer goods level followed by intermediate raw materials and capital goods (Appendix Table 1.2). The rate is represented by the effective rate which is the ratio of duties collected to the total value of imports since not all statutory duties are fully paid due to various exemptions, concessions, and provision of duty free imports. In 1990-91 the highest rate of import duty of 90% was charged on consumer goods while the minimum of zero percent on basic raw materials, foodstuffs, medicines and some essential inputs (Kemal 1994). Average rate of statutory import duties have remained quite high but are being reduced gradually, it was 79.2% in 1982-83, came down to 59.8% in 1990-91 and further reduced to 58.2% in 1993-94. In 1995, the simple average of statutory duty rate was lowered to 50%, with the highest rate of duty levied at 79%.

Much progress in reducing and rationalizing the tariff structure took place after 1987 and from 1988 to 1995 the reduction in statutory rate was from 77% to 50% (it was reduced to even 35% in 1997 but that period is beyond the ambit of this study). The import licensing and restricted list (including items to be importable from designated sources) was eliminated during this period, in 1993. The number of items on the negative list which prohibits the importation of these specified items, has been significantly reduced from 300 to 75 items until 1995. The negative list items are prohibited for import on religious, health and safety reasons but also include textile and clothing goods which could not be imported. Import quotas on machinery and millwork were eliminated by 1995. The standardization requirement for agricultural machinery and certain kinds of motor vehicles which require the imports of only specific makes has also been done away with. Apart form statutory rate of import duties, a number of other fees and duties were levied such as 6 % import fee, 5 % iqra surcharge and other regulatory duties. In 1995, this complexity was removed by unifying these para tariffs into a single customs tariff.

Keeping in view the fact that tariff structure and rates are in a continual flux, the difficult fiscal situation facing government during the later half of 1980s creates a dilemma. The commitment to stabilization program in 1987 requires narrowing the fiscal deficit. However, reducing the trade taxes can result in lowering the revenue and hence enhancing the fiscal deficit. The share of trade taxes in total taxes, type of trade reforms and the nature of protective structure are important factors to be considered while implementing tariff rationalization.

Total tax revenue has traditionally constituted nearly 14 percent of GDP and of this indirect taxes form a greater proportion from 1981 till 1999. The indirect taxes contributed almost 12 percent of GDP in the later half of 1980s but in the beginning of 1990s the ratio declined. Direct taxes have never been more than 2-3 percent of GDP, in 1980s' the ratio is nearly 2 percent and there is a slight increase in the early years of 1990 but still the gap between direct and indirect taxes is quite wide (Appendix Table 1.4).

Trade taxes have formed the bulk of revenue from indirect taxes while the share of indirect taxes in total tax revenue has remained as high as 80% until 1990-91. After that the share of indirect taxes in total tax revenue slightly decreased (Appendix Table 1.4). It is interesting to see the varying movement in the composition of indirect taxes since 1980. Customs duties constituted the major share of indirect taxes and traditionally this share stood around 50% and even crossed 60% in some years' i.e.1986-87 but since then the share of import duties steadily and significantly decreased (Appendix Table 1.5). The shares of other constituents of indirect taxes, sales tax and central excise taxes are on the rise. Initially share of sales taxes hovered around 10-11% but after 1986-87 the change was considerable with contribution from sales taxes increasing each year. By 1995-96 share of sales tax in total indirect taxes stood at 26.3%. Share of central excise also increased but is fluctuating. After 1989-90 a clear increasing trend is evident (Appendix Table 1.5, Figure 1.1).

The trends in the shares of customs, sales and excise duties in total taxes, indirect taxes and GDP represent a declining trend for customs duties, and increasing trends for sales taxes as part of total taxes, indirect taxes and GDP (Appendix Tables 1.6–1.8). Custom duties have remained crucially important until 1992-93 but sales taxes and excise duties have now assumed greater importance in the fiscal scenario faced by Pakistan. Sales taxes are imposed on both imports and domestic production at a standard rate of 15%, the rate was 12.5% until 1993. Sales tax revenue has grown rapidly over the period 1984-85. Its share in total tax revenue has increased from 7.5% in 1981-82 to 16.65% in 1995 and further to 29% in 1999. Central excise duty constitute the third important part of indirect taxes but unlike sales taxes and customs duties, its growth has been stagnant and slow since 1983-84.

Sales taxes were collected only at import and local manufacturing stages and not at retail trade stage until 2000. Hence most of the value added at the retail stage was not subject to sales taxes. Until 1992-93 a large number of products were exempt from payments of sales taxes including live animals, meat, fish, dairy products, tea, cereals, plants, drugs, medicines, newspapers, journals, fertilizers, insecticides and pesticides. Consequently sales tax revenue came from a few products. Six products, cement, cigarettes, iron and steel, man-made fibre and yarn, lubricating oil and motor cars have accounted for almost half of sales tax revenue from domestic production (Kemal 1994).

Figure 1.1 Composition of indirect taxes(%)

There was growing pressure from international donors and pressing need for mobilization of resources to shift the collection mechanism from manufacturing and import stage to retail stage and introduce VAT type economy since value added at retail stage was not taxed. The pressure was intensely resisted and withstood by trading community and even though they were able to pass VAT on to the consumers, they did not want documentation of the economy which could result in greater payments of income taxes on their part. However despite pressure tactics and lobbying, general sales taxes at retail stage was implemented in 1999.

Similarly, slow growth and stagnation in central excise duties is caused by limited coverage and concentration on a few products. Second reason for poor showing is that the industries subject to central excise duties have grown at a relatively slow rate. Small number of additional items has been put on the list subject to CED (central excise duty) and many among those are subject to specific duty rates which are not always adjusted upwards with price increases of products.

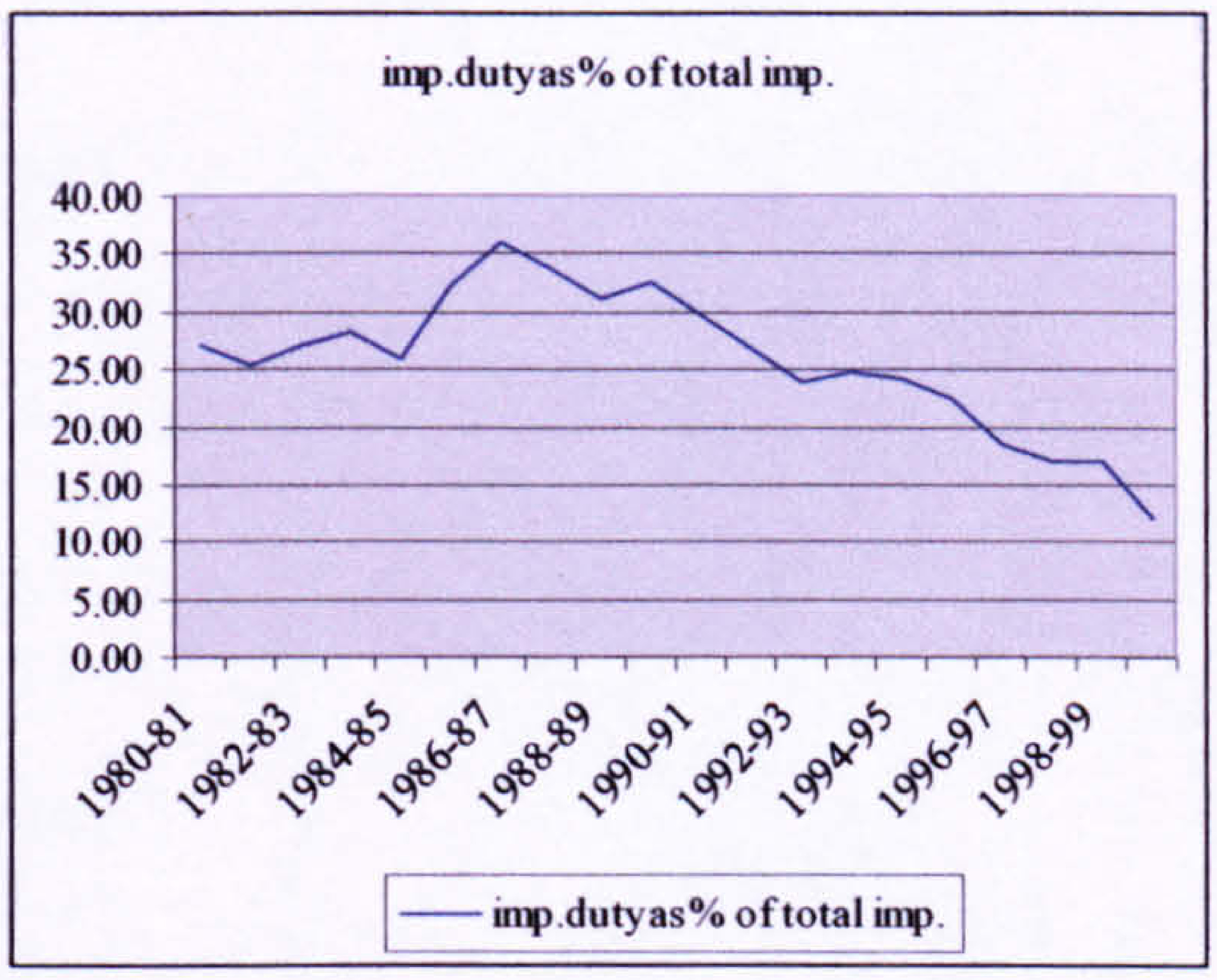
Tax system is still ridden with various fiscal incentives offered to manufacturing sector which include tax holidays, duty exemptions, accelerated depreciation allowances. The objectives of these fiscal incentives are to tax industrial profits less highly than other forms of income and to encourage investment in manufacturing. However fiscal pressure resulting from the overall tariff reductions necessitates a rethinking about the rationale and utility of these fiscal incentives.

The revenue motives and protective motives can be in conflict since the tariffs of the most protective nature can score badly on revenue raising side. Hence whether trade reforms are revenue contracting or revenue enhancing depends on whether the initial rate of tariff was above the revenue maximising level or not. The rates above the revenue maximising level are the protective ones and their reductions to the revenue maximising level will enhance the revenue collection by reducing the tariff evasion and smuggling activity.

Phasing of reforms in a sequence of replacing the non-tariff barriers with tariffs while reducing tariffs to their revenue maximising level can offset the revenue contraction impact of tariff reductions. Pakistan has followed the same sequencing pattern in which non tariff barriers have been first removed. In the second stage the tariffs are continually being reduced. However multiple concessions, exemptions and duty free imports are still an important feature of the trade policy incentives. These result in overestimating the protection applicable through statutory rates since statutory rates are less than applied rates because of special regulatory orders meant to extend exemptions and concessions. Despite very high taxes on international trade, revenue from import duties as a percentage of total imports are low as can be seen from the Appendix Table 1.3 and Figure 1.2. Import duty as a percentage of total value of imports was highest during mid 1980s and since then there is a persistent decline.

Figure 1.2

Import duty as % of total imports



After reduction and removal of the non-tariff barriers, the capacity of tariffs to accurately measure the differential between domestic and world market prices was undermined due to widespread smuggling, under invoicing of imports, exemptions, concessions, rebates, refunds and duty free imports. Statutory tariffs hence overstate the extent of protection implied and must be adjusted to account for the revenue forgone by exemptions and duty free imports.

Concessions and exemptions are granted for various objectives and some of these relate to specific industries which are allowed to import raw materials at reduced duty or duty free or industries located in export processing zones, in order to encourage investment in backward areas, to privileged persons or organizations such as U.N. diplomats and senior Pakistani officials. These concessions and exemptions are granted through various Special Regulatory Orders (SRO). According to an estimate (Kemal 1994) total imports covered by SROs amounted to Rs.52 billion in 1992-93 and goods worth Rs.33 billion out of this amount were imported duty free.

The extent to which the duty free imports overstate the amount of tariffs can be gauged from Kemal (994). After adjusting for duty free imports the rate of duty comes to 39% and 35% in 1990-91 and 1992-93 respectively while the average rate of import duty including duty free imports in these two years is 20% and 21 % respectively. The proportion of duty free imports has fallen after 1992-93. This decreasing trend is indicative of the withdrawal of concessions and exemptions but the share of duty free imports in capital goods category has sharply increased due to concessions granted for import of machinery in specific industries, areas and industrial estates.

Smuggling and under invoicing of imports which siphon off the revenue can be attributed to very high tariff rates. This renders the tariffs redundant as an objective of protection. It creates distortions since income and profits generated by these activities are not documented and hence escape taxes. Smuggling and faking of invoices occur as the traders engaged in these activities face incentives of reduced costs as compared to the import duties they would have to pay for legally importing.

An effort to determine the extent of under invoicing of imports by comparing the data of partner country in 1988 illustrates the existence of high underinvoincing in many industries (Mahmood et al 1993)). It was found that the importer has an incentive to under invoice imports if he has to pay less black market premium on foreign exchange as compared to the rate of import duty. This becomes possible also because of the inadequacy of the customs authorities who cannot use a reliable yardstick to prevent faking because nature of commodities makes it easy to distort international standard price (Mahmood et al 1993).

The study included six major trading partners of Pakistan, i.e. France, Germany, Italy, UK, Japan and Netherlands. These countries accounted for 40% of Pakistan's total imports in 1988. A clear under invoicing of imports was found to exist in chemicals, machinery, transport equipment and miscellaneous manufactured goods. Majority of commodities showing under invoicing have high import duties.

Presence of large scale smuggling and under invoicing suggests that there is considerable scope for tariff rationalization. Administering income based and consumption based taxes requires technical sophistication and increasing their share in total taxes requires that tax system and structure should complement trade reforms to compensate for the consequences of revenue loss by reducing dependence on trade taxes. As has been discussed above after 1988, Pakistan is steadily pursuing the recommended sequencing of trade reforms in first eliminating the non-tariff barriers, reducing the dependence on trade taxes and increasing the shares of sales taxes and central excise taxes.

1.4 Fiscal Incentives

Apart from trade protection, manufacturing industries were provided a number of fiscal incentives. They included tax holidays, tax rebates, depreciation allowance and availability of credit at less than market rates. Fiscal concessions encouraged demand for investible funds in the wake of limited capital availability. This led to credit rationing which was distorted further by political involvement at the level of decision making in the state owned development finance institutions. Instead of evaluating the projects on the basis of economic viability, bad projects were financed on the basis of political links.

These fiscal incentives affected the productivity because most of these concessions such as tax holidays and accelerated depreciation were available for setting up of new industries instead of expanding the existing units. This holds true for the preferential credit facility for new business enterprises. According to an estimate, in the period between 1980-81 and 1988-89, investment in new units amounted to nearly 75 percent (Hamid 1992).

Fiscal incentives are provided either to encourage specific industries or setting up of industries in backward areas. As far as the specific industries are concerned, Hamid (1992) mentions few high tech industries such as bio technology, solar energy equipment, computers and software equipment. The promotional policies for these sectors are flawed because of the absence of comparative advantage. The presence of educated human resources and workforce would be a comparative advantage for these kinds of industries. However, the focus has always been on providing fiscal incentives instead of training, providing know how and building infrastructure for promoting industrial development in backward areas. Additionally in some industries the anomalies present in the structure of protection are inhibiting. For example, in computers and fertilisers, the finished products are exempt from import duties while the components or raw materials required are subject to customs duties.

Regarding the objective of encouraging location in specific backward areas, the policies of tax holidays and exemption of import duty on capital equipment are significant incentives and have proved attractive for bringing investment to industrial estates. However, the industries established by these incentives will again be capital intensive and will not fulfil the objective to generate large scale employment in the area. The cost to the economy overall is the revenue forgone which is more pronounced if the effectiveness of these fiscal privileges is not fully established. Export industries are provided with incentives in the form of duty drawbacks, income tax rebates and subsidized credit. The principal raw materials for some exports, such as textile and leather are available at lower than world market prices because of the export taxes levied on their exports.

1.4.1 Trade and financing incentives for exports

a. Trade incentives

Exports were provided incentives through different trade related as well as financing facilities. Four trade related schemes intended for promotion of exports were duty drawback, bonded manufacturing warehouse, temporary importation and raw material replenishment. The objective of these schemes is to remove anti-export bias and enable exporters face the free trade environment and hence neutralise incentives between export and import competing industries. In nearly all these, the exporters can claim a refund of custom duties, surcharges, sales and excise duties on imported inputs (duty drawback). Alternatively imports can be obtained duty free by keeping them in a bonded warehouse from where they can be removed for production (bonded manufacturing warehouse). The exporter is also allowed to import components free of any duty or tax for re-exporting provided these parts are easily identifiable at time of export. This scheme has proved of limited use because of the difficulty involved in identification. Another scheme aimed at providing restricted import items required for production by exporters is, raw material replenishment scheme, which permitted exporters to have the import licenses for goods on banned or restricted list. Many of these items used to be consumer goods which carried high scarcity premiums and though it was not legal to transfer these licenses they could be marketed at high premiums.

b. Export Finance scheme

Export finance scheme was initiated in 1973 and it provides concessionary credit facility in the form of short term working capital for pre-shipment and post shipment periods covering all manufacturing commodities except a few items on negative list. There are two parts of the scheme, the first part is divided into two parts called ERS I and ERS II (Export refinance scheme). In ERS I, the exporter gets access to short term concessionary credit on applying with the proof of either export order or confirmed letter of credit. The conditions under which the commercial banks extend credit facility depend on their assessment of the creditworthiness of the exporter and credit limit is sanctioned according to the amount of collateral presented. The maturity period for the credit is 150 days and the exporter has to provide the undertaking that the finance will be exclusively used for exports.

ERS II is meant for exporters of locally manufactured machinery exports. LMMRS (locally manufactured machinery refinance scheme) provides long term finance for export of machinery containing not more than 20 percent imported components. Commercial banks and development finance institutions (NDFC National Development Finance Corporation and BEL, Bankers Equity Limited) operate this scheme and the interest rate charged to exporter is 6 percent. The financial institutions enjoy spread of 3 percent while State bank of Pakistan refinances at 3 percent. Credit facility under ERS II is not as fully utilised as under ERS I.

The second part deals with those established export producers who get automatic access to export credit up to a certain limit, on the basis of previous export performance. The performance of these exporters is continually monitored by the State bank of Pakistan on the basis of export receipts. The rate of interest charged was 2.5 percent prior to 1985 but increased to 6 percent afterwards. The State Bank of Pakistan provides refinancing to the commercial banks at a rate of 3% for the export credit they extend to exporters and hence they get a margin of 3%. The constraints are however placed on the maximum amount to be credited within the overall credit ceiling that the commercial banks are subject to.

Short term credit is mainly operated by commercial banks and foreign banks while long term credit is operated by development finance institutions. The State Bank maintains overall control on bank lending and allocates credit ceilings to the individual banks for private and public sectors, exports and priority sectors. Banks are supposed to meet targets for allocation of credit to specific sectors. The allocation of credit ceilings by State bank to commercial banks and financial institutions and specific allocation of credit for sectors is in accordance with the annual credit plan devised by National Credit Consultation council entrusted with formulation of credit policy of the country.

The control of banks over the mobilizing of funds and pricing of credit is restricted by the mandatory credit ceilings and by the fixing of interest rates by State Bank. The lending rates pertain to general, industrial and export finance categories. The general lending carries a rate of 14-20 percent, industrial carries a rate of 12-14 percent while export finance is credited at a rate of 6 percent. Deposit rates are also determined by State Bank of Pakistan, as notice deposits at rate of 5-6 percent, saving deposits at a rate of 7-9 percent while fixed deposits carry a rate of 9-12 percent. Hence the banks can earn better profit by lending in regular financing as compared to export finance and this creates an anti export bias. Increasing export finance means lesser availability of credit for general lending which carries a higher rate and hence a disincentive for active export financing facility.

Criteria for creditworthiness of the borrowers are also partly determined by the security requirements that State Bank demands the banks to satisfy before advancing loans. The collateral can be in the form of government securities, fixed assets or pledge of inventories. Banks maintain their own additional credit checks and requirements which determine the ultimate amount of credit extended to borrowers.

Until 1998, Export refinance scheme was not applicable to indirect exporters. Indirect exporters are manufacturer or supplier of goods or materials to be used as inputs in the exports. Similarly the small and medium enterprises and emerging new exporters were at a great disadvantage to have access to export credit. This was due to the fact that established exporters maintaining relationship with the banks are favoured by banks due to perception that these are less risky because of their past experience. While new exporters and small and medium enterprises which are mainly family owned, are unable to offer the excessive collateral guarantees and past experience. The collateral expected of the new exporters, small and medium exporters are stricter than that from established exporters and this becomes a hindrance to their getting accepted for export finance.

Small and medium enterprises being run as family organizations do not maintain formal standard accounting record. The banks' ability to assess the creditworthiness is further complicated by this inadequate accounting information. The banks have to experience higher transaction costs in case of small and medium enterprises as borrowers and hence they are rationed out of the scheme.

Despite extensive coverage of exports by export refinance scheme, the financing resources are still limited by tight credit restrictions. The fact that credit demand is higher than the available supply has been pointed out in Nasim (1990) and Asian Development Bank (1990) and this is because of the mandatory ceilings placed on the credit available to banks. The banks ceilings in 1985, 1986 and 1987 were found either to exceed the target or were fully used up. The credit ceilings influence the decisions of the banks about the borrowers. Usually large, established clients are considered low risk borrowers and hence preferred over small clients because the amount of credit is limited. This general lending skewness is present also in export financing because the banks have a limited spread on this finance and they tend to prefer low transaction cost clients so that their profits can be maximised.

The credit ceilings and fixed lending rates create incentives for the banks to prefer large exporters as they present easily evaluated clients implying low transaction costs. The collateral requirements impinge negatively on the access of small producers to export finance. In a nut shell, the wide margin in rates between export finance and general lending creates disincentives and anti export bias and within the export financing, the fixed credit ceilings, and exclusion of indirect exporters tend to be biased against the small and medium exporters.

In 1998, this weakness was recognised and the needs of small medium and indirect exporters started to be catered in the export finance scheme. A corporate entity was created in an attempt to resolve the collateral limitation of the small and medium exporters. This entity provides cover to these enterprises which is accepted as valid collateral by the banks.

The scheme has worked over a long time period and has catered to the financing requirements of large exporters. The emphasis has remained on the established, old and large enterprises just as it had been in the case of trade incentives. However the scheme has nevertheless provided enormous help to exporting sectors and contributed considerably to expanding exports.

1.5 Important trade reforms in various periods

Two prominent reform episodes can be identified, one dates back to 1960-65 and the other started in 1988 and continues to date. The reforms carried out in these two periods were vigorous, calculated, and effective though gradual. Rest of the two decades, 1970s and 1980s are marked by reforms which were either slow or erratic. The 1970s is distinguishable from other periods because of the existence of powerful exogenous shocks which neutralised the effect of whatever reforms were carried out. The second difference lies in the speed of reforms, rather than being drawn out over the entire decade, major reforms were accomplished in a short time span at the beginning of the decade. The reversals have also happened under the pressure of extraordinary events such as war with India in 1965 and oil crisis shock in late 1970s. This crisis affected the balance of payment situation greatly and forced the respective governments to reinstate the rigid trade controls. Thirdly, only the continuing reforms of 1990s were part of a stabilization program while earlier efforts were not initiated as integral component of any such program.

Export promotion along with import restrictions became the policy tenet of the trade regime in 1960 and has continued ever since. The incentives provided to the export sectors have been an effort to introduce the policy neutrality and reduce or remove anti export bias. It started with export bonus scheme which in essence provided the exporters with the import licenses equal to a certain percentage of their export value. This was provided in the form of bonus vouchers which were freely transferable in the market. Other important developments of this period include the open general licensing, automatic and repeat licensing, and request based licensing. Open general licensing to start with allowed pharmacists to apply for additional licenses in case their original license is used up within a pre specified period of six months. Open general licensing applied to raw materials and agricultural items but most importantly to consumer goods. Automatic licensing also covered essential raw materials and made available to the firms the required materials in sufficient quantities. A free list was introduced which included almost 50 items requiring no licensing. In theory it was free but practically there were restrictions since many raw materials included in list were available only under tied aid arrangements. The emphasis was to liberalize those items on a priority basis, which might be required by industry to realise full capacity utilization. The effect of these reform measures occurred in the form of increase in exports and transfer of import competing sectors to export stage. The reforms were not reversed by any adverse consequences as a result of the liberalization itself but because of the exogenous factors.

The trade reforms in 1970s were meant to placate the political constituents' needs as opposed to the earlier reforms in 1960s which were implemented with an objective to achieve efficiency gains (Adams 1983). In 1970, relaxation and simplification of import licenses did take place. Only two lists were maintained, a free list including items to be imported without restriction and tied list for items importable under tied aid or barter sources. However for those items which were not on the free list, the degree of protection was astronomical and could not be determined as there were no imports to set the scarcity premium. Smuggling however set an upper limit beyond which the producers cannot charge. Many of these items included consumer goods.

Bonus vouchers scheme was abolished because with simplification of licenses, the multiple exchange rates implied in the scheme appeared inconsistent with the currency devaluation achieved to bring a uniform exchange rate system. In previous reforms when licensing and import controls were far stricter, the scheme helped to alleviate the anti export bias but in the event of simultaneous reductions of restrictions and devaluation of currency, elimination of the scheme seemed appropriate in unifying the entire system.

While 1970s was characterised by cataclysmic events, the 1980s saw a period of easy growth helped by upsurge in workers remittances and the inflow of foreign aid because of Afghan war. The nationalization which in the earlier period has been pursued vigorously in a spirit to attack the perceived powerful industrial elites was reversed, though full scale privatization was not initiated until the beginning of 1990s. The trade reforms again were slow and unable to make any noticeable effect until 1988 when Pakistan started a stabilization program and there onwards followed trade reforms as an important component of the program. The most prominent reform that took place before 1988 was the replacement of free list with negative list system which comprised 'banned list and restricted list'.

From 1988-89, consistent progress can be identified in moving towards liberalizing the trade regime. The steps included gradually reducing the number of items on 'negative list' conversion of quantitative restrictions into tariffs, elimination of import licensing in 1991 and tariff reduction and rationalization.

Tariff reductions are being consistently pursued. In 1987 maximum tariff reduced to 125% from 225 % and then to 70% in 1994-95, to 65% in 1995-96, 45% in 1997-98 and 35% in 1998-99. The average statutory rate declined from 77 % to 50% between 1988 and 1994 and further to 35% by 1997. The para tariffs such as import surcharges, 6 percent import fee and 5 percent iqra surcharge were integrated into single tariff in 1994. Items on negative list system are now maintained only on health and safety, morality and national security considerations. The number of these items is gradually being reduced and the items on banned list were reduced from 300 to 75 between 1988 and 1994 and further to 57 items in 2001. It also contains certain textile and clothing items which are maintained in the list on the basis of balance of payment reasons. Similarly export taxes are levied on raw cotton and rice as a disincentive to exporting these items because raw cotton serves as the principal raw material for processed cotton products which is the mainstay of major proportion of exports. However even the amount of such taxes is in the process of gradual reductions.

1.6 Response of manufacturing industry to trade regime

Manufacturing sectors demonstrated phenomenal growth in all three categories, consumer goods, intermediate and capital goods after the implementation of trade protection policies in 1960. The structure of protection initially favoured consumer goods industries more than the other two and consumer sectors responded by registering rapid growth. This happened partly also because import substitution policies were biased against agriculture and in favour of industry as most of consumer goods industries were dependant for their raw materials on the agricultural sector which was taxed to provide cheap raw materials to industry. Simple technology and availability of these raw materials combined with severe protection in the form of quantitative restrictions and licensing enabled the manufacturing sectors to acquire high profits and record growth. Part of this high growth is also attributed to the factor that Pakistan started with an abysmally low industrial base and the extraordinary growth experienced in the initial years reflects a move from that stage. The expansion in demand created spill over effects in the intermediate and capital goods sectors as well which were doing very well. The protection also permitted the indigenous industries to graduate from import substituting sectors to develop into export sectors such as textiles, clothing, leather, sports goods. In the initial years of providing protection, ratio of domestic production to total domestic supply, increased at an astonishing speed which can be understood to mean that import substitution was clearly at work and was successful enough to provide for most of the domestic demand. The ratio of domestic production exported in consumer goods, intermediate and investment goods also increased substantially and was the highest for consumer goods (Lewis 1970) implying that consumer goods were the first to enter export markets. This was due to the high growth and labour productivity which permitted consumer goods to compete internationally through exporting their products. This led to some analysts commenting that import substitution has not resulted in allocative inefficiency but rather has caused more X-inefficiencies.

The fiscal incentive such as low interest rate on borrowing, tax holidays and accelerated depreciation led to more capital intensive techniques resulting in capital labour ratios higher than appropriate for a labour abundant country. These can be associated with the X-inefficiency referred to earlier that allocative inefficiency was not as severe as inefficiency in production methods. Nasim (1992) pointed out that there is considerable weight in the argument that in the first two decades of trade protection, trade restrictions did not result in allocative inefficiency. Most of the infant industries learnt by doing and replaced imports and then following increases in productivity broke into export sectors. The protection targeted heavily those industries in which the economy appeared to have comparative advantage in the form of indigenously available raw materials for processing of domestic industries.

X-inefficiency culminated in the building up of excess capacity as the licenses were granted on the basis of requirements creating incentives to show more than what is actually required so as to forestall the uncertainty implicit in the trade related policies. Rent seeking involved in acquiring licenses meant spending too much time and effort to gain approval for quota and licenses for investment and importing of raw materials and capital goods. Management techniques were surely imperfect and inefficient as the incentives to exert efforts were minimised by the high return available on the efforts to obtain permits and licenses in the form of excessive profits and scarcity premiums. Studies of Khan (1970) and Rozen (1969)

Winston (1971) and Islam (1981) have all indicated the presence of considerable inefficiencies resulting from the protectionist trade policies.

Ahmed (1980) argues that it is not only import substitution which contributed to the high growth of the manufacturing industries but export expansion also was an equally important source of growth during this period. Despite the fact that trade regime installed to protect domestic industries prior to 1960 was inward looking, the changes introduced after 1960 during a period of five years prior to war with India in 1965 helped encourage exporters. Some of these changes include bonus voucher schemes for exporters, open general licensing, repeat and automatic licensing and request licensing, all designed to introduce some relaxation in licensing procedures. The effect of these first liberalization efforts was to provide incentives to manufacturers in general and introduce neutrality of incentives for both exporters and importers.

It is argued that the growth of manufacturing industries until 1970 was accomplished at the expense of rest of the economy by providing subsidies to exporters through rebates and refunds of import duties they paid for raw materials, while they received official exchange rate for their exports. On import competing industries, the producers with the licenses received crucial imported materials and capital equipment at official exchange rate and sold their products to domestic markets at high prices. This led to some earlier criticism by Lewis (1970), Little, Scitovsky and Scott (1970) and Soligo and Stern (1965) that trade protection to manufacturing industries permitted them to raise value added considerably higher than that under zero protection and that industrial value added at world prices was actually negative. They even indicated that the difference between domestic and world value added exceeded world value added. This was true for most of the older established industries such as textiles.

As compared to 1950s and 1960s, when trade restrictions were at its highest, manufacturing industries in later decades exhibited more signs of allocative inefficiencies. This started with large scale public sector investment in engineering industry, iron and steel, chemical, fertilizers, cement and automobiles. Studies performed to analyze their operational efficiency suggested that Iron and Steel, Engineering industry, Chemical and automobile were all burdened with inefficiencies explained by non profit motives and reliance on excessive labour force.

Manufacturing sector is undergoing prolonged stagnation with occasional bouts of modest recovery and performance. By analyzing government policies which were and are in place to help and support the industrial sector, it emerges that policies have strongly tilted towards big industrial groups who have diversified and multiplied their businesses with the aid of protectionist policies in trade and facilitating role of financial institutions towards them. A secluded group of entrepreneurs reaped extraordinary profits which might have attracted new producers who were dissuaded from doing so by the entry barriers. The result was concentration and ownership of productive and financial resources into hands of selected industrial groups. With the only exception of 1970s, when there was a concerted effort to implement every policy against the big business groups, entrenched oligopolies have influenced the financial and trade policies in their favour. This allowed them to continue reaping high profits and not bothering to increase productivity through devising means for reducing costs.

Productivity has also not been helped by the fact that not enough attention has been paid to improve the quality of workforce through education and training. Huge population largely consists of illiterate labour force unable to be absorbed or to cope with changes in production or work places. Macroeconomic situation has contributed negatively since government has been unable to spend much on development projects because of the spiralling costs of debt overhang as well as the major expenditure on defence. Therefore a multitude of factors, such as distorted trade and financial policies and complex macroeconomic policies are responsible for the shape of industry now. Focused planning has been missing in the policies which are necessary to come out with a clear and healthy strategy to put the industry on the revival path.

Competition and its encouragement by enabling policies could have helped manufacturing industries to work hard to improve their productivity instead of relying on artificial means of entry barriers to increase their profits. All the support the government has been providing to the sector was directed to forestall the natural exit from market due to fear that this would be too costly and negative for employment and economy as a whole. However, ironically, this has hardened the negative production methods and practices with the prospect of hundreds of sick industrial units now on the verge of collapse.

The problems of the manufacturing industry, particularly large scale industry, have often been blamed on nationalization in the 1970's but it has been pointed out by Naqvi (1984) that even before nationalisation the growth was already halting. The causes often referred to are policies such as protection from imports and the promotion of export industries through subsidies. These have sapped the incentives to earn profits through productivity enhancing methods. Fiscal incentives also created distortions as they cheapened capital resulting in high capital intensity at the cost of labour intensive production much to the advantage of the large labour available. Various fiscal incentives reduced the cost of capital when the preference should have been to keep this low given the large pool of surplus labour.

Industry had no incentive to reduce costs, to improve quality or productivity as the high profits were still available due to cost reduction afforded by protectionist policies which also gave rise to monopolistic industry structure. No doubt the earlier protection available on the basis of infant industry argument did help entrepreneurs to quickly move to export industries.

The industrialization strategy pursued in the 1960's created monopolies by high profits ensured through low or no competition. Concentration of industrial power in the hands of big industrialists created disenchantment with the system of industrial support in place. It was proverbial to say that twenty two families in industrial sector ruled and dominated the bulk of resources of the country. Many researchers Lewis (1969), Papanek (1967), Amjad (1982) and white (1974), have pointed towards the highly concentrated, oligopolistic structure of the manufacturing industries in 1960's. This structure emerged through privileged access to import licenses and investment and joint ownership of industrial companies and banks and insurance companies. Once granted access, this ensured the preference given by government allocating agencies in future over other new or small producers. Their position was entrenched by loans and advances for investment from their own commercial banks.

The fact that nationalization is not entirely responsible for poor growth of industrial production during a large part of 1970's decade has been emphasised by Naqvi (1984) who shows through a comparison of public and private sector industries that public sector industries have shown better performance as compared to their private counterparts. This suggests that private sector manufacturing, especially large scale industries, started showing the allocative inefficiencies even earlier than nationalization, a situation which was made even worse by nationalization.

Economists and planners during the era of 1960 favoured growth oriented development strategy based on an industrial structure with productive and financial resources concentrated in the hands of urban industrial entrepreneurs. Nationalization in 1970 was pursued with the stated objectives to change "the uses and rewards associated with each of the four major factors of production in the economy: capital, land, labour, foreign exchange" (Iqbal and Adams 1983). Industrial producers were perceived to be the main perpetrator and receivers of the benefits of development strategies. In order to weaken their power, the drive to nationalization started with iron and steel, basic metals, heavy engineering, chemicals, petrochemicals, cement, and public utilities. It culminated in the nationalization of shipping, banking and insurance industry. In the last phase, even trade in cotton and rice, vegetable oil industry, cotton ginning and rice milling units was nationalized.

Rationale for nationalization of banks and insurance companies was that industrial groups had owned banks and financial institutions to avail themselves of the credit. The move was made with an objective to deny some or most of this financing to them. Since the source of industrial financing and investment has been and still is bank credit, taking control of banks was crucial and it meant that now government can direct credit to its priority sectors and entrepreneurs.

Iqbal and Adams (1983) have compared the commercial bank advances from 1970 to 1980, given to total manufacturing and the amount of advances offered to Agriculture, Textiles, Footwear and Garments. They point out that the pattern shows that more credit was offered to agriculture, non textile and small scale enterprise sector in Textile such as Footwear and Garments. Particularly from 1972 till 1976, the credit/advances to small scale textile sector were higher whereas it decreased to the textile sector which is mainly composed of large industrial firms. The shift was reversed after 1976 when once again government started wooing the private sector industrialists by greater flow of bank advances to them who have shied away from investment due to hostility of the current government and instability as a result.

The attack on industrial power was not just confined to the financial squeeze or ownership control but was exercised through symbolic empowerment of labour class which was achieved partly by reforms such as providing monetary and non monetary benefits i.e. pension and medical care welfare funds, but more by political rhetoric and tone which gave labourers a feeling that they can challenge management by resorting to violent means. Large as well as small producers complained that the militancy aroused in labour classes has resulted in the negative effects of absenteeism at work and poor quality of work which was further enhanced by the fact that industrialists were now nearly unable to fire the workers. This might have substantially contributed to the poor performance and low productivity of the large scale industrial sector in most of decade of 1970. As far as the legitimate rights of workers are concerned, the policies tried to provide for them. However the tone and feelings of the then workers/employees that they can shirk the work with impunity, proved counterproductive for short term as well as long term industrial productivity.

Regarding private investment, the succeeding governments have tried to encourage it by various means of incentives. Deregulation and privatization of public sector industries have also been done. Liberalization of economic policies has remained the theme of the economic history in Pakistan. Sometimes this was forced by the international agencies demanding as a precondition stabilization packages and sometimes because of the overwhelmingly compelling economic circumstances. Liberalization policies were implemented gradually in 1980 whereas in the 1990s, fully comprehensive economic reforms were and are still being carried out. The scale, scope and intensity of these reforms particularly after 1995 is affecting every sphere of economic life of the country but more profoundly changing the industrial setting via substantial trade and financial sector reforms.

Denationalization of some of the small scale industrial units has already been done at the beginning of 1980 and this trend continued unabated irregularly though. Full scale privatization even of infrastructure, utilities and energy sector was and is being pursued. Much of the restrictions such as investment sanction restriction operated until 1990 and then discontinued. There are only four specific industries which need government permission such as, arms and ammunition, security printing, currency and mint, high explosives and radioactive substances (Wizarat 2002).

1.7 Conclusion

Tariffs and non-tariff barriers have provided widespread protection to the manufacturing industries during the entire period of 1980-95. The structure of protection underwent changes as tariffs became the dominant form of protection from the later half of 1980s. Extremely high tariff rates and various kinds of exemptions and concessions in payment of import duties led to the complexities in achieving the objectives of providing protection. Noman (1991) argues that manufacturing industries have been virtually facing international competition due to the grant of numerous exemptions and concessions and the onslaught of illegal imports through smuggling.

Trade liberalization policies are following the recommended sequencing of removal and replacement of non tariff barriers by tariffs. Tariff rationalization and tariff reductions are the next phase in the liberalization which is being implemented. The tariff reductions entail reduced revenues from trade taxes and have to be compensated by alternative revenue sources. Tax exemptions and concessions are provided on a large scale and need to be reduced. Increase in other sources of indirect taxes is also being pursued.

The speed of reforms has been very slow and often inconsistent and has lacked any planning in terms of setting a time frame within which the reforms should be completed. Consequently the reforms are still far from complete in three decades and the manufacturing sectors are continuing through a transitional phase.

CHAPTER 2

Total factor productivity of industrial sectors in Pakistan

2.1 Introduction

Empirical and theoretical work on total factor productivity of manufacturing industries has its origin in country growth studies. To begin with, the neoclassical school of thought imposed restrictions of constant returns to scale in a perfectly competitive framework with exogenous technology. Later developments culminating in the endogenous growth theories eliminated these restrictions to model growth and total factor productivity in imperfect market conditions. Modern technologies and innovations imply spill over effects which can give rise to imperfect competition. The neighbourhood effects of new technologies and knowledge imply that it is difficult to completely exclude competitors from appropriating the benefits of the inventions. Property rights introduce monopoly profits, but difficulty in strictly excluding others creates disincentives for firms to invest in research and development with implications for government involvement to support Research and Development. These are the main themes of departure of endogenous growth theories from the neo classical growth literature. Recent literature focuses on investigating total factor productivity of individual sectors and firms in relation to the policy variables which can influence the particular level of total factor productivity.

The current chapter examines the theoretical literature on firm dynamics and empirical studies at firm level which have been conducted in order to estimate the total factor productivity of individual firms in order to explore its relationship with relevant policy indicators.

Sectoral characteristics and trends of the manufacturing sectors of Pakistan are analysed. Total factor productivity of the manufacturing sectors is computed by running a separate Cobb-Douglas production function for each sector because each sector employs different production techniques and pooling of all sectors will be inappropriate. The results of parameter estimates and total factor productivities calculated from them are discussed in the last section.

2.2 Human capital in endogenous growth studies

Studies of growth experiences of various countries, their convergence and divergence, preceded industrial and sectoral growth and productivity studies. Both relied on neoclassical growth theories in the beginning. The Premise of the neoclassical theory of growth emerging in late 1950's and 60's was the interplay of per capita income growth and growth rates of saving and population. Despite extensive work pointing out the contradictions in the assumptions of the Solow model and its failure to account for the differences in the rates of growth in income per capita across countries, this model provided considerable impetus to later research. Assumptions of diminishing returns to scale and exogenous technical change underlying neoclassical growth theories were seriously challenged in later studies.

Endogenous growth theories introduced dynamic concepts of increasing returns to scale, learning externalities, technical innovation and diffusion and sought to explain the cross country variation in economic growth. Endogenous growth theorists, Romer(1994), Lucas(1986) and Mankiw (1992) tried to understand and analyse what determines the variability of 'residual' across countries in growth accounting, the growth that remains unexplained by the growth of input factors. They view increasing returns to scale, differences in the level of educational attainment and research and technology policies as highly important determinants accounting for differences in the income per capita across countries. Of particular importance is their emphasis on inclusion of human capital as an essential input factor. Human capital was incorporated in growth accounting in some form, either augmenting the labour factor, correcting for quality or taking human capital as a separate input factor.

Lucas (1986) models investment in human capital and specifies an external and internal effect which necessitates government intervention for welfare enhancement because of the dimensions involved in the improvement of human capital. He discusses two forms of improvement, formal schooling and improvement through learning by doing. Formal schooling implies reduced consumption and production possibilities as the individual withdraws from current production and allocates part of his leisure time to formal education in order to raise his or her future productivity.

He distinguishes between external and internal effects of improving human capital. The external effect manifests itself in the contribution of the average level of skill to the productivity of other factors of production. The internal effect refers to the individual as he has to withdraw himself from the current job in order to improve his skill level. In the second case doing more of a job involves learning by doing and can have a positive effect on productivity. The model involves two goods and one of them is a high technology good with higher growth potential. Lucas (1986) argues that both the decisions, spending more time on producing high quality goods or withdrawing effort from current production to improve formal qualifications carry welfare implications. There occurs a less desirable mix of goods in the former case and formal education is acquired at the expense of current consumption. Government intervention in the form of subsidizing schooling in the later cases and an industrial policy aimed at subsidizing high technology goods are considered welfare enhancing. Such an industrial policy is equivalent to 'picking the winner' but in reality picking the winners is fraught with difficulties, Lucas points out.

Mankiw et al (1992) agrees with the basic framework and insight of the original Solow model that savings and population rate together can explain cross country variations in income per capita because, high saving rate combined with low population rate or vice versa are inversely related with growth. He agrees that directions in which the saving rate and population growth rate affect income growth are correct but he argues that the magnitude of the effect seems too large to be explained by these variables only.

To explain this anomaly, human capital is added to the production function and the model is empirically tested with a sample of 98 countries and another sample of 22 OECD countries. Human capital is measured by a proxy which measures percentage of working age population that is in secondary school. Mankiw recognises the imperfection of the measure because the enrolment rate of population aged 12-17 is multiplied by the fraction of working age population of school age, 15-19. The age range is different and this measure completely ignores primary and higher education.

Given these limitations, human capital appears to play a substantially important role along with saving and population growth rate in explaining cross country variation. Mankiw has also used the augmented Solow model to test the hypothesis of convergence in income per capita. Three regressions are conducted. In the first income per capita from 1960-85 is regressed against the income in 1960. In the second, population growth rate and investment growth rate are added as additional variables. In the third, human capital is included as an additional variable. There appears to be no convergence in the larger sample of 98 countries but in OECD countries there is tendency towards convergence. In the third regression with human capital variable, there appears a substantial convergence among countries.

Nehru and Dhareshwar (1994) represents the effort to determine the importance of human capital as an additional factor appearing alongside physical capital and raw labour which plays a key role in explaining the growth rate differential among countries. Total factor productivity estimates are computed for a sample of 83 countries spanning the period 1960-87. Human capital is found to be much more important than both the physical capital variable and the simple unadjusted labour variable. Inclusion of human capital as a separate factor profoundly affects the results. Elasticity of value added with respect to physical capital declines for the low and middle income countries as well as for the entire sample when human capital is included in the equation.

It is also found that growth of total factor productivity is positively associated with the variables indicating political stability, initial stock of human capital and initial level of per capital income. He also compares the TFP estimates from three regressions. The first does not include any human capital variable and uses only raw labour. The second includes a quality adjusted labour variable, by taking shares of the labour force having different educational attainments weighted by wage rates. The third variable includes human capital as an additional variable. The purpose is to try out different methods in order to find out the best way to incorporate human capital. TFP estimates appear to be sensitive to the method by which human capital is incorporated in the model. The TFP estimates derived from first and second method are highly correlated. Total factor productivity estimates derived using human capital as separate factors are weakly correlated with the first and second method.

Bosworth et al (1995) have also recognised that human capital is a crucial factor to be accounted for when considering the variations in growth and total factor productivity across countries. Their sample includes 88 developing and industrial countries over a period of 1960-92. They use both growth accounting methodology to decompose the growth rates per worker into the growth rate of physical and human capital and total factor productivity and regression analysis to determine the relative contribution of factor accumulation and total factor productivity to income growth. Their results indicate that physical capital accumulation and total factor productivity have played more important role for growth rates of income for East Asian countries and industrial countries respectively. Similar to Nehru and Dhareshwar (1991) they have also experimented with the three formulations, one without including any human capital variable, one with a separate human capital variable and one with a quality adjusted variable.

In an effort to understand whether the initial level of human capital plays any role in explaining the per capita growth rate, Barro and Lee (1991) relate per capita growth rate 1960-85 with initial level of human capital proxied by school enrolment rates at primary and secondary level in 1960. The results from a sample of 98 countries for a period of 25 years spanning 1960-85 indicate that variations in per capita growth rate can be explained by the level of initial human capital in 1960. It is found that the countries with high values of initial human capital in 1960 such as Pacific Rim countries Japan and Taiwan experienced higher subsequent growth rates while African countries with relatively lower levels of initial human capital experienced decreasing subsequent per capita growth rates.

2.3 Firm Dynamics

Studies conducted to explain the cross country growth dynamics incorporate imperfect competition by recognising the role of knowledge and its characteristics of non rivalry and non excludability. However these studies are conducted at a level which requires aggregating heterogeneous inputs like capital and labour. This might be expected to affect the parameters of the aggregated production function and introduce bias in the estimation. Cross country studies to determine the causes of growth and its variation are limited in the sense that they do not delve deeper into the microeconomic dynamics that can contribute and affect the overall growth and productivity of the economy.

Recent developments have extended to the disaggregated level of sectors, sub sectors and firms. The rationale for looking at individual firms is the heterogeneity found among producers in terms of characteristics or patterns concealed in the aggregate statistics. For example, aggregate data does not reveal the changing structure of firms in terms of the size, age, ownership and profitability. Hence the differences in the productivity, profitability, market share and market power of individual firms and the possible causes could not be evaluated from such aggregate data. Heterogeneous firms react differently to changing trade or financial regimes and their different responses can be evaluated only by analyzing such firms over a period of time. Studying productivity growth at the micro level by contrast helps in understanding the aggregate productivity growth since aggregate productivity is the average of plant or firm level productivity growth. If a particular policy has a negative impact on some of the firms resulting in their exit, failure to study that or to account for this behaviour means that we will not be able to investigate how and why that policy had a negative effect on those exiting firms.

Contemporary literature on productivity has focused on firm level studies. These new developments originate from industrial organization theories dealing with models of industry dynamics which provide insight into the mechanics and evolution of firms. There is not a vast amount of research on theoretic models dealing with industry dynamics with heterogeneous firms and plants. Few widely quoted and relevant studies are those of Ericsson and Pakes (1995), Jovanovich (1982), Lambson (1998 and 1992) and Hopenhayn (1992).

Ericson and Pakes (1995) formulate a model of industry and firm dynamics incorporating heterogeneity, entry and exits in the same industry and growth rates of firms after controlling for firm specific factors such as age, location and type of firm and industry specific factors. Firms react to changes in policies in different fashions. The model developed envisages a firm whose initial investment to increase its profitability depends on the competitive pressure within and outside the industry and success of other firms. If a firm fails, this leads to exit in extreme cases.

When a firm makes an initial investment, and the outcome is 'favourable' it moves to a better state. In this state new ideas are changed into goods for marketing and sale. However if the competitors of the firm are also successful, the firm is relegated to a less successful condition. A stochastic process determines the model. Competitive pressure forces the firms to work harder to stay profitable. The incumbent firm faces an optimization problem of staying in business or exiting. This problem requires the firm to choose an investment level where the future value generated by the optimal investment is higher than the opportunity cost of the entire business. If it is less than or equal to the opportunity cost, then the optimal decision is to disband the business.

Entering firms face a similar optimization problem, since entering at period t they will turn into incumbents at t+1. The firm has to pay sunk costs at the beginning and at period t+1 has to invest to generate a profit or a maximum value. The firms evaluate their decisions to enter the industry, by comparing this maximum value to the prospective sunk costs. If this value is less than sunk costs, then the optimal decision is not to enter the industry.

The equilibrium is considered dynamic because of interaction between entering and incumbent firms. The firms are aware of the structure of the industry, their state, and their competitors' states and are also informed of the effect that their investment will have on the industry. Firms have knowledge about the industry structure, of other firms entering the market, of those exiting and future conditions or states emanating from this structure. These phenomena of new firms entering, some of the incumbents exiting, incumbents making investments, all take place simultaneously. Dynamic nature of the equilibrium is explained by the fact that the 'beliefs' of entering and incumbent firms about their present and future states generate their optimal decisions and generate change in the industry structure. The dynamic equilibrium originates from the synchronised decisions of the firms which create constant fluctuation.

Their results show that the number of firms entering the industry will be low and even zero in cases where competition is very strong. The incumbent firms if successful in investments move to higher states. If not, they still do not leave the industry and keep incurring fixed costs in the hope of improved and profitable future production probabilities. Much of this behaviour is visible in an industry characterised by continued exploration and learning activities.

Ericson and Pakes have raised an important question, that is whether in this fluctuation, any pattern in the structure and average number of firms emerges or not. Investments, entry and exit decisions take place as a response to a certain industry structure. Further investments and their results, shape further the structure of the industry in the next period. This raises questions whether recurrent patterns of industry structure are different from the initial structure and if they are different, what paths they have followed before settling into this structure. If industry survives in the face of continuous exits, is it possible to identify a long run average industry structure? Do policy changes and different policy environments have an effect on the answer to this question? Continual entry and exits of firms and investments by them represent responses of firms to the opportunities presented by the industry structures. The outcomes of these investments and competitive pressure of the varying states of the firms shape and change the structure of industry. This model has been empirically tested in Olley and Pakes (1991) and Pakes and Ericson (1998) and will be discussed in the later sections.

These dynamic movements of the firms happen more in accordance with the predictions of the above model if there are no artificial entry barriers and nearly perfect competitive market conditions prevail. In the presence of monopolistic or oligopolistic profit opportunities, new entrants might be tempted to enter the market but can do so only if not prevented by explicit or implicit barriers such as restrictions on entry or on getting credit from financial systems or licensing restrictions. Only those firms will be able to enter the market that have made it to the stage of official sanction of their investment or sneak their way through some kind of non market interactions or influences. The decisions to invest in sunk costs or further investments in such circumstances are lopsided.

In Ericson and Pakes (1995) model, which has been labelled as an active learning model by many later researchers, firms invest with the knowledge that their future probabilities of productivity and profits are a function of current productivity and investment. In the opinion of the writers, the model is more appropriate for those industries dealing with research and exploration and hence the firms which lag far behind in technology have to exit the industry.

Jovanovic (1982), often cited as passive learning model, has approached the question of evolution of industry somewhat differently. In his model firms gather information about their efficiency while operating and producing in the market. As a result of a number of bad indicators or signals, some firms decide to quit the industry. He also tried to find out whether size has any relationship to growth and whether efficiency determines the size. He has referred to proportional growth theories which state that growth happens in proportion to the size. In his opinion later evidence contradicts this and maintains that smaller firms show high growth but their survival probabilities are variable. Jovanovic proposes that it is efficiency of firms which drives the growth and survival probabilities. Firms find out about their efficiency and this gives rise to different size distributions.

Average efficiency of surviving firms increases with the failure of inefficient firms with the passage of time. The firms with high expected costs are less likely to continue. Leaving firms are also unprofitable ones, so causing the profits of survivors to increase. The Jovanovic model predicts a positive relation between profits and concentration in industry. Concentration increases the profits of larger firms' more than smaller ones and unusually high profits cause high growth in the next period. Average efficiency of the survivors keeps improving because of the exit of inefficient firms. Growth rates are more variable and faster in younger firms while mature firms exhibit constant and equal growth rates.

Ericson and Pakes (1995) rely on both active and passive learning models. An active learning model predicts that current profitability varies in response to the outcome of current investment and competition from other firms in the industry. Entry, exit and investment decisions are made in order to maximize future expected net cash flows depending on the current information set. A Passive model espouses the idea that past profitability serves as a guide to future profit possibilities. The dynamics of firm behaviour, firm specific uncertainty and the effect of entry and exit are investigated using both these models. Ericson and Pakes (1995) indicate that optimality in both models implies maximizing expected future net cash flows inducing exit of some of the firms. Empirical applications of these models in Pakes and Ericson (1998) suggest that one model fits firms in manufacturing while the other is more befitting the retail firms. In this paper, authors liken the passive learning on the part of firms in Jovanovic to the learning involved for retail firms who have to see whether the environment in which they operate will be able to support or sustain their business.

The data for the study was taken from unemployment insurance coverage in Wisconsin in manufacturing and retail sectors. The models imply that size distribution of surviving firms increases with age of the firms. It is observed that from 1979, sixty percent of the firms in retail sector and over 50 percent in manufacturing sector exited by 1986. Secondly, proportion of firms in any size category increases with age.

Differences in the evolution of size distribution between the two sectors' firms depict that, in the initial year, firms in the retail sector are somewhat bigger than in manufacturing. But as time passes, firms in manufacturing show larger size distribution than retail firms. A regression of current size on immediate past sizes and initial size is conducted as both models predict an increasing function in initial size. The results depict that manufacturing data conform more to the active learning model while retail sector data is consistent to the passive learning model.

Overall theoretical models illustrate a dynamic process in which firms are continuously learning about their own efficiency and the state of their compatriots. The decisions to enter a market are based on the sunk costs they will have to incur and depend on the assessment of new entrants about probability of their success. This probability can be influenced by the general level of profitability of incumbent firms. In highly competitive environments, high profitability of existing firms can set higher standards for new entrants. Once in the market, investments by new firms are determined by a comparison of their expected future success and the costs of the operation. Current efficiency serves as a guide to this decision while past profitability may also serve as a signal for the success of any future investment. This dynamic process of entry, exit, future investments and their success determines the long run structure of the market. Government policies and different responses of the firms may also shape the structure of the market.

2.4 Empirical work with firm level data

Tybout and Roberts (1996) surveys firm level studies for a number of developing countries in an endeavour to quantify the heterogeneity of firms and to find possible explanations for that heterogeneity. In addition, they examine the role of this heterogeneity in explaining the differing responses of firms to policy changes. These empirical studies establish that producer turnover is not low, quite contrary to the perception of low producer turnover in developing countries which is thought to be caused by institutional weaknesses and small markets. The findings show that entry and exit rates are comparable to the industrialized countries. Entering firms/plants are smaller and more likely to fail soon. However, the probability of failure among the survivors lessens with the passing of time. Variations in the entry and exit rates at the level of an industry can be explained by specific technology of the industry and macroeconomic conditions. If the government follows a policy of protection for indigenous domestic industry, it is likely to be reflected in the hegemony of established producers creating an entry barrier and hence resulting in low turnover.

Through several plant level studies for different countries, Tybout and Roberts arrive at the conclusion that there is a great deal of flux in the manufacturing sector of these developing countries due to large turnover of firms/plants and competitive pressure exerted through this process is at least equivalent to that in industrialized countries. They also observed that productivity is not much affected by the entry of new plants. This is because both, new entrants and exiting plants/firms are on average not very efficient. However, among the entrants, those who survive show high growth and contribute to productivity positively. Hence, in developing countries, the policies encouraging the entry of new producers and the facilitating the exit of dying firms or plants can be a source of improving industry level productivity.

There are many ways in which producer turnover, exits and entry of new firms may contribute towards productivity. If some of the incumbent firms are inefficient, it is better for them to exit, since their exit will contribute positively towards overall sectoral productivity. It has also been observed in many studies that plants or firms who eventually exit the industry, show less productivity or were unproductive in the years prior to their exit. If these unproductive firms are propped up and kept in business unnaturally, it will be a hindrance to productivity of the industry. If government policies help sustain them in their inefficiency, this can decrease aggregate industry productivity. These policies can be of any form, for example, the policy of credit rationing in which capital and financial markets favor established producers against new ones who need loans to support their entry. It may also result from trade policies of the government geared towards protecting established but high cost producers and restricting the entry of new firms.

Tybout and Roberts (1996) point out that in earlier productivity studies, the representative plant approach does not recognize the differences in the technologies of different industries and plants as this uses the same production function for all industries. However, in various recent studies, economists are now modeling the micro economic concepts of heterogeneity, effects of externalities, learning by doing and the effect and interaction of these phenomena with the productivity of the industry and firms. This alternative approach allows for differing technologies of firms and plants and scale effects. Once individual productivities are so calculated they can be decomposed into their components. Also at the individual unit level, productivity can be related to such factors as age or size of the firm. In these studies, a different production function is used for each firm to suit its production technology.

While a number of firm level studies focus on dimensions of productivity among the firms in an industry, differences in productivity among firms across industries and over time persist. Heterogeneity prevalent among producers within industries might be a factor causing dispersion in productivity. Many researchers also try to determine the causes of productivity growth and explain the differences in productivity among firms. Such studies examine the relationship between productivity movements and its determinants such as management, technology, effects of changes in regulation and effects of economic liberalization policies.

Tybout and Roberts (1996) relate intraplant productivity with the policy changes to see if they are positively related. The most important policy change considered is trade liberalization. They cite many studies and emphasize that evidence on this issue is far from conclusive. At best, it can be argued from the vast literature that trade liberalization does not have any negative effect on the productivity of the firms and industries. The effect has many dimensions since trade liberalization is not accomplished in most of the cases as an isolated reform measure because exchange rate regime as well as other financial liberalization measures are introduced at the same time and confound the picture.

In one such work in an effort to determine the relationship between productivity and its sources Tybout and Liu (1996) have investigated the micro processes of entry and exit and their contribution to productivity growth. They also consider the effect of macroeconomic conditions and policy regimes on the efficiency of plants in the economies of two countries, Chile and Colombia, in both cases at different stages of their economic history. Chile following open policies was suffering from financial crisis and recession while Colombia, following protectionist policies was 'experiencing mild business cycles'. Five industries at three digits ISIC level were examined: food, textiles, footwear, wood products and metal products.

Chile is studied over 1973-1981 while Colombia is investigated from 1976-85. Both countries in their respective periods under study experienced varying patterns of growth. Chile suffered serious destabilization due to overvalued exchange rates, which caused the trade reform process initiated in 1974 to halt or reverse in 1983. Columbia managed to pursue reasonable progress towards trade liberalization encouraged by promising output and export growth in late sixties and early 1970's. However beginning in early 1980 it cannot escape stagnation until 1984 when recovery again started. Results from using the technical efficiency frontier method reveal very different outcomes. After extracting productivity measure, it is found that exiting plants are ten percent less efficient than incumbents are and so their removal improves aggregate productivity. Entering plants' productivity is not much different from exiting ones and so in the short run, turnover has no significant effect on aggregate productivity. These new firms or plants become more productive and after several years, their productivity is faster and higher than the incumbents. Overall, in the long run, this contributes to the aggregate productivity in a substantially positive manner. This is in line with the findings of many other researchers that turnover contributes to productivity through weeding out the inefficient producers.

The studies to determine the causes of productivity growth or slow down are conducted in an effort to better understand the relationship between policies and productivity movements. Griffith (1999) investigates the contribution of foreign owned establishments to the productivity growth of United Kingdom using dynamic panel data techniques with firm level data. UK enjoyed productivity growth in early 1980's, and possible factors in this growth were the changes taking place in the technological fields such as computerization and improved quality of labor force. One of the major factors she emphasizes is the role of multinational firms by positing that foreign owned establishments are more efficient than those domestically owned. Using ARD(Annual business inquiry Respondents database) data at the plant level in the motor vehicle industry, she shows that foreign owned plants have higher output per worker, value added per worker, investment and intermediate inputs per worker.

This study was conducted for 1176 establishments for the period of 1980 to 1992 with 5,314 observations. Of these observations, 2092 observations were excluded for various reasons e.g. missing data, or insufficient information. The motor vehicle industry consists of three 3-digit industries, the motor vehicle and engines industry, the motor vehicles parts industry and the motor vehicle bodies industry.

Griffith discusses two approaches to measuring productivity. A simpler approach relying on observed factor shares to calculate total factor productivity does not involve specification of the production function. However, she recognizes that assumptions used are restrictive such as "Constant returns to scale, competitive markets, and full utilization of all inputs" (Griffith 1999 p.433) and hence TFP estimates may be prejudiced.

Econometric estimation is considered preferable since it is workable without these restrictions. Griffith has therefore used a dynamic production function derived from Cobb-Douglas production function:

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta} X_{it}^{\gamma} \qquad (2.1)$$

Y is output, A , K, L and X represent productivity parameter, capital, labor and intermediate inputs respectively, while i and t denote firm and time subscripts .
The model is estimated in log-linear form:

$$y_{it} = \alpha k_{it} + \beta l_{it} + \gamma x_{it} + a_{it} \qquad (2.2)$$

Following Solow a_{it} is considered to be an indicator of total factor productivity and it is composed of:

$$a_{it} = \eta_i + t_t + e_{it} \qquad (2.3)$$

η_i denotes fixed establishment specific differences in productivity, t_t represents common macro productivity shocks while e_{it} indicates idiosyncratic and serially uncorrelated establishment specific productivity shocks.

If firms fail to adjust spontaneously or experience a continuing productivity shock, the idiosyncratic error term may be serially correlated.

$$e_{it} = \rho\alpha e_{it-1} + \mu_{it} \qquad (2.4)$$

μ_{it} is an idiosyncratic error term.
The dynamic production function will take the following form:

$$\begin{aligned} y_{it} &= \lambda_1 y_{it-1} + \lambda_2 k_{it} + \lambda_3 k_{it-1} + \lambda_4 l_{it} + \lambda_5 l_{it-1} + \lambda_6 x_{it} \\ &+ \lambda_7 x_{it-1} + (1-\rho)\eta_i + (1-\rho)t_t + \mu_{it} \end{aligned} \qquad (2.5)$$

The above equation is derived after equation (2.2) is lagged by one period, multiplied by ρ and the resultant equation is subtracted from equation (2.2).

Griffith uses, OLS and First difference GMM estimators to check the problem that unobserved factors at establishment level might be correlated with the regressors. TFP estimates were extracted from these estimates and a regression of TFP estimates on time and ownership dummies showed the differences between foreign and domestic establishments regarding their respective productivity. It was concluded that the productivity of foreign owned plants is not substantially higher than domestic plants. When comparisons were made of the TFP estimates drawn from static and dynamic specification, it became clear that static specification substantially overstated the productivity difference between foreign and domestic plants.

Harris (2000) extends the work conducted by Griffith (1999) disputing the main findings of the paper that foreign owned plants are not substantially more productive than domestic owned. He argues that findings by Griffith that foreign owned plants are not more productive than their domestic counterparts, carry serious implications for government policy of supporting FDI. Harris considers it desirable to extend the analysis to include more industries than just the motor vehicle industry in Griffith's original paper. He conducted the analysis on the four largest sectors. He modified the model used by Griffith on the contention that Griffith's parameter estimates are not fully representative of the population of establishments operating in the UK because the data used is 'unweighted'. Harris considers that in order to reflect the underlying distribution in population, it is essential to calculate the sample weights for each plant since ARD data is biased towards larger units and no weights are used for smaller or larger plants. Methodology adopted is the same as in Griffith's but data in Harris's work is weighted which produces markedly different productivity estimates for both foreign and domestically owned plants in that foreign owned establishments as well as plants appear to be considerably more productive than domestic plants.

Theoretical research led to empirical studies exploring the relationship between total factor productivity of firms and its determinants. With the help of firm level data, empirical research established the variations in the growth rates of firms, dispersion in the total factor productivity of entering and surviving firms and simultaneous entry and exits. Firms are heterogeneous in terms of their output, investment and productivity and this heterogeneity determines their responses to changes in their environment. Other sources of heterogeneity identified in the literature are age, size and ownership of the firms, which can also contribute to the variability in productivity of these firms. The contemporary research links the firm specific differences with the specific response changes occurring in their markets due to changes in policies. Calculating total factor productivity of firms, plants and industries and determining the factors causing the variability in its levels is important in identifying the effect of policy changes on the performance of the firms.

2.5 Stylized facts about firms dynamics

Some stylized facts have become apparent as a result of research with firm level data in numerous studies. Some more prominent of these are heterogeneity among firms and plants in all industries, persistent dispersion in productivity of firms, the role of reallocation of resources in affecting aggregate productivity as a result of exit and entry of new firms and plants. In studies on turnover of firms and its contribution to aggregate productivity it has emerged that out of new entrants only half survive and survivors are smaller in size than the established firms.

Caves (1998) lists the few stylised facts that have emerged from empirical studies on firm turnover and mobility. Mobility implies changes in the shares of firms operative in a market and this is reflected in expansion or contraction in the shares of certain firms or plants. It has been found that variability of growth of firms is related to the size and age of the firms. This variability decreases as the firm ages and increases in size. From later studies it became known that, for larger firms, this does not hold and growth rates are not related with the size. He cites a few studies which show some evidence of the correlation of turnover with some of the firm related factors. For example, Geroski, Machin and Walters (1997) quantifies British firms' sales growth and tries to explain it against changes in market values, industry output growth rate and GDP growth rate and any innovation within the industry. It appears that the most important source explaining variability of growth rate of sales is an individual firm's shocks. Aggregate industry growth rate and innovation can also explain this variation to some considerable extent. Some other studies find that productivity is inversely related to the age of the plant or firm; ageing firms appear to be least productive. Among other determinants of mobility that Caves refers to, is the one of 'active learning model' Ericson and Pakes (1995) discussed above, where firms invest in uncertain projects. These firms grow if their investment is successful and they have to exit if it fails. Most of the entrants cannot survive beyond the first year of their existence and the 'hazard rate' is quite high. However the productivity of entrants starts improving with age and passing time, hence the growth rate of surviving firms is high.

The generally held perception is that most of the entrants fail early because they start at a small size. However many studies have shown that entering firms decide about the size of their operations due to some assessment of their capabilities. Hence those who are not very confident about their capability start with small investment and later, if successful, expand their business. The relationship between concentration and turnover through the S-C-P (structure conduct performance) framework can be mutually interdependent and thus explain each other. Concentration influences the behaviour of firms and hence can be an important factor influencing mobility and turnover of firms. In most of the studies, it is established as a stylized fact that there is an inverse relationship between concentration and turnover.

2.6 Growth Accounting Methodology

Total factor productivity can be calculated either according to traditional growth accounting methodology or econometrically. Assuming a Cobb-Douglas production function of the form:

$$Y = AK^{\alpha}L^{1-\alpha},\quad \textit{where},\quad 0 \langle \alpha \langle 1 \qquad (2.6)$$

Y is Output, K is capital input, L is labour input and A is total factor productivity. TFP (total factor productivity) is commonly identified with the level of technology but it actually incorporates a wide variety of factors, such as internal organisation of firms and level of workers' efforts.

Expressing the equation in log linear form:

$$y_{it} = a_{it} + \alpha k_{it} + \beta l_{it} \qquad (2.7)$$

y, k and *l* represents log of output, log of capital and log of labour while i and t are industry or firm and time subscripts. α and β indicate elasticity of output with respect to capital and labour respectively. a_{it} denotes the total factor productivity parameter.

TFP is calculated from equation (2.7) as a residual by subtracting the contribution of shares of capital and labour from output. Estimates of α, and β are required to calculate TFP. Under perfect competition and constant returns to scale, this parameter is equal to the share of capital and labour in output. TFP can then be derived from above equation (2.7), denoted as a_{it}, and takes the following form:

$$TFP = y_{it} - \alpha k_{it} - \beta l_{it} \tag{2.8}$$

This growth accounting equation allows a break down of growth into components that can be attributed to the observable factors of the growth of the capital stock and of the labour force and to a residual factor often called the *Solow residual*, that is the portion of growth left unaccounted for by increases in the standard factors of production.

Calculating productivity by the growth accounting method has been used in many cross country growth studies. In the contemporary literature, productivity is mostly calculated with more sophistication by econometric method which allows to relax the restrictions of constant returns to scale. In econometric estimation, α and β, shares of capital and labour respectively, are derived econometrically and not based on observed factor shares. Various procedures are applied to deal with the issues of endogeneity of inputs and productivity as well as other related problem like heteroskedasticity and serial correlation. For current study total factor productivity is calculated econometrically and the next section is about econometric estimation.

2.7 Econometric methodology

Productivity is modelled in the production function framework using the panel data technique. Four methods have been tried in this study, Ordinary Least Squares (OLS), Generalized Least Squares (GLS), Fixed-Effects or Random-Effects and the third method is adapted from Levinsohn and Petrin (2003) procedure which corrects for endogeneity of inputs.

Given the panel nature of the data set, pooling by OLS overlooks the panel characteristics of the data. This also requires restrictive assumptions such as uniform intercept and slope across units and time and identically, independently distributed error term uncorrelated with explanatory variables.

Dummy variables can instead be used and hence these restrictions can be relaxed. Including dummy variables makes it possible that each unit can have its own intercept term. This models individual specific heterogeneity. The model looks like:

$$y_{it} = \beta_{0it} + \beta_{1it} x_{it} + \beta_{2it} d_i + \beta_{3it} d_t + \varepsilon_{it} \tag{2.9}$$

Where i = 1, N and t = 1, T, y_{it} is the dependant variable for ith firm, industry or country at time t whereas x_{it} is a vector of input variables.

Fixed-effects regression is supposed to produce the same coefficient estimates and standard errors as ordinary regression when indicator (dummy) variables are included for each of the groups. Fixed-effects provide a short cut because in the presence of many groups, creating or including dummies for all can be laborious:

$$y_{it} = \beta x_{it} + \varepsilon_{it} \tag{2.10}$$

The error term can be decomposed into following components:

$$\varepsilon_{it} = \mu_i + e_{it} \tag{2.11}$$

Where μ_i represents a time invariant, individual specific, fixed or random component capturing some unobservable factors such as capital intensity in the case of an industry. This component is different for each unit but, for that particular unit, its value is fixed. It is a measure of panel level nuisance parameter and determines the decision to use fixed effects. e_{it} represents the overall idiosyncratic error component and it is equivalent to the usual residual in a regression. The choice between OLS and random effects is based upon results of Breusch-Pagan test[1].

The correlation between the error term and explanatory variables or its absence is the basis for choosing between Random-Effects or Fixed-Effects. If there is no correlation between error term and explanatory variables, Random-effects will provide consistent estimates. In case of the presence of such a correlation, coefficients will be inconsistent and Fixed-Effects model is the appropriate choice. The Hausman test[2] helps in deciding between Random or Fixed-Effects.

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[1] Breusch-Pagan tests the null hypothesis: $\sigma_\mu^2 = 0$ versus the alternative hypothesis: $H_1 : \sigma_\mu^2 \neq 0$.It checks whether Poooled OLS can work equally well. Depending upon the results, OLS or random effects can be chosen.

[2] In Hausman test, the null hypothesis is: $H_0 : E(\mu_i X_{it}) = 0$. Hence the Random-Effects model is consistent and efficient. The alternative hypothesis in this case is that these estimates are inconsistent and biased because: $H_1 : E(\mu_i X_{it}) \neq 0$. Rejection of the null determine using Fixed-Effects model.

Heteroskedasticity and serial correlation are the usual problems associated with panel data and may affect the results. Heteroskedasticity can result in the underestimation or overestimation of true variance, may be either because of variability in cross sectional units, owing to outliers, or incorrect specification of models. In the presence of serial correlation, error terms may be correlated across different observations instead of independently, identically and normally distributed. The incorrect functional forms, such as use of linear form in the presence of non linearity, or interdependence in the data figures can cause serial correlation. In the presence of serial correlation, coefficient estimates will be inefficient.

With both serial correlation and heteroskedasticity in the data, one has to choose the models which can generate reliable coefficient estimates after correcting for these problems. The data on Pakistani manufacturing industries consists of different industries as will be discussed in the section on Data. Heterogeneity and serial correlation is bound to appear with this kind of data set as each manufacturing sector contains many sub sectors which all may have specific characteristics. It is crucial to obtain estimates which have been corrected for heteroskedasticity and serial correlation.

GLS (Generalized Least Squares) with panel corrected errors can correct for both heteroskedasticity and serial correlation. This procedure provides consistent estimates, however they remove fixed effects in the procedure. In many productivity studies, fixed effects are treated as an indicator of productivity, representing mean level of productive efficiency of the firms or industries. It is not possible to extract fixed effects while using GLS. Xtregar method in STATA implies the Baltagi and Wu(1999) method and is appropriate for cross section, time series regression and corrects for autocorrelation when the disturbance term is first order autoregressive. It allows one to derive extract fixed effects estimates after correcting for serial correlation, but one has to contend with heteroskedasticity and its consequences as it is not corrected in this method. To estimate fixed effect, this method is not that bad a choice even if there is heteroskedasticity as the estimated betas will still be consistently estimated though the standard errors of the betas will be wrong. In the final results, parameter estimates derived with OLS, fixed or random-effects depending on the result of Hausman test, GLS and Levinsohn–Petrin method, are compared. The Xtregar method was tried to check whether a problem of autocorrelation exists or not. It was found that substantially large autocorrelation is present in nearly all the sectors. However the parameter estimates are not reported in the final results.

2.8 Olley-Pakes Robust estimation of production function

Methods described above do not allow for endogeneity of regressors or inputs in production function estimation. The works of Olley and Pakes (1992) and later on Levinsohn-Petrin (2003) have explicitly recognised this problem and have devised a method to correct for it so as to provide a reliable estimate of productivity. The next section deals with their work and subsequent modification to it by Levinsohn and Petrin (2003)

2.8.1 Dealing with endogeneity and selection bias

The celebrated work of Olley and Pakes (1992) deals with two problems that might arise while dealing with production functions and firm data. These problems relate to the simultaneity between inputs and output and unobserved heterogeneity. The current level of capital input might be related to the productivity level in previous periods which results in investment in previous periods. The intuition is that the variable inputs, like labour or investment respond to productivity almost contemporaneously while capital responds in a lagged fashion. Firms are likely to invest more in response to positive productivity and investment can be used as proxy for productivity.

Olley and Pakes (1992) observe that the fixed-effects model is not appropriate for the firms since there are substantial differences among plants in their abilities to obtain output from capital and labour. These differences among plants in their respective productivities determine the aggregate productivity of the industry.

In their seminal study of USA Telecommunications for a period in which major technological and regulatory changes took place, they show that the sector was characterised by significant changes in the size of establishments as well as entry and exits. They propose the hypothesis that firm's input demand decisions are influenced by these changes in size, and exit decisions are also linked to the productivity of the firms. They discuss that there can be substantial simultaneity problems in estimating a production function estimated. This problem is caused by the fact that both these decisions are based on the unobserved productivity. They have developed a dynamic model allowing for firm specific differences.

OP's(Olley-Pakes) production function is written as:

$$Y_{it} = \$_0 + \$_a a_{it} + \$_k k_{it} + \$_l l_{it} + T_{it} + O_{it} \quad (2.12)$$

Y_{it} is the log of output from plant i at time t, a_{it} is its age, k_{it} is the log of capital stock, l_{it} is the log of its labour input, T_{it} is its productivity, O_{it} is a measurement error.

Olley-Pakes maintains that OLS produces biased estimates of input coefficients at time t. The reason for this is that input demand decisions are dependent upon their assessment of the values of T, productivity. Choice of variable factors such as labour, is affected by the current value of productivity. In case of serial correlation in T_{it}, inputs in a particular time period will be positively correlated. OLS in these circumstances does not recognise these productivity aspects and produces upwardly biased estimates of input coefficients.

Investment, i_{it} at time t, is a function of three variables i.e. values of productivity T at time t, a_t age of firm, and k_t value of capital at time t:

$$i_t = i_{it}(T_{it}, a_{it}, k_{it}) \quad (2.13)$$

Olley and Pakes maintains that providing $I_{it} > 0$, then the above equation is increasing in T conditional on the values of age and given capital. Above equation is invertible and can be written as:

$$T_{it} = h(i_{it}, a_{it}, k_{it}) \quad (2.14)$$

In this way simultaneity problem can be solved by expressing unobservable productivity as a function of observable factors. The idea here is that firms with higher T, with a particular value of capital stock, will invest more. Substituting equation (2.14) into the main production function equation (2.12):

$$Y_{it} = \$l_{it} + N_t(i_{it}, a_{it}, k_{it}) + O_{it} \quad (2.15)$$

In the above equation,

$$N_t(i_{it}, a_{it}, k_{it}) = \$_0 + \$_a a_{it} + \$_k k_{it} + h(i_{it}, a_{it}, k_{it}) \quad (2.16)$$

The main idea is, that enterprises differ in their efficiency or productivity. The differences among these firms, plants or enterprises in productivity are serially correlated. This serially correlated productivity determines the probability of survival among firms and their choices of inputs. Secondly, it is assumed that there is an instantaneous relationship between productivity and investment. The simultaneity problem then is caused by the correlation between variable input demands and unobserved productivity.

Olley and Pakes (1992) devised a framework which can allow for endogeneity of inputs. They show that the level of inputs used by firms may be correlated with productivity shock, that the firms receive and respond by increasing production and investment. This method is based upon the fact that there is a relationship between unobserved firm level productivity and its decision about the level of investment it chooses. Exit by firms is modelled as conditioned on unobserved productivity.

Levinsohn and Petrin (2003, 1999) use the same framework but instead of investment they have used intermediate inputs like electricity or fuel. They show that while estimating firm level productivity, the OLS method imposes restrictive assumptions which suppress firm-level heterogeneity across firms and over time. Fixed-Effects method assumes that a firm's productivity is constant over time. The authors are of the view that a model which allows 'firm level productivity to be both serially and contemporaneously correlated with inputs' (Levinsohn-Petrin 1999,p 9) is more appropriate because of its ability to depict not just the differences in productivity of a firm over time, but also the differences across firms at a given time. The intuition is that, firms differ in their decisions about the level of capital and labour on the basis of present and future profits. These profits however are determined by a sequence of present and future productivity realisations. The unobserved productivity follows a stochastic process and should be modelled by a dynamic model.

One approach could be to use instruments which are correlated with inputs but uncorrelated with productivity but it is difficult to find such instrumental variables. Following Olley and Pakes (1992), Levinson & Petrin used a proxy for productivity shock to correct for the correlation problem. They support the use of investment as a proxy on the basis that firms witnessing an improvement in productivity in the current period as compared to similar firms will tend to invest more in the current period. This is because more productive firms expect to perform better in future. However, they preferred to use intermediate inputs instead of investment as a proxy for productivity because not all firms make investments frequently. Using investment then would mean leaving such firms out of the analysis and truncating the sample whereas the proxy of intermediate inputs is available for almost all firms. Secondly, with an increase in productivity, firms will increase output to match the higher marginal products at constant input prices. This means increased use of intermediate inputs, materials, fuel and electricity.

In their model, K, capital follows a deterministic pattern:

$$K_t = (1-\delta)k_{t-1} + i_t \tag{2.17}$$

i is investment and δ is the depreciation rate.

Productivity as in Olley-Pakes follows a first-order Markov process, so knowing this period's productivity, the firm has some expectations about the state of productivity in future.

A firm chooses its level of investment at the start of the period and then observes productivity. Knowing its capital k, and productivity w, input and output prices, the firm then decides about the level of its variable inputs, labour and intermediate inputs, in order to maximize profits.

The production function estimated is of the form:

$$y_t = \beta_0 + \beta_k k_t + \beta_s l_t^s + \beta_u l_t^u + w_t + \mu_t \tag{2.18}$$

y is the log of output in year t, k is the capital in year t, l_t^s is the log of skilled labour, and l_t^u is the log of unskilled labour input. The error term in this equation is the product of two objects, w_t and μ_t, where w is productivity of plant or firm whereas μ may be either measurement error or an unexpected productivity shock. Firms make the choices of variable inputs in response to w_t, hence variable inputs will be positively correlated with w_t.

Just like Olley and Pakes (1992), Levinson-Petrin show that intermediate inputs, m, are an increasing function of w:

$$m_t = h_t(w_t, k_t) \tag{2.19}$$

Inverting this equation, they obtain productivity as a function of observable intermediate inputs and capital:

$$w_t = h_t(m_t, k_t) \tag{2.20}$$

This can then be used as a proxy for productivity :

$$y = \beta_s l_t^s + \beta_u l_t^u + h_t(m_t, k_t) + \mu_t \tag{2.21}$$

The equation is then estimated using semi parametric methods in which the error term μ is assumed to be uncorrelated with labour input, hence generating the consistent estimate of skilled and unskilled labour.

This technique deals with the problems arising from simulataneity and endogeneity of inputs. However, instead of firm level data, the present study is dealing with the census data at the level of five digit industries', and data on intermediate inputs and electricity/fuel is available for all the sectors and sub sectros. Hence the Levinsohn and Petrin procedure is used at the sectoral level. This is not perfect because the census data aggregates data taken from individual factories/plants and the aggregation might complicate the true picture and mask the heterogeneity among firms. Depite this weakness which we have to contend with, even at the sectoral and sub sectoral level, census data can reveal differences among various industries at the sectoral level. Fixed-effects or Random-Effects methods have also been used to extract estimates. GLS (Generalized Least Squares) is the next reliable procedure as it corrects for both heteroskedastcity and serial correlation but does not account for simultaneity or endogeneity of inputs. The Levinshon-Petrin technique is preferred to extract the coefficient estimates and to estimate productivity. The production function cannot be fitted to all sectors together as every sector and even sub sectors vary substantially in the production methods, technology and characteristics.

Assuming a Cobb-Douglas production functin :

$$y_{it} = \beta_0 + \beta_1 emp_{it} + \beta_2 capital_{it} + w_{it} + \mu_{it} \tag{2.22}$$

y is log of value added, emp is log of average number of daily employees, capital is log of fixed capital, w represents the productivity term, μ is the iid(independently and identically distributed) error term. i and t are sector and time subscripts respectively.

The Levinsohn-Petrin (2003) procedure is implemented by a command in STATA with the help of ado files .

2.9 Data

The data set comprises factory level data, as aggregated in the census of manufacturing industries. Data spans fifteen years with intervals, from 1980-1995. Until 1990 census was conducted every year and afterwards it was conducted every five years. There are some years for which there is no data because in those years census was not conducted. This can create problems of inconsistency and missing data. In the absence of consistent and complete data set on the factories or plants, this is the only available information. The data used is far from perfect but can still provide adequate detailed information on the selected variables. Secondly census data provides information on the composite sectors within a major sector and periodic survey of these sectors over time can help compile a panel data set. As the information on various factors for these sectors is varying over time and across the sectors, use of panel data techniques is appropriate and justifiable.

The data covers all factories with at least ten employees. The Federal Bureau of Statistics, Statistics division of Pakistan conducts the census. It is carried out by sending questionnaires to all the factories whose list is maintained by Provincial Chief Inspectors of factories and Directorates of Labour Welfare of the provinces. Provincial Bureau received responses from each factory on its list. The data so gathered is aggregated so as to represent the responses of factories under a particular sector. Each Provincial Bureau sends the respective compiled data to Federal Bureau of Statistics which aggregates it at the level of entire sector in Pakistan.

As the units or factories are not individually identified, only the industries and sub sectors within these are investigated. Each sector comprises of certain sub sectors which are studied over time. The component sub sectors are also cross sectionally investigated and compared in a particular year

This research focuses on eight industries reported in the census. Establishments are classified according to Pakistan standard industrial classification 1970 which is comparable to international standard industrial classification 1968 at 3-digit level and analysis is carried out at 5-digit level. The census does not provide identifying details of a particular factory or establishment, hence making it impossible to track the factory to study its evolution over time such as the entry and exits of factories to determine the turnover rates and their contribution to the productivity of an industry and the effect of concentration or its correlates. Instead all the information gathered is masked into an aggregation which is broken down though by employment size, fixed assets size and type of legal organization. This makes it feasible to work with the effect of these factors on output, value added or productivity. Unfortunately this kind of information is also provided only until the census of 1990 and discontinued afterwards.

The industries are listed below:

1. Food, beverage and tobacco
2. Textile, apparel and leather
3. Chemical, rubber & plastics
4. Metal products, machinery and equipment
5. Basic metal industries
6. Non metallic mineral products
7. Wood, wood products and furniture
8. Paper, printing and publishing

Disaggregating by factory or plant is not possible, but each industry is decomposed into further sub sectors enabling study of a particular industry into detail at sub sector level. The list of all industries with their corresponding sub sectors is given in appendix, table 2.1.

Data observed annually includes measures of:

1. Capital (Value of fixed assets)
2. Employees (Average daily persons engaged including contract labour)
3. Labour cost (Employment cost during the year)
4. Output (Value of production during the year)
5. Value added (Value added during the year)
6. Materials (Value of raw materials consumed)

7. Fuels (Cost of fuel and electricity consumed)

Value added: is constructed by adjusting output value for industrial cost measure. The industrial cost includes cost of raw materials, fuels and electricity consumed, payments for work done, payments for repairs and maintenance and cost of goods purchased for resale. Value of production or output measure mainly comprises the ex-factory prices including indirect taxes but excluding transport costs of finished products and by-products, receipts for work done for others, receipts for repairs and maintenance, value of sale of semi-finished products and by-products and the net increase in the value of work in process.

Capital: includes land and building, plant and machinery, transport equipment, furniture and fixture and other fixed assets. The value of fixed assets is constructed as:
Value of fixed assets at the end of the year = value of fixed assets at the beginning of year + (additions/alterations during the year + new fixed assets produced by the establishment –sales-loss) - depreciation charged for the year.
Sales include value of fixed assets used by the establishments and then sold during the accounting year. Loss refers to the loss incurred due to flood, fire, earthquake, theft and other unforeseen reasons.
This is equivalent to:

$$k_{t+1} = (1-\delta)k_t + i_t$$

where δ stands for depreciation charged and i stands for investment which is reported as additions/alterations made and includes purchases of fixed assets obtained from other establishments or produced by own employees. The value is adjusted for any sales and losses during the accounting year.

Labour: is recorded as average daily employment including contract labour and unpaid family members. Labour cost is constructed as total employment cost including wages and salaries, other cash payments, non cash benefits and amounts paid to contract labour. Labour is differentiated between production and non production workers. Production workers are those directly associated with the manufacturing activity, assembling, packing repairing etc. Supervisors are also included in the category of production workers. Non production workers include administrative and professional, white collar office employees, drivers, watchmen, sweepers etc.

Fuels: comprise ten different kinds of fuel and electricity consumed. Fuels are recorded in terms of both the quantity consumed and value of that quantity. Value of the amount of electricity and other fuels consumed is taken to indicate the measure of fuels here.

2.9.1 Variables

All the variables are expressed as logs in the estimation and denoted by:

lncapital = log of value of fixed assets

lnemp = log of number of employees

lnempcost = log of employment cost

lnoutput = log of value of output

lnvad = log of value added

lnmaterials = log of value of raw materials consumed

lnfuel = log of value of fuels and electricity consumed

For deflation of all these variables, Wholesale manufacturing price index is used. In Pakistan prices are measured by four types of indices :

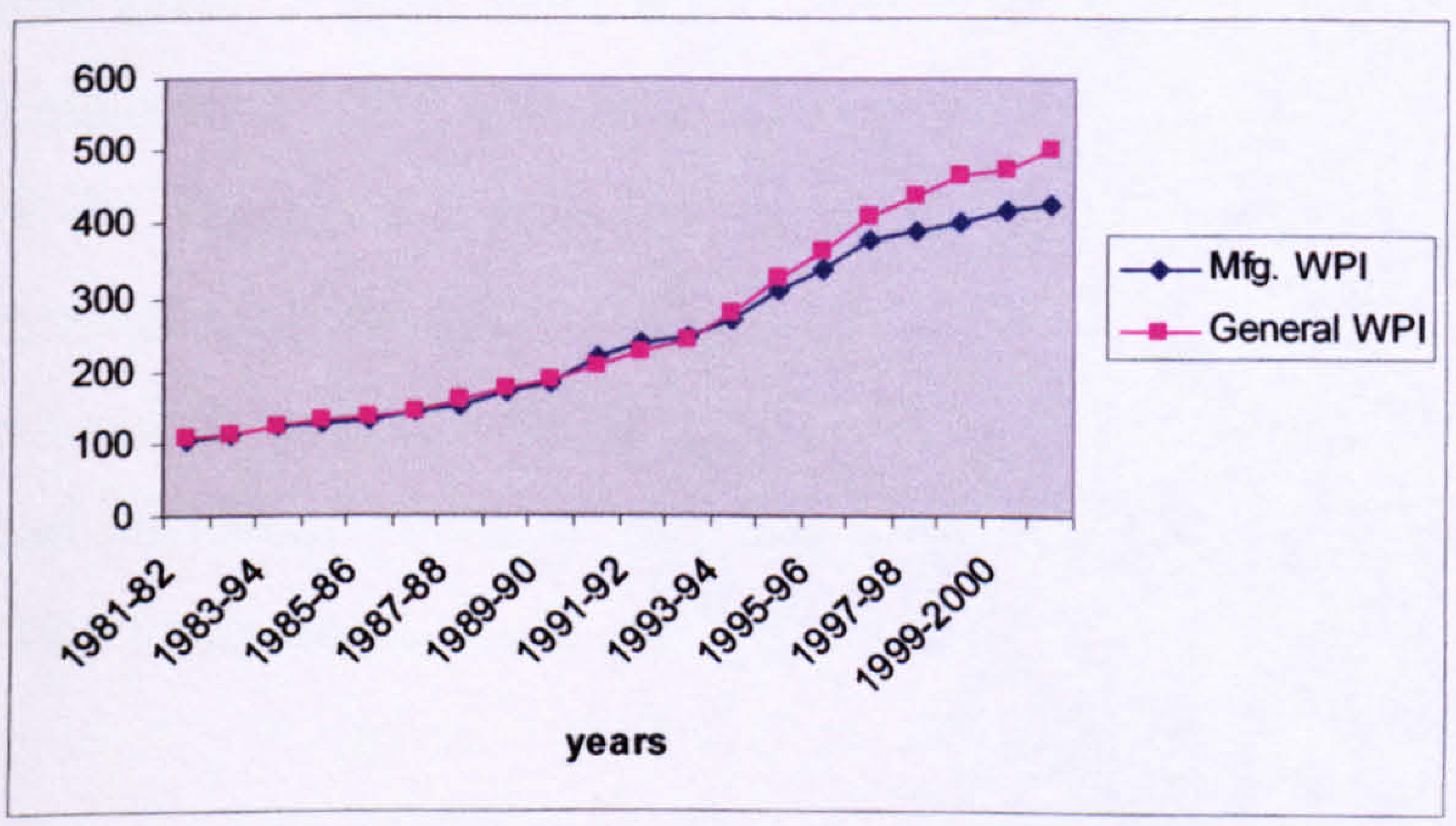
1. CPI , Consumer price index, is mainly concerned with retail prices of 460 consumer items covering nine commodity groups.
2. WPI, Wholesale price index, is mainly concerned with primary sellers at ex factory level and covers 97 commodities. Services are not included.
3. SPI, Sensitive price index, is limited to 47 essential commodities.
4. GDP Deflator, includes prices of all goods and services produced in the economy and is broad based.

Considering the scope of this study, which is dealing mainly with manufacturing industries, industry level price deflators are preferable but not available. Consumer price index is a useful indicator for measuring the cost of living. Wholesale is divided between general, food group and non food group. Non food group includes raw materials, fuel, lighting&lubricants, manufactures and building materials. Comparison of these two groups is shown in a line graph, below. Both price categories in wholesale price index have moved together until early 1990 when manufacturing price changes started to divert from general price increases. Manufacturing wholesale price index is chosen to deflate the variables because it seems more appropriate to the manufacturing activities.

Table 2.1

Year	Mfg. WPI	General WPI
Base 1980	100	100
1981-82	103.44	107.36
1982-83	110.16	113.11
1983-94	124.5	124.44
1984-85	127.75	130.9
1985-86	132.11	136.95
1986-87	141.24	143.8
1987-88	151.78	158.21
1988-89	168.9	173.5
1989-90	184.01	186.16
1990-91	216.56	207.99
1991-92	237.24	227.26
1992-93	245.72	243.42
1993-94	272.09	280.02
1994-95	311.45	325.64
1995-96	338.13	362.65

Figure 2.1



2.10 Descriptive statistics of manufacturing industries

The empirical analysis comprises eight sectors at three digit level which is further composed of sub sectors. Descriptive analysis of these sectors in terms of their contribution to the manufacturing output, value added and employment reveals interesting variations in their shares. Similarly analysing sub sectors separately in terms of the share of each towards the output, employment and value added of that particular sector not only shows the relative significance of each but also the shifts in their shares over the years. Therefore, it becomes possible to identify the major sectors and illustrate the relatively strong or poor performance of some across all the sectors and over time.

Comparison of the percentage shares in manufacturing output, employment and value added (Appendix table 2.2) at 3-digit level, it appears Textile and Food industries hold the highest shares. The Textile sector share in total manufacturing employment decreased from 1980 and was consistently declining until 1990 when it increased greatly but decreased further in 1995. In terms of contribution to manufacturing value added, there is a steady increase. The share of Textiles in value added until 1985 fluctuated around nearly 16%. From 1986 till 1990 Textile gained an increase in its share of manufacturing value added when it stood at 26.35% while in 1995 it accounted for 22.31 percent of manufacturing value added. Other wearing apparel and ginning sector form a small part in terms of their contribution to manufacturing output, value added and employment.

The Food sector, particularly food manufacturing is the second largest industrial sector contributing 15.19 percent in terms of manufacturing value added and 12.27% employment in 1995. There is a slight reduction as compared to previous years. Especially for value added, the share of food manufacturing declined to 20.12 percent in 1980 and hovered around nearly 18% percent until 1985. In the later half of 1980s, gradual reduction is witnessed. While Textile manufacturing gained in its share of manufacturing value added but food manufacturing recorded a loss in its share.

Among other sub sectors, non electrical and electrical machinery, other non metallic mineral products, transport equipment, drugs and pharmaceuticals and iron and steel have achieved reasonably large contributions to manufacturing output, employment and value added. There are no substantial shifts and fluctuation in these shares over the period 1985-1995.

One or two specific sub sectors predominate over others within each sector and account for nearly more than half of these shares (Appendix table 2.3). For example, medicines and basic drugs, fertilizers and other industrial chemicals in Chemical, Rubber and Plastic sector hold dominant positions. Performance of Food & Allied sector is controlled by vegetable ghee, wheat and grain milling, refined sugar and beverages. Cement and cement products are the major sub sectors of Other Non Metallic Mineral Products and account for nearly eighty percent of the sectoral output, employment and value addition. In the engineering industry, iron and steel mills and foundries constitute the overwhelming share of production, value added and employment of Basic Metal Industry.

Cotton spinning and cotton weaving are the largest sub sectors in Textile Manufacturing (Appendix table 2.3). In 1995, spinning accounts for more than 55 percent of total output from the Textile sector, 53 percent of employment and more than 56 percent of value added. Cotton weaving is the next largest constituent, which shows a decreasing trend in its shares to sectoral aggregate. The decline has been gradual except 1986 which was the worst year for the textile weaving sector. Woollen and jute textiles, carpets and rugs, Spooling and threadball making are showing gradually declining output, employment and value added. Silk and artsilk textile, the fourth largest constituent of the Textile sector, have been steadily increasing contribution to textile output, employment and value added until 1987 but afterwards a decline is apparent. The sectors which have gained prominence by an increase in these indicators are finishing of textiles, knitting mills, manufacture of textile and ready made garments. These sectors have shown better performance in the most recent years or at least maintained the level. Ginning, pressing and bailing of cotton fibres contributed more than thirty percent of textile output until 1985, after which its share in sectoral output plummeted. Its share in overall textile employment has decreased greatly from 5.79 percent in 1980 to 2.36 percent in 1995. The same is true for value added contribution which stood at an impressive 15.83 percent in 1980 but in 1995 no more than 5 percent. Overall cotton weaving, woollen textiles, jute textiles, silk & artsilk textile, made up textiles, carpets & rugs, spooling and threadball making and ginning and bailing of fibres have all shown considerable decrease in their contribution to sectoral output, value added and employment, particularly in 1995. Perhaps this could explain the fact that although Textile is still the dominant contributor in absolute terms, its share in total manufacturing output, employment and value added has experienced a decrease in 1995.

Food & Allied Industry comprises of three 3-digit sub sectors, food manufacturing, beverage industries and tobacco manufacturing. In these three sectors, food manufacturing alone holds more than seventeen percent manufacturing output share, more than twelve percent employment and nearly sixteen percent manufacturing value added in 1995 (Appendix table 2.2). There is a clear decline as compared to 1980 when food manufacturing contributed more than 20% of total manufacturing output, nearly 13 % employment and 20% manufacturing value added. Beverage industries contribute moderate shares in terms of manufacturing output, employment and productivity.

Food manufacturing is comprised of seventeen sub sectors. Five among these, vegetable ghee, refined sugar, wheat and grain milling, and blending of tea contribute more than sixty percent to the Food sector output in 1995. More than sixty percent of employment in Food and Allied industries is concentrated in these sub sectors. Further, refined sugar alone holds more than forty seven percent of food sector employment. In value added as well the biggest contributor is refined sugar. Refined sugar is noteworthy because over the past fifteen years it has increased its shares in sectoral output, employment and value added. Vegetable ghee share in total food sector output, and particularly employment and value added drastically reduced over the years. Wheat and grain milling gained or at least maintained its share in food sector output, value added and employment. Overall, vegetable ghee and other vegetable oils, refined sugar and beverages appear as the major segments of the industry while processed fruits and vegetables and dairy products are increasingly becoming important.

Metal products, Machinery and Equipment consists of thirty two industries at five digit level. Overall the share in manufacturing output of this sector has fluctuated between 9 and 11 percent from 1980-1995. Whereas its share in manufacturing employment has been hovering around fourteen percent until 1987 and after that it has declined to ten percent. Value added contribution on the other hand has improved from nine percent in 1986 to thirteen percent in 1995. Contribution from the five digits sub sectors within this sector illustrate variations in the shares of sectoral output, value added and employment. For example agricultural machinery, other industrial machinery, other non electrical machinery, electrical industrial machinery, electrical appliances, motor vehicles, motor cycles, pedicabs, building and railroad equipment and surgical instruments appear as main players. Notably these sectors contribute more towards sectoral employment than their contribution to sectoral output or value added. Engineering industries such as industrial, electrical, other industrial machinery and non electrical machinery have been established and developed with the help of The Pakistan Industrial Development Corporation and the State Engineering Corporation which helped create a number of public sector enterprises. Besides, the sector is also characterised by a large number of small and medium enterprises, which may explain the relatively high share of most of the segments in this sector to the aggregate sectoral employment.

In Basic Metal Industries there are only two three digit sectors disaggregated to further four, five digit sub sectors. Iron&steel mills and iron&steel foundries, taken together hold more than seventy percent of total sectoral output, more than ninety percent of value added and employment of Basic Metal Industries.

Other Non Metallic Mineral Products is comprised of seven more disaggregated sub sectors. However most of the output, employment and value added of this sector are concentrated in only two sub sectors, cement, and cement products. Cement in 1995 holds more than seventy five percent of sector output and its share of employment is more than sixty seven percent. It contributes more than seventy seven percent of sectoral value added. Cement products have increased their contribution in output and value added from a small 3.34% and 2.72% in 1980 to 10.49 and 11.01 percent in 1995, respectively. The share of cement products in sectoral employment steadily increased until the decline in 1995.

Average labour productivity (Appendix table 2.4) during 1980-85, 1985-90 and the year 1995 illustrate that Food group, Chemicals, Other Non Metallic Mineral Products and transport equipment in Metal Products, Machinery and Equipment have shown improvement. The beverage industry has done considerably well into the year 1995 and food manufacturing has also appeared with consistent improvement. Textile industry is regarded as the backbone of manufacturing industry because of the contribution it makes to total manufacturing employment, output and value added and also receives enormous support from the government. However it shows only a modest increase in its labour productivity. The Chemical group constituting of drugs, industrial chemical and other chemical products have recorded significant improvement over the years. Transport equipment and non metallic mineral products have also increased their labour productivity.

There is enormous variation in the performance and contribution by establishments in various size categories (Appendix table 2.6). The establishments have been grouped in three size categories, with the smallest size category comprising of establishments employing up to 19 employees, medium sized employing 20-99 employees while the largest sized establishments are those employing above one hundred employees. The shares of these size classes in the manufacturing output, value added, employment and capital illustrate that the largest sized establishments predominate over the other two size categories in their contribution.

The largest sized units historically contribute above 80 percent of manufacturing value added, employment and output while employing nearly 90 % of the manufacturing capital. The smallest sized firms make the least contribution as is apparent from their shares in total manufacturing output, employment and value added (Appendix table 2.6). The basic partial productivity ratios, output per worker and value added per worker (Appendix table 2.7) demonstrate that medium sized establishments are most productive in almost all the segments of the eight industries. This holds true for food manufacturing, textile manufacturing, wearing apparel and ginning and bailing of fibres. For Paper Products, Printing and Publishing, other chemical products, rubber and plastic products in Chemicals, iron and steel industries and nearly all segments in Metal Products & Machinery, the gap between smallest and medium sized establishments in terms of their output productivity is very narrow. The highest number of establishments is found in the smallest and medium size classes except cotton spinning, drugs & pharmaceuticals, industrial chemicals and Other Non Metallic Mineral Products where the number of units in each sized category is balanced.

2.11 Results

Panel regressions have been conducted on data using four methods, ordinary least squares (OLS), fixed or random effects, generalized least squares and the Levinsohn-Petrin method (2003). The purpose of using these four methods was to compare the behaviour of coefficients on variable inputs because greater reliance is placed on the Levinsohn-Petrin procedure. Levinsohn-Petrin method is expected to generate the most accurate parameter estimates by virtue of its ability to account for the simultaneity bias caused by the correlation between the level of unobserved productivity and choice of variable inputs.

Given the panel nature of data, heteroskedasticity is expected to affect the estimation and the test for heteroskedasticity following OLS, shows that major sectors with large numbers of groups, such as Textile, Chemical, Food and Allied, are characterised by significant amount of heteroskedasticity problem. The Breusch-Pagan test for the other industries accepts the null hypothesis of constant variance implying heteroskedasticity is not affecting the results.

GLS produces parameter estimates after correcting for heteroskedasticity and first order autocorrelation but suppresses the fixed or sector specific effects. However, the Breusch-Pagan test for diagnosing whether variance due to sector specific effects is zero shows that only Basic metal industries and Paper, printing and publishing do not exhibit any variance due to presence of sector specific effects.

In order to compute productivity estimates which will be used in the later chapters as dependent variables, parameter estimates produced by the Levinsohn-Petrin method are preferred. As has been discussed in the section on methodology, Levinsohn-Petrin has adapted the procedure from Olley-Pakes (1996) because their use of fuel or intermediate materials as an instrumental variable means greater use of available data and no truncation of the sample. Regarding heteroskedasticity and first order autocorrelation, this method is more efficient in that standard errors are bootstrapped to get the robust estimators which renders heteroskedasticity a non issue. As far as autocorrelation is concerned, productivity is incorporated as following a first order Markov process. The method is based upon the contemporaneous correlation between adjustable inputs and productivity level implying that when firms are experiencing good productivity, they will hire more labour and use less of it in a bad year. According to this intuition behind the Levinsohn-Petrin (2003) and Olley and Pakes (1996) method, if there is such a correlation between the variable inputs which can easily adjust in response to the productivity changes in a particular period, the OLS coefficient estimates will be biased. The direction of bias will be easy to determine if there is only one variable input as Olley and Pakes and Levinsohn-Petrin have done in their papers. According to these, productivity shock in a period is positively correlated with that period's variable inputs, hence using OLS, and not adjusting for this correlation will result in an upward bias on variable inputs i.e. blue collar and white collar workers in their study. If capital is also positively correlated and responsive, the direction of bias on capital will also be upwards. However, in case it is not correlated or less correlated, then bias on it will be downwards.

Production function estimates for eight industries, Food& Allied, Chemicals, Textiles, Basic Metal Industries, Metal Products, Machinery and Equipment, Other Non-Metallic Mineral Products, Wood, Wood Products and Furniture, Paper, Printing and Publishing, are presented below in tables 2.2-2.9. These results have used fuel and electricity as proxy for unobserved productivity while labour is used as a freely variable input.

(Figures in parenthesis are t-statistics for all sectors. Hausman test statistics determines the choice between fixed or random effects.)

TABLE 2.2
Production function estimates

Metal products, Machinery & Equipment

Dependant variable log value added	OLS	GLS	Random effects	Levinsohn-petrin procedure
Average daily employees	.271	.365	.35	.305
	(13.84)	(7.14)	(4.61)	(2.33)
Capital	.657	.582	.60	.651
	(4.14)	(15.42)	(12.6)	(3.89
log likelihood		-137.45		
Prob >chi2		0.000		
Wald test of CRS:				
RTS	.928	.947	.95	0.956
chi2				0.07
(P-value)				0.76

Hausman Specificantion test
Test: H = difference in coefficients not systematic
Chi2(1) = 1.25
Prob>chi2 = 0.53

Breusch Pagan test for heteroskedasticity
Test . Ho: constant variance
Chi2(2) = .19
Prob>chi2 = .66
Number of observations : 256
Number of groups : 32

TABLE 2.3

Food & Allied

Dependant variable log value added	OLS	GLS	Random Effects	Levinsoh-petrin procedure
Average daily employees	.769 (4.5)	.76 (14.08)	.69 (8.2)	.513 (2.23)
Capital	.32 (8.69)	.265 (6.25)	.23 (4.03)	.266 (1.62)
log likelihood		-80.98		
prob>chi2		0.000		
Wald test of CRS:				
RTS	1.08	1.02	.92	.779
chi2				0.82
(P-value)				0.36

Hausman specification test
Test: Ho : difference in coefficients not systematic
Chi2(1) = 3.2
Prob>chi2 = .19

Breusch Pagan test for heteroskedasticity
Test . Ho: constant variance
Chi2(2) = 5.44
Prob>chi2 = 0.019
Number of observations : 144
Number of groups : 18

TABLE 2.4

Chemicals

Dependant variable Log Value added	OLS	GLS	Fixed Effects	Levinsoh-Petrin procedure
Average daily employees	.409	.345	.029	.374
	(5.64)	(6.87)	(0.33)	(2.20)
Capital	.59	.57	.46	.43
	(11.82)	(19.9)	(7.6)	(2.62)
Log likelihood		-70.88	.	
Prob>chi2		0.000		
Wald test of CRS:				
RTS	1.007	.918	.50	.805
Chi2				0.66
P-value				0.415

Hausman specification test
Test: Ho : Difference in coefficients not systematic
Chi2(1) = 14.89
Prob>chi2 = 0.0006

Breusch-Pagan test for heteroskedastictiy
Test . Ho: constant variance
Chi2(2) = 8.95
Prob>chi2 = 0.002
Number of observations 192
Number of groups 24

TABLE 2.5

Textile manufacturing & Wearing apparel

Dependant variable : log value added	OLS	GLS	Random effects	Levinsohn-Petrin procedure
Average daily	.321	.179	.27	.32
Employees	(4.56)	(3.76)	(3.5)	(1.89)
Capital	.54	.676	.54	.57
	(8.48)	(15.73)	(7.9)	(2.23)
log likelihood		-12.005		
prob>chi2		0.000		
Wald test of CRS(P-value)				
RTS	.859	.855	.81	.895
Chi2				0.25
P-value				0.62

Hausman specification test
Test : Ho : difference in coefficients not systematic
Chi2(1) = 4.65
Prob>chi2 = 0.097

Breusch-Pagan test for heterokedasticity
Test . Ho: Constant variance .
Chi2(2) = 24.15
Prob>chi2 = 0.000
Number of obs: 120
Number of groups : 15

TABLE 2.6

Basic Metal Industries

Dependant variable : Log Value added	OLS	GLS	Levinsohn-Petrin procedure
Average daily employees	1.35 (8.34)	1.36 (11.79)	1.37 (.25)
Capital	-.11 (-1.04)	-.11 (-1.61)	-.67 (-.70)
Log likelihood		-8.88	
Prob Chi2		0.000	
Wald test of CRS(P-value)			
RTS	1.24	1.25	.70
Chi2			.00
P-value			.95

Hausman specification test
Random effect returns sigma_u=0
Random effects in this case has degentrated to pooled OLS. Fixed or random effects are not appropriate.

Breusch-Pagan test for heteroskedasticity:
Test . Ho: constant variance

Chi2(1) = .22
Prob>chi2 = .64
Number of observations 32
Number of groups 4

TABLE 2.7

Non Metallic Mineral Products

Dependant variable Log Value added	OLS	GLS	Random effects	Levinsoh-Petrin procedure
Labour	.88	.86	.31	.61
	(6.74)	(7.99)	(3.6)	(1.78)
Capital	.38	.35	.95	.20
	(4.40)	(4.95)	(6.9)	(1.01)
log likelihood		-13.74		
Prob>chi2		0.000		
Wald test of CRS(P-value)				
TRS	1.26	1.21	1.26	.81
Chi2				.28
P-value				.59

Hausman Specification test
Test : Ho : difference in coefficients not systematic
Chi2(1) = 1.94
Prob>chi2 = .37

Breusch Pagan test for heteroskedasticity
Test . Ho: constant variance .

Chi2(1) = .42
Prob>chi2 = .51
Number of observations 56
Number of groups 7

TABLE 2.8

Wood, Wood products & Furniture

Dependant variable : Log Value added	OLS	GLS	Random Effects	Levinsoh-Petrin Procedure
Labour	1.12	1.13	.015	.85
	(8.68)	(12.22)	(.26)	(.59)
Capital	.035	.005	1.08	-.16
	(.50)	(.11)	(8.6)	(-.41)
Log likelihood		1.53		
		0.000		
Wald test of CRS(P-value)				
RTS	1.15	1.13	1.09	.69
Chi2				.04
P-value				.83

Hausman Specification test
Test : Ho: difference in coefficients not systematic
Chi2(1) = .09
Prob>chi2 = .95

Breusch –Pagan test for heteroskedasticity
Ho: constant variance
Chi2(2) = .24
Prob>chi2 = .62
Number of observations 32
Number of groups 4

TABLE 2.9

Paper, Printing & Publishing

Dependant variable: Log Value added	OLS	GLS	Levinsohsoh-Petrin procedure
Labour	.69	.68	.65
	(8.32)	(12.18)	(4.49)
Capital	.42	.40	.25
	(6.97)	(9.99)	(2.32
Log likelihood		-16.73	
Prob>chi2		0.000	
Wald test of CRS(P-value)			
RTS	1.11	1.08	.90
Chi2			.50
P-value			.48

Breusch-Pagan LM test that Var(v[i]) = 0
Test Var(u) = 0
Chi2(1) = .61
Prob>chi2 = .43

Breusch Pagan test for heteroskedasticity
Test . Ho: constant variance

Chi2(1 = 3.83
Prob>chi2 = 0.05
Number of observations 72
Number of groups 9

In three sectors, Chemical, Rubber and Plastics, Textile and Metal products, the coefficient on capital is the highest as compared to labour while in the rest of the sectors the labour has returned the higher coefficient. It is important to mention here that Textile, Food, Chemical, and Metal Products are regarded as important industrial sectors in terms of their contribution to total manufacturing output, value added and employment. In the rest of the sectors, Food along with other minor sectors, have a coefficient on labour which is larger in size.

In Basic Metal Industries the coefficient on capital appears with a negative sign which is difficult to interpret except that the sector consists of small number of observations and this result might have been due to some errors in measurement. Comparing the coefficients on capital and labour with Levinsohn-Petrin vis-à-vis OLS and GLS methods, the size of the labour coefficient is considerably and unambiguously reduced in Levinsohn procedure in Metal products, Food and Allied, Non Metallic Mineral Products, Wood & Products, and Paper & Printing. For Chemicals, Textiles, Basic Metal Industries, if we compare OLS with Levinsohn procedure, it appears that the coefficient on labour has decreased with the later method. However in these sectors the GLS and Levinsohn-Petrin methods, both produce nearly the same coefficient on labour.

If labour is positively correlated with productivity as more workers are hired in good years and less vice versa, then the coefficient on it is supposed to be upwardly biased with OLS. The labour variable in this study does not differentiate between blue or white collar workers. It includes a large proportion of contract labour, and wage earners particularly in small sectors like wood products or non metallic mineral products, which can be highly responsive or adjustable. It is fair to assume that the coefficient on labour will be upwardly biased with OLS. In most of the sectors the coefficient on labour goes down when the correction for contemporaneous correlation is implied via the Levisohn-Petrin method. The fact that coefficient on labour is considerably reduced with the Levisohn method as compared with other methods is consistent with the intuition and the expectation of Olley and Pakes theoretical reasoning. This result is obtained despite the fact that data used here is aggregated industrial data and the labour variable includes white collar workers as well who are mostly administrative/management staff who are not easily and quickly abandoned in low productivity periods.

The direction of bias may not be clearly determinable as various assumptions may be behind it. If capital is positively correlated with this period or last period's productivity, its coefficient is expected to be upwardly biased. If labour and capital are positively correlated and only labour is correlated with productivity but capital is not, then the coefficient on capital is expected to be downwardly biased. The direction of bias is not clearly determinable as all sorts of bias may be at work and in different directions. However for Chemicals, Non Metallic Mineral Products, Wood and Cork products and Paper & Printing, the coefficient on capital has decreased in size with Levinsohn-Petrin method as compared to OLS and GLS. For rest of the sectors, the result is mixed and it is not possible to determine the direction of bias. For example, in Metal Products, Machinery and Equipment, the size of the capital coefficient increased in the Levisohn procedure compared with GLS but is the same as with OLS. However for the Food sector, it appears with the same size in both GLS and Levinsohn procedure but in OLS the coefficient on capital is largest.

Three major sectors, Metal Products, Machinery and Equipment, Chemical, Rubber and Plastic and Textile Manufacturing have appeared with significantly larger coefficients on capital as compared to labour. Some earlier studies have produced the similar results with capital being the more significant variable. Majid (2000) argues that during high growth of manufacturing industry during the 1980s, there was increasing labour productivity which might have been caused by decreasing employment. He found a declining trend in employment growth during the 1990s. He points out that during 1980-95, despite the 2.3 percent employment growth rate at economy wide level, the large scale manufacturing sector only registered 1.8 percent per year growth in employment. There has been a consistent trend for low job creation giving rise to low share of wages in value added and higher labour productivity caused by greater use of capital equipment.

This assumption is tested by a regression for large scale manufacturing for a period of seventeen years, 1980-97 and it is found that labour productivity expressed as value added per employee is positively and significantly associated with capital intensity expressed by capital per employee ratio. The time trend in the same equation also appears to be positive, though the magnitude is not so high. This is interpreted as the improvement in labour productivity through better management, organization methods or improved skills. Labour productivity is also found to be positively correlated with level of value added. Employment is negatively related with capital intensity but positively associated with the level of value added. This suggests that capital intensity is actually playing an important role in increasing labour productivity through reducing the use of labour. However there is scope for increased labour use even with greater amounts of capital in higher value added production since there is a positive association between higher value added and employment.

Ahmed (1980) illustrates the same idea by relating labour productivity to unit wage costs. He found that an inverse relationship exists between higher labour productivity and unit wage costs, such that with increase in labour productivity unit wage costs have declined. One has to consider the limitation of the productivity measure which is being used i.e output per worker. He did not discuss the relative importance and role of other inputs such as capital and materials vis-à-vis total factor productivity. Majid (2000) pointed out that increased labour productivity is affected by the dominant effect of capital intensity instead of greater improvement in production technology or management. Ahmed (1980) emphasised that increased labour productivity has resulted in or explains the substantial wage cost reductions. He suggests that this could imply that the increase was achieved by economising on labour content and increased use of other inputs such as capital and materials.

Increased capital-labour ratio implying greater use of capital instead of labour is found to hold for many but not all the sectors. However in the early years of the1980s the increase is modest while after 1985 or 1986, in many sectors such as Food Manufacturing, Paper &Products, drugs and pharmaceuticals, industrial chemicals, Non Metallic Mineral Products , fabricated metal products, non electrical and electrical machinery, the ratio has markedly increased. Regarding capital output ratio, there has been an increase in the ratio during the first half of the 1980s but after 1985, it started to decline for many sectors. Increase in this ratio during 1980s could be explained by the fact that the 1980s was a decade of stable and high growth and at the same time of significant additions to capital.

The greater use of capital by manufacturing sectors can be linked to numerous fiscal incentives making capital cheaper to acquire and hence producing a bias in favour of capital intensive production, as has been discussed in chapter 1. There was a steadily increasing trend in loans and advances from scheduled banks provided to private sector manufacturing during 1982-2000. Industrial enterprises were getting an enormous amount of credit, but at the same time there is evidence that manufacturing industry was building excess capacity and its utilisation rates remained low. Pasha and Qureshi (1984) worked out the capacity utilization rates for 1971 and

1976 for twenty three industries including important industries such as fertilizers, cement, pharmaceuticals and synthetic fibres. The sample does not include Food manufacturing, Textile or Engineering Industries. The findings substantiate that there was excess capacity in many sectors in 1976 although some sectors were working at high rate of capacity utilisation such as industrial chemicals, synthetic fibres and fertilizers but in others the rate was abysmally low. Kalim (2001) has calculated utilisation rates for 68 industries during 1995-96 and found strong evidence of idle capacity and highly variable capacity utilisation rates in many sectors. Pasha (1984) found that availability of imported raw materials was significant for capacity utilization rates but Kalim (2001) found it to be insignificant.

Industrial sectors, particularly the large and dominant sectors, Textiles, Food and Chemicals were having bank loans at an increasing rate which might have been used to set up the new units while manufacturing industries were overall working below the full capacity utilization rates. This was due to various fiscal incentives encouraging investments in new units instead of expanding the capacity in existing units and secondly subsidizing of finance by low rates and directed credit to specific industries. This led to greater use of capital, capital intensive production methods and excess capacity building. These factors can account for the low levels of total factor productivity which are observed in majority of the sectors.

2.12 Total factor productivity of manufacturing sectors

Productivity has been calculated from the coefficient estimates obtained by applying Levinsohn-Petrin procedure as :

$$\Pr oductivity = \exp(\ln vad_{it} - \beta_{capital} \ln capital_{it} - \beta_{emp} \ln emp_{it}) \qquad (2.23)$$

Where $lncapital_{it}$ and $lnemp_{it}$ denote the industry or sector specific measures of capital and employment.

Total factor productivity of individual sectors is presented in Appendix tables 2.8. Food and Chemicals appear as the most productive sectors. In Food & Allied, beverage, refined sugar and vegetable ghee are the most productive sub sectors. Productivity of vegetable ghee and refined sugar declined as compared to the mid 1980s while that of beverage increased in 1995. Canning of fish&seafood, canning of fruits and vegetables and dairy products show increases in their productivity while productivity of wheat&grain milling and rice milling declined over the years.

In Chemicals, drugs & pharmaceutical products and industrial chemicals (fertilizers, insecticides&pesticides, paints&varnishes and other industrial chemicals etc.) are the most productive subsectors showing overall increasing trends while rubber and plastic products are relatively less productive.

Textile appears among the least productive sectors such as Paper&Printing and Metal products. In subsectors of Textiles, carpets and rugs, demonstrate decline in productivity. Silk&artsilk textiles, knitting mills and madeups have increased their productivity levels while cotton weaving, ginning and manufacture of textile appear stagnant. Overall most of the textile sectors have shown stagnant productivity level in absolute terms with no or little change or improvement over the years.

Most of the subsectors in Metal Products, Machinery and Equipment show stagnant productivity trends. Industrial machinery show constant productivity levels with no improvement but electrical industrial machinery and surgical instruments appear to have performed better.

Paper Products, Printing & Publishing relatively are less productive sector but the sub sectors show increasing trends in their productivity levels as compared to subsectors of Textiles and Metal Products which show stagnant productivity levels.

Non Metallic Mineral Products and Wood Products show intermediate level of performance with cement and cement products being the most productive segments. Their productivity has been constantly increasing until 1990 when it tapered off slightly but recovered again in 1995.

2.13 Conclusion

The objective in implementing three different econometric methods is to verify whether there is any benefit to be obtained by relying on the Levinsohn-Petrin procedure. Analysis of results illustrates that there is evidence of contemporaneous correlation between the unobserved productivity level and the choice of adjustable inputs. Hence the coefficients on inputs are altered with the latter procedure and adjusted downward for the variable input i.e. labour. If the procedure applied does not take into account this correlation factor, the coefficient on variable inputs will be biased and hence will affect the accurate estimation of parameters and consequently the accurate measurement of productivity levels for individual sectors. The Levinsohn method is preferred because of its technique to use intermediate inputs to serve as proxy for unobserved productivity levels.

Total factor productivity estimates become meaningful when studied in the context of policy indicators in order to explore the response of manufacturing industry to the changes in policies. The productivity for individual sectors and sub sectors have been calculated with this objective. Total factor productivity estimates will subsequently be used as dependent variables in later chapters. Therefore, computing TFP estimates can be viewed as the first stage in estimation. In the second stage, these estimates will be related with measures indicating trade policies such as trade shares, average tariff rates, anti export bias, imported raw materials, export rebates and subsidies.

Descriptive analysis of shares of major sectors in manufacturing value added, production and employment illustrate the importance of Textile, Food and Chemical sectors in terms of their contribution. Within each of these sectors, the shares of various sub sectors have undergone major shifts with some sectors performing badly and lagging behind while others emerging as better performers.

Sectoral analysis reveals low productivity trends in many sectors and notably decreasing productivity levels in the1990s. Within each sector, sectoral production, value added and employment is concentrated in few segments such as refined sugar, vegetable ghee in Food ,fertilizers and pharmaceuticals in Chemical, cement and cement products in Non Metallic Mineral Products and spinning and weaving in Textile manufacturing. These segments particularly determine the performance and productivity of the overall sector and ultimately the aggregate performance of manufacturing. The pattern has not changed over the years and this can also have an effect on allocation of resources and incentives provided by government which are oriented towards larger and in some cases export oriented industries. There can be a probable link between the incentives and size of the industries and units which might have been affecting the productivity and profit rates and hence creating a specific industrial structure. These questions are investigated in subsequent chapters.

CHAPTER 3
Total factor productivity and trade liberalization

3.1 Introduction

There are two distinct schools of thought in the debate regarding the effect of trade policy on economic performance. One school of thought believe that the effect of trade policy on long term growth is not clear. The other pioneered by endogenous growth theorists have introduced new dimensions to the debate by bringing in the new ideas of, learning by looking and externalities, innovation and imitation. Mankiw (1992), Romer, Barro and Sala-i-Martin (1998) show the positive effect of trade policy changes on long term growth. Developing countries, because of imitation possibilities, grow faster than the leading developed nations and so converge to their level of growth (Barro & Sala-i-Martin 1998). In this context, trade policy serves as a link, as greater openness in trade will provide access to innovations through increased imports and exports and enhance the learning by looking.

3.2 Infant industry argument

Trade policies have long been influenced by the argument that the key to economic development requires protecting domestic manufacturing industry from international competition. Until the 19th century the developing countries protected their manufacturing sector through tariffs and quotas. Many factors led development economists in the 20th century to advocate protection of domestic manufacturing industry from international competition. An important impetus in this direction came from the development strategy devised by the Economic Commission for Latin America. Dr. Raul Prebisch analyzed the problems of developing countries and his work led to a sharp focus on import substitution. He emphasized that developing countries should try to develop "from within" because prospects for expanding traditional exports are limited since the demand for primary goods, in which the comparative advantage of most developing countries lies, was price and income inelastic and could not ensure high rates of growth. This policy came to be known as import substitution industrialization and was propelled partly during the years of the great depression of the 1930's by the necessity to produce the goods which could not be imported. In addition, there was a belief that developing countries as late comers in the process of industrialization were at a great disadvantage vis-à-vis established industrial countries and could not compete in free trade. Hence to catch up they must de-link their industry from that of industrially advanced nations.

The theoretical arguments primarily rested on the popular 'infant industry' argument. That is, to get industrialization started it is important to protect industries with a potential to establish themselves as mature ones until they become strong enough to withstand international competition. This happens by the process of learning by doing as new industries free from international competition establish themselves by producing the same goods. Capital market failure and the appropriability problem provided the rationale. The new industry needs protection because financial markets and intermediaries are not mature enough to divert savings to the new industry and hence this can be an obstacle even if the prospects of long-term investment are good. The second best policy is then to protect these infant industries to allow more rapid growth.

The appropriability argument pertains to the fact that firms in a new industry generate intangible social benefits which they are unable to appropriate while they have to incur the set up costs of adapting technology to local requirements and opening new markets. This phenomenon may prevent entrepreneurs from establishing industries and hence government needs to step forward to encourage entry by using trade policy measures.

In many developing countries import substitution of manufacturing goods was not seen as an end in itself but as a means to economic development. However the objective of rapid growth foundered on the rock of eventual shortage of foreign exchange. The policy of import substitution went far beyond the original intention and imposed significant economic losses. As typically the import substitution strategy took the form of virtually prohibitive protection characterized by outright ban on imports. Import licences for intermediate and capital goods were allocated to producers of commodities for the home market. The economies implementing these policies witnessed losses of shares in the rapidly expanding international economy. As domestic markets were very small, these protective mechanisms provided great monopoly power to producers of commodities competing with imports, as well as providing incentives to expand into new import-competing lines. Due to protection, the normal market mechanism creating incentives for lowering costs and punishing inefficient producers while rewarding the efficient ones were much weaker under import substitution strategy.

This chapter deals with the effect of trade related policies on the total productivity of industrial sectors of Pakistan. Following the early protection phase trade policies in Pakistan have been gradually and continually liberalized in an inconsistent manner, but rapid and consistent trade liberalizing measures started in 1987. Greater openness increases the level of competition and forces the manufacturing sectors to devise means to improve their total factor productivity. Since the industries were in the process of being exposed to international competition, it is reasonable to assume that there might have been strong pressures for adjustment. The empirical relationship between trade policy indicators and total factor productivity is examined in an endeavour to evaluate the response of manufacturing sector of Pakistan to changes in trade policies over time.

3.3 Political Economy of trade policy

Many empirical studies attribute the growth differentials among countries to varying degrees of trade liberalization and emphasize that openness to trade spurs the diffusion of technology through learning by trading and encourages specialization in industries with scale economies. This causes a long term increase in growth rate. It is a fairly well established conclusion that trade openness causes cross country variation in levels of GDP per head and total factor productivity. This conclusion is arrived at by controlling for the reverse causality between trade and growth by proper instrumenting techniques. The issue that trade openness can result in convergence among countries is still open to debate but the fact that trade nevertheless plays a substantial role has been accepted. Berg and Krueger (2003) amply argue that trade openness can lead to faster growth of poorer countries since it has been empirically seen that regions linked by freer agreements have grown faster.

Trade influences growth through various channels and most of these contradicts the very basic arguments which served as foundations for protectionist trade policy. Protection has been implemented and most convincingly defended on the basis of providing a temporary shield against onslaught of competition. The protection, however, stretched across the board and lingered for an indefinite period of time, resulting in chronic distortions. In more recent research, competition, which was regarded as a threat to domestic firms is believed rather to enhance their efficiency and total factor productivity. This occurs by changing the incentives which protect the firms and removing the cushion of easy profits.

Dodzin and Vamvakidis (1999) empirically show the weakness of the infant industry argument often applied in practice since many developing and agricultural economies have experienced greater increase in their share of manufacturing production after they opened up the trade. This endorses the findings of many other studies which show that liberalizing trade increases the prospects of growth. One effect of liberalization is learning by seeing or trading through the use of imported commodities and inputs. This has been likened to technology and knowledge externalities or spillovers. More open countries have greater varieties of international products available to them offering higher chances to learn from these imports instead of learning by doing while relying on the same methods of production.

This finding holds true even when different measures of openness are used. Dodzin and Vamvakidis (1999) define three groups of countries; one labelled developing countries; one developing and agricultural economies including countries with agricultural value added as a share of GDP between 33 percent and 44 percent; and thirdly the highly agricultural economies with the share of agricultural value added in GDP above 44 percent.

The question whether greater openness has resulted in an increase in the share of agricultural or manufacturing production is examined through estimation of spearman rank correlation coefficients between changes in trade shares and changes in shares of value added in agriculture, manufacturing and services for the period 1970-1995. Two kinds of trade variables are used to indicate openness, one is trade shares and the other is import shares and this is justified on the basis that agricultural economies may have higher trade shares not because of openness but because of higher exports of primary commodities. The results show a positive and statistically significant relationship between openness and industrialization as indicated by the share of value added in manufacturing. The share of value added in agriculture is negatively correlated with changes in trade variable.

In order to further check the validity of the results a regression was also conducted with the share of value added in each sector as dependent variable while independent variables include initial shares of value added in each sector, log of GDP per capita in 1970 and its squared value, and change of trade or import share during 1970-1995. The results again endorse the earlier finding with the spearman correlation coefficient showing that increase in trade shares or imports is associated with increase in share of value added in manufacturing and decrease in share of value added in agriculture. Interestingly, the effect of increase in trade share or imports is more pronounced for more highly agricultural economies leading to the conjecture that at lower levels of industrialization greater openness can lead to greater industrialization. This can be explained by the fact that previously closed agricultural economies can witness the closure of some inefficient industries in the short run but opening up of new industries resulting in more industrial production in the longer run.

Trade liberalization enhances growth by decreasing distortions and inefficiencies associated with anti-market political economy functioning in a closed trade regime. Roderick (1993) has associated this fact with the greater economic growth experienced by more outward oriented economies. However, he contests the arguments proposed by proponents of open economies that more open economies are better placed to cope with external shocks. He argues that it is theoretically implausible because countries with greater exposure to international markets in trade and capital flows are likely to be affected more. However, he concedes that in practice more open economies have shown their resilience in the face of external shocks. Perhaps their improved economic growth and the political economy operative in their economies facilitate the smooth response.

Political economy favouring protectionism gives rise to rent seeking activities. The costs of rent seeking activities are caused by pervasive controls associated with protectionist policies and have been well established and recognised. The amount spent on lobbying government officers and the resources spent on this exercise are labelled rent seeking. These activities lead to deadweight loss because bureaucracy assumes control through allocation of licences and permits. This discretionary power results in compromising efficiency when a large number of industrial units are vying for greater access to imports or import licences. This happens because acquiring permits or licences means windfall profits and the anticipated above normal profits cause economic agents to invest in time and resources to lobby administration. The costs associated with rent seeking activities range from lobbying, generation of excess capacity, smuggling, under invoicing and overinvoicing of imports.

However the intensity of rent seeking activities varies with the kind of instrument used. Some instruments such as quota and licensing are less transparent and hence more prone to rent seeking than tariffs. East Asian countries have eschewed these resource costs while pursuing import substitution policies and have limited rent seeking activities by state intervention in the form of combining export subsidies, targeted protection to selected industries along with setting strict performance standards, stable macroeconomic management and low fiscal deficits. Above all the central focus on export promotion has enabled them to pursue state intervention in the industrial sector while largely avoiding the damage caused by the rent seeking that is often witnessed in other developing countries. Most developing countries practicing protectionist trade policy failed to recognise the need to set a time period during which the industries should be able to demonstrate the benefits from learning by doing so that on the basis of this, a framework for phasing out of protection can be set out. The difference with other countries lies in how the government administered the restrictive or interventionist trade policy, (Roderik 1993).

Liberalizing trade controls and eliminating quantitative restrictions results in minimising the costs associated with rent seeking. Incentives to exert effort on improving efficiency and reducing costs become more powerful in a liberalized trade regime because time and resources to spend on efforts for influencing trade policies are not required. The returns to these incentives are higher because of the pressures of competition against which the rent seeking promised to protect the entrepreneurs in the protectionist regime.

3.4 Institutional quality and the effect of trade openness

Empirical studies aimed at determining the causes of growth differential among countries have increasingly recognised that institutional quality prevailing in a country plays a major role in realising the desired effect of changes in trade policy. Institutional quality appears to be highly correlated with trade openness. It is often proxied by such factors as bureaucratic quality, corruption and government repudiation of contracts.

The positive link between openness and higher growth is substantiated because a number of cross country studies have experimented with a variety of trade measures. Of particular importance is the study carried out by Dollar and Kraay (2001) whose specification deals with lagged values instead of levels. The purpose of using lags on the right hand side is to account for possible reverse causation from growth to trade:

$$Y_{ct} - Y_{c,t-k} = \beta_1 (Y_{c,t-k} - Y_{c,t-2k}) + \beta_2 (X_{ct} - X_{c,t-k}) + (\gamma_t - \gamma_{t-k}) + (v_{ct} - v_{c,t-k}) \qquad (3.1)$$

Here Y is per capita GDP in country c in time t, t-k signifies lag k years ago while k is here a period of ten years. X represents a set of control variables which are used as averages over the decade between t-k and t. Trade volumes as exports plus imports as a share of GDP are included in X. Gamma is time period effect, v is serially uncorrelated error term.

Control variables include such time varying variables as government consumption as a share of GDP, log of inflation rate and average number of political revolutions. Institutional quality is also included because improved institutional quality makes the country a more desirable trading partner. The measure is proxied by including one minus the ratio of currency in circulation to M2. This measure might capture the confidence about the property rights as it indicates to what extent people are willing to hold liquid assets through financial intermediaries.

They focus on the economic performance of the developing countries that have liberalized their trade after 1980 and examine the effect of trade on growth rate. These countries have been categorized globalizers based either on the increase in their trade volumes or reductions in trade tariffs. The countries are divided into two groups, one group comprises twenty four OECD countries and five more advanced liberalizers (Chile, Hong Kong, Taiwan, Singapore and South Korea) and this group serves as benchmark against which the rest of liberalizing or less liberalizing countries' performance can be compared or assessed. Liberalizing countries have been categorized both on the basis of changes in trade volumes and change in trade policy i.e. reductions in trade tariffs. The list is very comprehensive and represents the entire spectrum such as Costa Rica and Dominican Republic in Central America, Rwanda and Zimbabwe in Africa, Bangladesh, India, China and Nepal in Asia, Argentina, Brazil, Venezuela and Peru in South America, Thailand, Philippines in South East Asia, Indonesia and Malaysia in South East Asia.

The results show that increased trade shares are associated with changes in GDP. This conclusion is not affected even if institutional factors and other control variables such as inflation and government stability proxied by frequency of revolutions are included as well. Dollar and Kraay (2001) found that changes in institutional quality variables appear positive but insignificant endorsing their argument that institutional quality is too slow to change and its effect on growth is not predominant. Similarly including inflation and government stability variable do not alter the basic result about the significance of trade volumes on growth. The results also show that the countries that have experienced large reductions in their tariff rates after 1980 increased their trade volumes and experienced faster growth rates.

Two important issues haunt the efforts to precisely determine the effect of changing trade policies on growth and total factor productivity. One relates to difficulty in finding an accurate indicator variable measuring degree of trade liberalization and this is dealt with in a later section. A second concerns the simultaneous or complementary effect of macroeconomic, institutional and geographical variables. This assumes heightened importance in a cross country study since the countries differ vastly in the quality of their institutions and the state of their macroeconomic variables as well as geographical properties. It becomes complex as well as essential to properly deal with the heterogeneity caused by these different factors in order to be able to persuasively segregate the effect of trade related measures on productivity at the economy wide level. It is argued by some researchers that confluence of so many factors make it difficult to accurately determine and separate the effect of only trade reforms. Roderik (2000) maintains that the drawback of including a large number of other variables is that they can reduce the significance of the trade variables. The conclusions from studies including these variables, are mixed and do not strongly support the view that macroeconomic or institutional variables can categorically alter the contribution that trade can make towards economic growth, performance and improvements in productivity.

In an all encompassing study, Alcala and Ciccone (2001) deal with these issues. Their solution lies in using a refined measure where the ratio of imports and exports to GDP is measured in purchasing power parity dollars. Their second alternative is to use nominal value of production in the tradable goods sector instead of overall GDP. The first alternative is preferable for such studies where effect of trade on productivity is investigated in cross country studies, since using purchasing power GDP rectifies the distortions which might creep up into the estimation due to cross country differences in prices of non-tradable goods. They argue that traditional summary measures of nominal imports plus exports to nominal GDP leads to less reliable and imprecise effects of trade on productivity. They point out that greater openness increases productivity more in the manufacturing or tradable goods sector than in non tradable goods sector hence using value of manufacturing production is preferable than overall GDP.

They examine the effect of institutional quality, such as expropriation risk and fixed geographic factors, such as distance from equator, on the relationship between trade and average labour productivity across countries. The results demonstrate that the effect of trade by either measure on productivity appears to be substantial and the above mentioned control variables play an important role in determining that relationship.

Institutional quality is included as an integral part of the estimation used to establish the effect of trade on average labour productivity across countries:

$$\log\left(\frac{PPPGDP_c}{Workforce_c}\right) = a_0 + a_1 ITrade_c + a_2 \log Workforce_c + a_3 \log Area_c + a_4 IQual_c + a_5 X_c + \mu_c \qquad (3.2)$$

Here ITrade, Workforce, Area, IQual denote respectively, intensity of trade, size of labour force of a country, the area in square kilometres and institutional quality of the respective country. Variable X represents the geographic variables. The estimation is conducted with each of three different trade variables, namely the traditional trade shares to nominal GDP measure, trade shares to purchasing power GDP and trade shares to tradable GDP. The study deals with cross country regressions using average labour productivity.

To account for endogeneity of explanatory variables, the instrumental variable technique is tried. This technique has been adapted from the Frankel and Romer (1999) two step approach. In the first step a gravity equation is estimated in which bilateral trade shares are related to the geographic characteristics and population of the countries. Predicted bilateral trade shares for all countries are obtained from the coefficient estimates of OLS. These predicted bilateral trade shares are aggregated to get the values of aggregate imports plus exports relative to PPP GDP for each country. This predicted value of trade intensity is then used to indicate the trade intensity and termed as the geography predicted trade intensity. This is used as an instrument for estimating the effect of trade on productivity or average labour productivity.

Following Hall and Jones (1999) they experiment with constructing an index of institutional quality. The index contains equally weighted average values for five categories; bureaucratic quality, law and order, corruption, risk of appropriation and government repudiation of contracts. The value lies between zero and unity.

In the baseline estimation, average labour productivity is regressed on workforce, area, population and trade intensity fitted values. The results indicate that the openness measure (trade shares to PPP GDP) and trade shares to traded GDP work better than conventional summary measures. Once geography control variables are included with conventional measures of openness, workforce appears insignificant while openness becomes highly significant. However, including institutional quality variables and excluding geography variables produces highly significant results for the institutional variable while the rest of the variables turn insignificant. Using the unconventional measures produces statistically significant effect of trade on productivity even after controlling for geography and institutional variables.

Institutions create a facilitating and favourable environment for economic agents to work towards improvement of their skills and conduct of their businesses. The most frequently used variables to indicate institutions include bureaucratic quality, rule of law, risk of appropriation, corruption and repudiation of contracts. Sometimes these measures are used as a composite index and sometimes as separate variables. Hall and Jones (1999) constructed a composite index and termed it as 'social infrastructure'. They found that this seems to be a predominantly strong variable affecting output per worker, physical capital and human capital.

They argue that in the absence of appropriate 'social infrastructure', diversion of resources from their productive use becomes widespread. In the presence of corruption, fear of expropriation or lack of confidence in the enforceability of contracts, economic agents have to devote time and resources to protect their businesses and interests from being plundered or harmed. They consider that government is best placed to provide the means to control the diversion activities because of its capability to regulate and act collectively. For this very reason, government itself can become a source of diversion of productive resources by the kind of policies it is pursuing.

Working with a conventional growth accounting framework for 127 countries in the year 1988, Hall and Jones calculate the decomposition of output per worker into capital intensity denoted by capital output ratio and productivity which has been derived as a residual from the growth accounting equation of the form

$$y_i = \left(\frac{K_i}{Y_i}\right)^{\alpha/(1-\alpha)} h_i A_i \tag{3.3}$$

Here y_i is output per worker, and h is human capital per worker, K represents stock of physical capital, A denotes the measure of productivity while i is country subscript. Calculation of output per worker, capital intensity, human capital per worker and productivity for these countries reveals that differences in productivity account for the major differences in output per worker among countries. Without these differences in productivity, output per worker would not have been substantially different.

The social infrastructure measure is constructed from the data on five categories provided from the Political Risk Services Group. These five categories deal with the government policies to counter diversion and the government's role itself in diverting resources and include information on such indicators as law and order, bureaucratic quality, corruption, risk of appropriation and government repudiation of contracts. The composite measure is a weighted average of these five indicators and ranks them between 0 and 1. Another measure is also used which is related to the openness of the country to international trade and relies on the Sachs and Warner (1995) index. This index is compiled for 1950-1994 and categorise the countries as open according to five indicators, four of these include level of non tariff barriers, average tariff rates, black market premium, and government position in monopolizing the exports of the country. The overall social infrastructure measure is constructed as an average of these two variables.

Reflecting the hypothesis that social infrastructure primarily influences output per worker, the following equation is estimated:

$$Log Y / L = \alpha + \beta S + \varepsilon \qquad (3.4)$$

The results support the hypothesis that the countries with higher values of its social infrastructure variable also happen to be the countries with higher values of output per worker, USA, Canada and Switzerland rather than Bangladesh, Zaire and Haiti. Regressing capital intensity, human capital and productivity variables on social infrastructure variables reveal that social infrastructure influences the level of physical capital, human capital, and productivity.

3.5 Empirical research at micro level

Studies at the microeconomic level of plants, firms and industrial sectors and sub sectors have reinforced the conclusion of a positive link between openness and growth found at the macroeconomic level. These studies identify various channels through which trade liberalization can affect productivity. The issues arising from this research are reminiscent of the concepts in industrial organization analysis such as the role of market structure, nature of competition, role of entry or exit barriers and their causes and effects which are seen to be profoundly affected by the elimination of trade barriers and restrictions.

This is in sharp contrast to the traditional free trade theories based on factor endowments and comparative advantage as these operate on the assumptions of perfect competition and so assume constant or fixed returns to scale. The core tenets of these theories that productivity differences and differences in resources among countries play an important role in international trade and it is the comparative advantage that matters, are widely accepted. However, monopolistic or oligopolistic markets caused by economies of scale are not recognised. Contemporary research recognizes imperfect competition and the role played by externalities, free availability of information, strategic interaction between firms and the role of research and development. These concepts of industrial organization have now been accepted and given new orientation. Recognising the interaction between international trade and industrial organization allows a richer role for individual firms.

Theoretical literature presents conflicting conclusions. On the one hand, it is predicted that trade openness increases competition for domestic producers. This competition might result in reducing the market power and contraction of output for domestic producers. With this effect, the producers might not be in a position to invest in new technology unless they have increased their international sales to compensate for domestic contraction. Foreign competition might also introduce incentives to reduce costs as prices are lowered as a result of competition.

Resources can shift from low productivity producers to more productive firms with the onset of trade liberalization and this can contribute to improving productivity. The channel lies in heterogeneous firms or plants whose productivity varies greatly. This very heterogeneity can become a source of productivity improvement following trade liberalization. The ability to lower costs assumes significant importance when prices are lowered following competition fostered by trade liberalization. The inefficient producers failing to do so are forced to leave the market. This can result in a flux in market structure of respective industries causing widespread exits of inefficient producers but continuing survival of more productive industrial firms. This phenomenon is reflected in an increasing turnover of firms which is expected to possibly affect the total factor productivity of the firms. This happens because less productive firms leave the market while more efficient and productive firms increase their market shares and hence cause industrial productivity to rise.

3.6 Empirical studies of developing countries on trade reforms, turnover and total factor productivity

Empirical studies on industrial sectors of developing countries focus on the changes in total factor productivity following trade liberalization. These studies are conducted at firm level and total factor productivity of plants and firms is found to improve mostly by changes in turnover of firms provided free entry and exit are allowed. The response of Chilean plants after the major reforms at the end of 1970s and early 1980s has been studied by Tybout (1991, and 1996) and Pavcnik (2002) with findings supporting this effect.

Plant level studies have been conducted by many researchers and there appears to be conclusive evidence from them that the trade reforms are positively associated with the improvement in efficiency of plants. Tybout (1996) in his book has compiled a number of studies at plant level on many developing countries analyzing the effect of trade regime changes on productivity, resource shifts between plants, the changing turnover and profitability influenced by competitive pressure of open trade.

In one such study on Chile, plants in a number of industries such as food, beverage, textiles, apparel, leather, paper, printing and publishing, chemicals, rubber, iron and steel experienced reallocation of resources after reforms. Chile experienced highly protected regime in 1967 but by 1979, much of the protectionist measures had been scrapped. It pursued dramatic trade liberalization over the period 1974-79. Major liberalizing measures were implemented in a period of four years, the extent of which could be realized from the fact that the average nominal tariff was reduced from 105 percent in 1974 to 12 percent in 1979.

Tybout (1996) found that in the early years of the 1980s there was a considerable decrease in the total number of plants. A large number of plants exited many industrial sectors, while the entry of new plants was limited. This accompanied the reasonable growth of total factor productivity leading to the suggestion that inefficient plants exited and efficient ones survived contributing to the productivity. These patterns indicate that there was a major restructuring activity taking place during the earlier phase of the post liberalization period. Surviving plants switched to other products and the new entrants were larger in size than the exiting plants. Secondly it emerged in the analysis that industries characterized by higher import penetration experienced lower price cost margins and were characterized with increasing number of entrants.

Trade reforms in Chile were achieved at a fast pace and the recovery process did not take too long. Morocco (Haddad et al 1996) on the other hand experienced gradual liberalization of its trade regime and the industrial response evolved over the time period of reforms. The reforms were spread over, beginning in early 1980s and the progress with reductions in severe restrictions was modest. The change or shift in the productivity or resources was not very dramatic. Total factor productivity is related with growth of exports, growth of output, growth of import and an interaction between concentration measure and import penetration. The results (Haddad 1996) suggest a significantly positive association between total factor productivity and export growth and output growth.

Pavcnik (2002) endorsed the same findings for Chile somewhat differently. The total factor productivity measure was devised by a semiparametric method to account for simultaneity bias. Plants were categorized as import competing, export oriented or non traded goods sector. The same results appeared as in previous studies that less productive plants exited the market irrespective of their trade orientation. The important result emanating from both these studies is that the growth of the manufacturing sector of Chile was mostly achieved as a result of its ability to reshuffle resources from less to more efficient producers. Hence if there are entry and exit barriers, this reshuffling cannot effectively happen. Hindering the rationalization of market or industry by barriers reduces the chances to get the expected and desired outcomes of trade reforms in the form of higher aggregate productivity.

It is believed that industrial sector firms or plants come under increasing pressure to work hard in order to introduce efficient production methods and reduce their costs following trade reforms. Krishna and Mitra (1998) investigate the trade reforms in India in 1991 and conclude that these reforms reduced the price cost margins of domestic producers but the effect of reform on growth rate of productivity is not so strong. Chand and Sen (2002) identify the effect in India that increased import competition on the one hand provides the opportunity to get superior technology and on the other hand fosters X-efficiency, forcing workers to exert greater efforts. These two dimensions of trade reforms are tested on thirty Indian manufacturing industries using a 'price-wedge' trade variable, which compares the price of industry's output with that of its price in USA to see how much the domestic price deviates from the international price. It is observed that this differential has decreased after reform measures, and the reduction is more pronounced for intermediate and capital goods than for consumer goods industries. The results suggest the positive effect of the intermediate inputs liberalization on total factor productivity growth.

The market structure created by the conspicuous absence of competition in a protected economy turns out to be oligopolistic. It induces slack and lowers incentives for managers to work hard to increase profits. If trade liberalization decreases profits by more than the margin, the incentives for effort will substantially increase (Hay 2001). Many studies have focused on this kind of distortion induced by trade restrictions which affects incentives for effort and have analyzed whether trade liberalization corrects it and improves efficiency of the firms by reducing their profits. Harrison (1994) in a study on Cote d'Ivoire manufacturing industries relates the change in total factor productivity and price cost margins to changes in trade policy. Import penetration and tariff rates are used to indicate trade orientation and the conclusion supports the result found in many studies, that price cost margins were the highest in the most protected and most inward oriented sectors. After reforms, the margins decreased significantly in export oriented sectors and total factor productivity showed increasing growth trends in less protected sectors. The strong positive association between total factor productivity growth and trade changes is the most pronounced when the tariff rate is used as an indicator.

Changes in incentives' pattern compelling producers to improve their methods of production, underlies Hay's (2001) empirical work on Brazilian industry. By combining accounting balance sheet data on 318 firms, Hay examines the relationship of the degree of protection in different sectors with the market shares and profits of the firms. The relationship of these two variables with the efficiency of the firms is studied. He also investigates the relationship between changes in sales productivity and changes in level of protection across different sectors. This empirical study on Brazilian manufacturing industries like many other such works demonstrates that firms did improve total factor productivity and, hit by large decreases in profits, were forced to exert more effort to increase their profits instead of relying on protection from competition.

Trade is expected to reduce the gap between the most efficient and less efficient producers. Haddad (1990) has shown that in the case of Moroccan liberalization, firms in the industries with higher foreign ownership and export orientation such as electronics, textiles and leather industries showed less dispersion from the most efficient firm. The deviation of productivity of each firm from the most efficient firm was calculated for food products, textile, clothing, leather, wood products, paper, electronics, chemical, machinery and equipment etc. In an effort to estimate the relationship between productivity and trade policies, this deviation in percentage terms is regressed on a number of explanatory variables. Foreign share in total equity of the firm, import penetration, firm export share in total sales, age of the firm, and Herfindhal index at sector level are some of the important variables. The results returned a significantly positive association between trade variables and total factor productivity with high export shares either increasing the level of productivity or decreasing the dispersion from the most efficient firm. Regarding import penetration, the effect of this variable on the level of total factor productivity is shown to increase the level of TFP but only to a certain point. This is attributed to the U-curve hypothesis that up to a moderate level, import penetration serves to increase productivity, but onslaught of imports will result in a decline as the industries unequipped for this competition will be forced out. Another variable indicating openness of economy, foreign share in total equity of firms seems to have positive association with total factor productivity.

Tybout and Westbrook (1995) examined Mexican manufacturing industry to analyze whether trade liberalization contributes to improved productivity through a scale effect, a rationalization effect or a residual effect which they called a 'catch-all' and 'hard-to-measure' category. The first two effects are interrelated and occur through competition that domestic industry has to face in the aftermath of trade liberalization. The firms losing market power are forced to decrease their average costs and reallocation of output takes place from inefficient or less efficient producers to more efficient producers. The residual effect covers all types of effects such as externalities caused by exposure to foreign, imported goods, and increasing exports, better technology, innovations and superior management techniques. The analysis shows the reduced scale effects caused by increased import penetration. This can be explained by shift of domestic demand leading to contraction of local output. Productivity improvement and average cost reductions are recorded however and explained to be the result of residual effects. A relatively greater contribution is considered to be occurring from factors improving overall efficiency by removing waste, improvement in capacity utilization and reorganizing production.

Roderick (1988) integrates tenets of industrial organization with trade through its effect on industrial structure, competition, conduct and performance of the industries. He emphasises the rationalization effect reducing the number of firms and efforts by firms to decrease their average costs as potential benefits from liberalizing trade. The market structure in developing countries is characterised by imperfect competition with higher concentration ratios in industrial sectors which are often documented to be positively associated with profits. Lee and Norman (1969) discuss extensively, in the context of structure conduct and performance model, how the structure of the market determines the behaviour of the firms and the structure is influenced by such factors as capital intensity, advertising intensity, profits and trade variables.

These concentration ratios, though large for many developing countries, are underestimated because of the fact that many of the oligopolies might be indulging in collusive behaviour, not included fully or demonstrated by these ratios. Industry rationalization and reallocation of resources examined in studies supporting trade liberalization needs certain conditions to be met. It depends on what kind of restrictions are prevailing, and the kind of market structure. Most importantly, however, is the provision of free entry and exit. If entry of new firms is blocked or made difficult and exit is averted by intervention from government, it is inconceivable to get the maximum benefit to be had from rationalization or resource reshuffling. The firms will not exit as long as the cost of leaving the market is higher than loss of profits. Hence explicit and implicit entry and exit barriers should be removed so that the effect of trade liberalization in terms of competition and its complementary processes can work at its best.

3.7 Implementing trade reforms

The perceived relationship between institutional quality, the macroeconomic situation and the effect of trade on economic growth and productivity gives rise to the issues of complementarity of trade reforms with macroeconomic and institutional reforms. A frequent criticism is that trade policy effects are difficult to disentangle from the effects of other policy reforms such as macroeconomic stabilization and exchange rate liberalization. This is related to the question of overall sequencing of reforms: whether trade reforms should simultaneously be carried out along with other reform programs in the financial sector, capital markets and stabilization reforms or these reforms should precede trade reforms for the successful implementation of trade liberalization. The fact that trade holds a central position in providing incentives to the domestic industry and is responsible for a number of factors such as determining market structure, encouraging rent seeking and inefficiency by providing easy profits. This predominantly important role implies that despite the simultaneity of various reforms going on, trade reforms hold a centrally important place in the sequencing of reforms. Hardly any study has found that other reforms should precede trade liberalization. However some reforms such as higher education rates and stable macroeconomic environment are necessary complements without which trade reforms might not work as successfully.

Trade reforms provide spillovers for other reforms (Krueger & Berg 2003). Greater openness and subsequent competition that domestic firms encounter with foreign firms and goods expose the inadequacy or weakness of existing industrial policies. Trade reforms also necessitate reforms related with infrastructure such as telephones and roads because of their crucial importance for exporting activity. Doing so can also lead to the increased productivity of domestic industries producing for domestic consumption. Opponents of trade reforms suggest that institutional reforms should precede trade reforms but Krueger (2003) has suggested that such institutional reforms come as complements because trade openness forces such reforms.

Di Tella et al (1999) have shown that countries where firms are protected from competition have higher corruption. Di Tella and Alberto (1999) postulate that in economies where controls are in place to lessen the competition prevailing in the product market, rents give rise to corruption. The government officials administering controls to reduce competition have incentives to indulge in corrupt practices as they are enticed by business men who want to get the benefit of higher rents from barriers restricting competition. Empirically they show that corruption is high in the countries where domestic firms are protected from competition by trade policies or by entry barriers. Hence fostering competition by implementing policies designed for this purpose can minimize the chances of corruption.

Speed of trade reforms has also attracted the attention of a number of studies. Analyzing and comparing the performance of the economy before and after the implementation of trade liberalization reforms can effectively help determine the contribution that liberalization makes towards the performance of the economy. However this kind of analysis is feasible only with speedy and swift reforms. Studies dealing with the effect of episodes of trade liberalization often have to face the difficulty that trade liberalization is implemented in a gradual process with phasing out of various protection measures. In a large number of cases, reforms are not as easily categorized as a single episode neatly dividing the two phases. In developing countries the reforms are often long drawn out and pursued in an intermittent manner. The speed may vary but the approach adopted is gradualism with conversion of quotas into tariffs, reducing tariffs slowly, consolidating various duties into a single measure, and reducing tariff exemptions. This makes it even harder to clearly determine the possible effect of trade liberalization on economic performance.

In recent years, many studies have examined the liberalization episodes and analyzed their effects. For example, Choksi (1991) found that consistent liberalization increased growth of real GDP and exports. There are positive and negative points associated with both gradual and rapid reform programs. Gradual approach can give time for adjustment but if the reforms are long drawn out, it allows interest groups to organize and lobby against reforms. However as the nature of reforms can affect variegated areas of the economy, taxation systems and industrial profits, the gradual approach gives time to administrations for implementing reforms in a complementary fashion. In order to avoid the lobbying by vested interest groups, it is essential that a reasonable time frame should be determined while following gradual reforms.

Despite the broadly generalized conclusions drawn from the vast amount of empirical research carried out with the aim to explore and identify the relationship between trade liberalization and economic performance either of an individual country or in cross country studies, evidence to this effect is mixed. The reason for this is the wide range of issues involved once the developing countries assign a central role to trade policy in order to develop their manufacturing industries. In many developing countries during the 1980s or 1990s incentives were biased against the export sector. Import competing sectors were provided with protection from a variety of complex commercial systems designed to discourage imports either by high tariffs, non tariff barriers such as quotas, licensing requirements and maintaining of lists for the type of products permitted to be imported and the conditions under which to import. Trade liberalization can work either by equalizing the incentives between import competing and export producing sectors which can be implemented by providing exporters more facilities and promotional policies if there is an anti export bias. It can also be implemented by reducing the level of intervention and reducing import barriers. The transformation of multiple trade instruments in protectionist regimes and later on the complexity inherent in loosening and ultimately eliminating these controls is fraught with many practical hurdles, making it difficult to fully reflect itself in the positive effect on growth.

The positive effect in the form of enhanced economic growth depends on a positive supply response of manufacturing industry and how quickly the industrial sector adjusts itself to the new trade regime. This supply response is conditioned by a number of other factors, one of which is the availability of skilled, educated human resources and infrastructure development. As many of the developing countries rely on trade taxes as a major proportion of their revenue, the fiscal crunch following tariff rationalization makes it difficult to continue development projects as usual. The fear that trade liberalization will result in revenue loss becomes an impediment to successful implementation of reforms. However the overall effect depends on the tariff rates, whether the rate is above or below the revenue-maximising level. The effect of tariff reduction will not necessarily cause revenue loss if the rate is above revenue maximising level. The unification of various import taxes such as import surcharges or special import duties into a single tariff often increases revenue as it reduces the chances of evasion (Greenaway and Milner 1993).

Thomas and Nash (1991) argue that reduction in tax revenues caused by trade reforms depends on the careful calculation and composition of taxes to compensate for the loss of tax revenue such as when quantitative restrictions are changed to tariffs and when exemptions are reduced or eliminated. They argue that the problem of fiscal deficit and implementation of trade reforms interact with each other in many developing and reforming countries. They suggest that while implementing trade reforms, it is preferable to reduce fiscal deficits by cutting public expenditure in non infrastructure related areas. This is suggested because cutting expenditure on public infrastructure can have a deleterious effect on the supply response from the manufacturing sectors.

Thomas and Nash (1991) do not expand upon channels and the dynamic relationship between trade policy reforms and total factor productivity, but have generally explored the ensuing economic growth and recovery witnessed in a number of countries afterwards. Having grouped countries according to the level of trade restrictiveness, they examine the performance of these developing countries in implementing the reforms regarding opening up their trade and removing the restrictions. These groups are categorised as countries with low restrictiveness, high and moderate level of trade restrictiveness. It is observed that during the period of 1980-87, all the countries lowered the level of protection consistently by lowering the tariff dispersion albeit maintaining escalated tariff structures and highly dispersed effective protection rates. It is pointed out that overall import protection in all these countries, however, has not been reduced substantially.

Their study discusses the politico-economic dimension of trade policy reforms. It is argued that an asymmetry of incentives is witnessed between the potential beneficiaries and losers of reform programmes. The group of beneficiaries from reforms is large and it is costly to organize to lobby for reform. Free riding is a major problem, since every beneficiary can benefit without making an effort for reforms and they know that they can still benefit without any effort in case of a successful reform process. The magnitude of individual benefit may be too small to force each individual to take action. Losers from reforms are concentrated in small groups and find it easier and less costly to organise or arrange to lobby against the reforms. The benefits to each participant in this group are also large enough to drive them towards action. Secondly, adjustment costs are felt immediately while benefits appear with a delayed effect. Interests of government officials and government agencies entrusted with promotion of specific industries with trade restriction instruments stand to lose as this position gives them perks, prestige and budgets as well.

3.8 Computing appropriate trade variables

Accurate modelling of the restrictiveness of a trade regime is of fundamental importance. Choosing and computing an indicator that reflects the effect of complex and multiple trade control instruments has been acknowledged as a very difficult task. Roderick (1993) discusses the problem for the cross country, industry level and firm level studies, since these include a number of control variables in the regressions and are complicated by the inability to choose the right trade indicator. The most frequently used indicators are trade shares, tariff rates and non tariff barrier coverage ratios.

Trade instruments employed for protection in developing countries are deliberately kept complex, diverse and vague. The wide range of restrictive measures makes it difficult to clearly calculate and ascertain their economic effects, which facilitates governments' ability to make frequent changes with little political costs or resistance. Complexity in measuring trade variables also stems from relying on both price and non-price measures which are difficult to quantify in a single indicator variable. Quantifying and aggregating the quantitative restrictions such as quotas, licenses and permits, bans and domestic content requirements into a single indicator is nearly impossible. Attempts to assess the non tariff barriers qualitatively, however, has proved useful in suggesting the degree and level of protection applied in a number of developing countries.

The developing countries' governments simultaneously follow import protection and export promotional incentives. Some of the studies have tried to solve this problem by constructing a single measure with the help of relative price effects. Effective exchange rates facing exportable and importable sectors have been compared and if the exchange rate facing export sector is higher than that facing import substitutes, the trade orientation is considered to be outward oriented and vice versa.

This single indicator approach has the drawback that many factors or policies other than trade might be causing the direction of this index and hence one has to explore the index carefully. The fact that one indicator provides summary information about a number of complex policy tools at work is its greatest benefit. Many other studies have used both policy input measures such as import tariffs, direct controls, and policy outputs such as trade shares and relative prices. In choosing both kinds of measures, policy inputs and outputs, an element of discretion is involved however (Greenway and Milner 1993).

Trade measures can be categorised as either outcome based measures or incidence based measures (Baldwin 1989). Outcome based measures include ratio of trade to GDP, import penetration, exchange rate measures such as black market premium. Andriamananjara and Nash (1997) point out that outcome based measures reflect more the structural characteristics and other external factors such as location and transport costs.

In the presence of trade protection domestic prices will considerably diverge from international prices and reflect the effects of tariff and non tariff barriers and it is simple to interpret these effective protection rates. However it is very tedious work and involves a great deal of resources and time to carry out estimation of their degree of divergence successfully. Domestic prices of individual commodities are compared with border prices of same goods and an adjustment is also made for transport costs, distribution mark ups and quality differences.

Measures based on incidence of trade policy instruments include average tariff rates and indexes of non tariff measures. In developing countries, exemptions and smuggling are widespread making statutory tariff rates less representative of the amount of protection. Computing the ratio of import duties to the value of imports would perhaps be preferable in this context. An average of statutory rates weighted by production shares is the best tariff based measure. Finding the corresponding production data from the industrial surveys to match with the tariff rates usually levied at commodity level makes the task unenviable.

In the relative absence of non tariff barriers, the tariff level can correctly measure trade policy. A measure of non tariff barriers, if present, is often constructed by dividing the number of product categories subject to some kind of barrier by total number of product categories in the classification scheme being used. This number is weighted by import share or share in domestic production. The weakness with this measure is that it does not reflect anything about the increase in domestic prices caused by the non tariff barriers.

Apart from these measures, structural models are also applied when trade volumes are compared with the predicted values of the volumes in the absence of restrictions. Leamer (1988) has developed these adjusted trade ratio measures but he has taken it further and developed a factor endowment model. The model predicts the composition and volume of trade without the trade restrictions and then measures the deviation of the actual from the predicted values as a measure of intervention and openness. The variables affecting trade and included in the model are: income per capita, total population, mineral exports, and distance from 5 most important export markets. There are two issues with this model that it should include all the relevant determinants of trade to be reliable and secondly it only measures the relative instead of absolute because it captures a country's deviation from normal pattern of trade.

Pritchett (1996), after analyzing various measures, finds the variety of trade indicators is all uncorrelated. Import ratios and incidence based measures present a consistent picture of how various developing countries gradually removed the trade restrictions. The best correlation occurs between Leamer's structural trade model and tariff rates, and tariff rates and non tariff barriers. In a detailed scrutiny, he discusses tariff rates, their dispersion, import ratios adjusted for structural characteristics of the country, and measures depicting deviation of actual trade pattern from predicted pattern based on a resource based comparative advantage model. Pritchett (1996) suggested that the weak or no correlation among various measures is due to the fact that different measures capture different dimensions of trade policy which can have varying levels of effect on growth.

Edwards (1992, 1993) also tries to grapple with the formidable task of constructing a single most reliable indicator of trade policy due to the complex nature of the commercial policy. Edwards criticises the effective rate of protection measure because it relates to a particular point in time and provides no information about the evolution of trade policy or gradual changes in trade regime. Large amounts of data are required to compute effective rates of protection.

Edwards (1992, 1993) discusses trade ratios, export ratios, categorical indicators and subjective indices. He argues that trade ratios might not reflect actual trade policy and may be endogenous. Subjective indicators rank countries according to the degree of openness based on the information available on trade policy such as the subjective index of Michaely et al (1991) and 'outward orientation index' of the World Development report 1987 of the World Bank. Categorical indicators such as that constructed by Sachs and Warner, are computed from the information on a series of trade related indicators, at one point in time- tariffs, quotas coverage, black market premia, social organisation and the existence of export marketing boards. Balassa (1982) introduced five classifications ranging from outward orientation, where anti export bias had been eliminated, to inward orientation where the bias was highest. All these studies using classifications for strong or weak liberalizers or using binary dummies involve a degree of arbitrariness and personal discretion. Such measures fail to specify how different grades of trade liberalization affect growth and other variables and are also unable to distinguish between varying levels of protection as they classify countries on a binary code- open or closed.

Tariff averages, average coverage of quantitative restrictions and collected tariff ratios defined as the ratio of tariff revenues to imports are recommended positively because of their ability to allow for intermediate situations for an evolving trade regime. Pritchett (1991) also finds the correlation among these measures. With the decision to choose among these measures, the effort should be directed to determine the robustness of alternative indicators, argues Edwards.

Edwards has used nine alternative openness indices to analyze the connection between trade policy and productivity growth during 1980-90. Among these nine, three belong to the category of subjective and categorical indices of Sachs and Warner, World Development Report Outward Orientation index and Leamer's openness index. The rest of the six measures are related to average black market premium, average import tariffs, average coverage of non tariff barriers and collected trade tax ratios.

These indicators tell a somewhat similar story, that there is evidence of a negative relationship between TFP growth and trade distortions: the higher the distortions the lower the TFP growth. Various techniques were used to check the robustness of results and all indicated that the original conclusion was not altered. Including institutional or political variables, macroeconomic stability variables or removing outliers had no effect on the original results.

3.9 Structure of trade in Pakistan

3.9.1 Structure of exports

Export led growth is now regarded as an alternative to import substitution policies, and underlies openness policies in order to promote industrialization and achieving the objective of economic growth eventually. Export growth can improve total factor productivity by means of links with international entrepreneurs which provide unique opportunities to learn new techniques in production, management, and marketing. The causality might run from highly productive producers breaking into export markets. However, it has been established at the same time that export producers experience increases in total factor productivity after starting export activity.

There has been an awareness of the benefits that might accrue as a result of a growing export sector and several incentives have been provided to encourage exporters, starting even in the 1960s. The fact remains though that the structure of Pakistan's trade and exports particularly has changed little over the decades. Weaknesses pointed out repeatedly by a number of policy analysts and researchers, such as the product concentration, high volumes of low value added products and lack of diversification in the export sector still persist. Pakistan's manufactured exports comprise mainly of agri based industrial products like cotton textiles, yarn, leather, carpets. Among these, cotton based industries dominate with a share of more than fifty percent. Growth rates of exports has been low in recent years.

Lack of diversification both in terms of high concentration of cotton related products mainly textiles and in terms of geographical diversification of export markets has been well documented and identified in a number of studies. Presently the bulk of Pakistan's manufacturing exports consist of textile products. The destination of exports comprises only a list of eleven countries who are the major trading partners of its industries. Nasim (1992) has compared the manufactured exports of Pakistan with a number of selected developing countries during the period 1965-1990. It appears that Pakistan has steadily lost the share of its exports to OECD countries while the rest of these developing countries have acquired gains in their export share to OECD countries. In absolute terms as well, Pakistan is lagging far behind rest of the developing countries, particularly India, Korea, Taiwan, Turkey, Mexico and Hong Kong. While in 1965, Pakistan was ahead of many of these in absolute terms and relative market share to OECD markets.

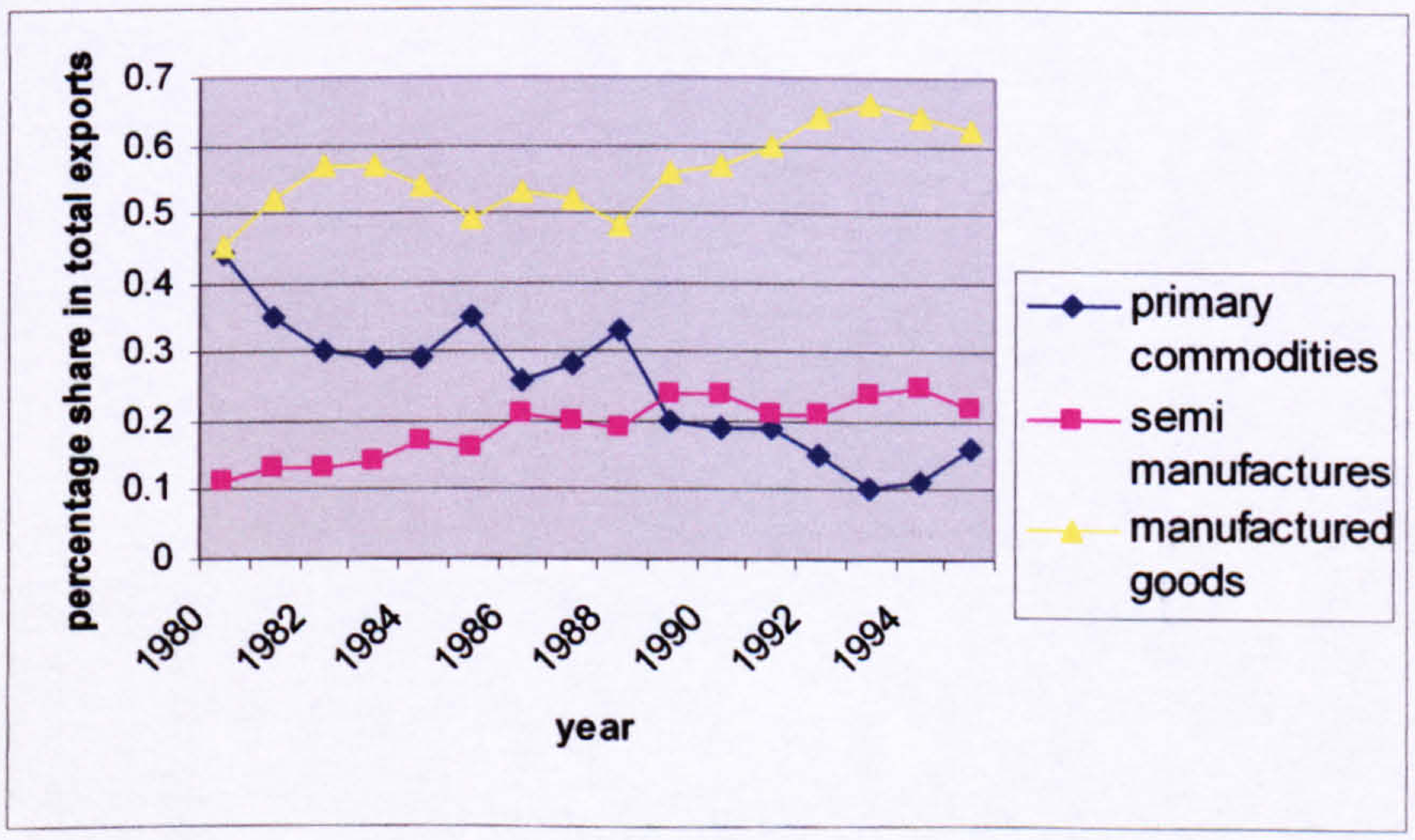
Shares of all Pakistan's exports by economic classification demonstrate a shift away from primary commodities and an increasing share of manufactured goods while share of semi manufactures in total exports has also more than doubled by 1995 (table 3.1, figure 3.1). The decline in the share of primary commodities has been phenomenal with the current figure standing at sixteen percent. Primary commodities occupied fourty four percent in 1980 and consistently show a decreasing trend ever since with the lowest share recorded for 1993. The manufactured exports have maintained more than a fifty percent in total exports which has increased to more than sixty percent in the decade of the 1990s.

Table 3.1: Share of exports by economic classification.

Year	primary commoditie s	Semi manufactures	manufactured goods
1980	0.44	0.11	0.45
1981	0.35	0.13	0.52
1982	0.3	0.13	0.57
1983	0.29	0.14	0.57
1984	0.29	0.17	0.54
1985	0.35	0.16	0.49
1986	0.26	0.21	0.53
1987	0.28	0.2	0.52
1988	0.33	0.19	0.48
1989	0.2	0.24	0.56
1990	0.19	0.24	0.57
1991	0.19	0.21	0.6
1992	0.15	0.21	0.64
1993	0.1	0.24	0.66
1994	0.11	0.25	0.64
1995	0.16	0.22	0.62

Figure 3.1

Share of exports by economic classification



An increasing reliance on textile manufactured products is masked within this increasing share of manufactured exports. The share of textile manufactures excluding the exports of raw cotton occupies the highest position in total exports. It stood around 22.5 percent in 1980 but has been gradually increasing and reached around 53.8 percent in 1995 (table 3.2). Non textile manufactured items have been losing ground consistently, starting from 20 percent or more in the early years of 1980s, their share has slipped to just nearly 10 percent in 1990s. Cotton and rice are among the major contributors in primary commodity exports though both are steadily decreasing their share in total exports (table 3.3).

Leather goods, carpets, sporting goods, footwear and engineering goods are categorised as small scale sectors and the share of exports from this group have not shown any significant increase except the sports goods sector (table 3.3)

Since exports of Pakistan are concentrated in such a limited number of commodities, there is great need to diversify the commodity composition of exports (Mahmood and Akhtar 1996, Mahmood 1981), Tariq and Najeeb 1995)). Textile sector exports comprise mainly of cotton yarn, cotton cloth, ready made garments, bed linen and towels (table 3.4, figure3.2). Higher value added products such as synthetic textiles do not rank high with the share of synthetic textile exports always fluctuating between 10 and 15 percent and even decreasing to nearly 10 percent in the early years of 1990s.

TABLE 3.2: Share of textile &non textile manufacturing exports in total exports (%)

year	Textiles excluding cotton	share of non textile manufactures
1980	22.46	19.60
1981	25.35	22.20
1982	34.24	14.89
1983	33.48	16.62
1984	31.91	17.41
1985	29.75	16.17
1986	39.86	14.62
1987	38.62	16.60
1988	36.39	13.73
1989	46.47	14.13
1990	50.39	12.76
1991	50.86	10.98
1992	53.24	10.08
1993	57.58	9.22
1994	56.29	9.85
1995	53.78	9.42

TABLE 3.3: Share of major non textile exports in total exports (%).

year	rice	raw cotton	leather	carpets& rugs	Fish&fish preparations	Surgical instruments	Sports goods
1980	19.13	37.10	3.05	7.66	1.91	0.902	1.066
1981	15.71	26.06	4.39	6.39	3.01	0.959	1.218
1982	10.69	22.14	3.47	5.55	2.60	0.833	1.283
1983	15.23	10.68	5.28	6.22	2.70	1.152	1.781
1984	8.79	23.59	6.12	5.35	3.24	2.038	1.775
1985	11.14	32.21	5.85	5.43	2.69	1.698	1.587
1986	8.11	21.70	6.44	3.85	3.05	1.509	1.578
1987	8.16	23.65	6.43	5.67	2.79	1.272	1.460
1988	6.62	32.60	5.21	4.94	2.32	1.354	1.518
1989	4.83	14.93	5.64	4.62	1.90	1.411	2.171
1990	5.68	11.34	4.47	3.62	1.86	1.375	2.241
1991	6.02	12.21	3.49	3.32	1.66	1.312	2.047
1992	4.64	6.62	3.26	2.56	2.67	1.503	1.934
1993	3.56	1.90	3.30	2.23	2.26	1.372	2.933
1994	5.58	1.29	3.34	2.43	1.90	1.399	3.251
1995	5.82	9.52	2.96	2.42	1.60	1.457	2.841

Figure 3.2 Share of textile products in total textile manufacturing exports

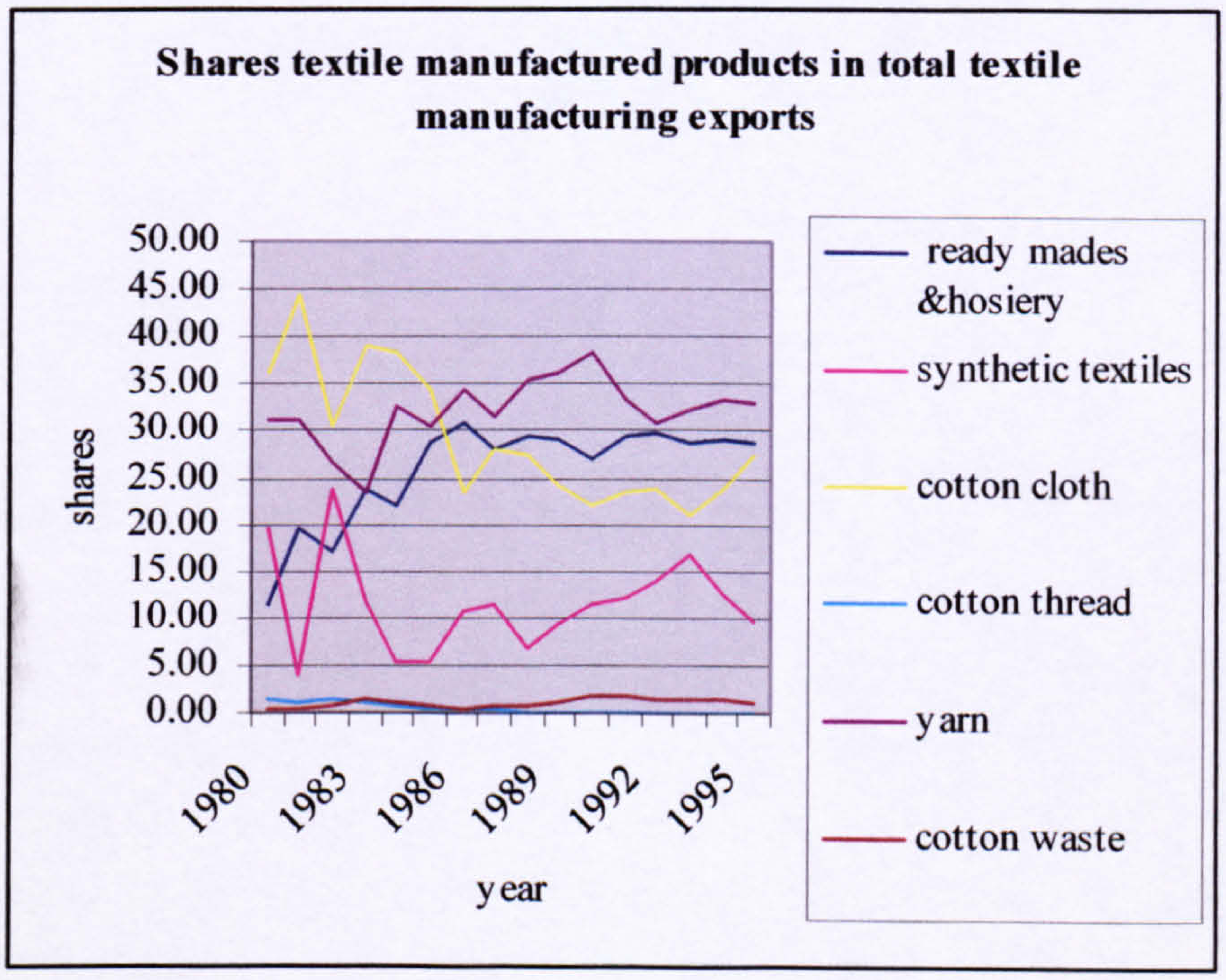


TABLE 3.4 Share of textile products excluding raw cotton in total exports (%)

year	Textile mfg. excl.cotton	Cotton waste	cotton yarn	Cotton thread	Cotton cloth	Synthetic textiles	Ready mades
1980	22.46	0.29	31.17	1.54	36.34	19.34	11.33
1981	25.35	0.18	31.16	1.22	44.29	3.72	19.43
1982	34.24	0.70	26.68	1.37	30.35	23.73	17.17
1983	33.48	1.56	23.45	0.93	38.85	11.62	23.60
1984	31.91	1.13	32.79	0.59	38.27	5.25	21.97
1985	29.75	0.58	30.57	0.41	34.45	5.44	28.56
1986	39.86	0.40	34.48	0.23	23.48	10.68	30.72
1987	38.62	0.53	31.45	0.22	28.19	11.48	28.12
1988	36.39	0.73	35.48	0.18	27.26	6.82	29.53
1989	46.47	1.21	36.21	0.13	24.25	9.21	28.99
1990	50.39	1.80	38.28	0.11	21.81	11.20	26.79
1991	50.86	1.70	33.40	0.11	23.32	11.91	29.57
1992	53.24	1.36	30.96	0.13	23.80	13.88	29.87
1993	57.58	1.59	32.18	0.10	20.95	16.57	28.61
1994	56.29	1.38	33.38	0.04	23.61	12.55	29.04
1995	53.78	1.22	32.91	0.03	27.30	9.74	28.81

Among cotton textiles, towels, garments, cotton bags, tents, convas and tarpaulins constitute the small scale cottage industries. However they have increased their share in exports but they export inferior quality goods. Increasing trends in the export of these products can reflect the forward integration of the textile sector.

The share of cotton yarn has always remained the highest among other textile products, and has hovered around more than 30 percent with the figure in 1990 as high as 38.28 percent. Cotton cloth on the contrary started with a higher contribution in 1980 at 36.34 percent but gradually decreased its share to 27.30 percent in 1995. Ready made garments and hosiery increased their share from 11.33 percent in 1980 to nearly 30 percent in 1995.

Major non textile exports consist of rice and raw cotton in primary commodities, leather, carpets and rugs, sports goods and fish&fish preparations from manufactured goods or semi-manufactures and surgical instruments in light engineering goods. Except sports goods, none has shown any improvement by increasing its share of exports. Surgical instruments demonstrated its best performance in 1984 and since then it has remained stagnant. Carpets & rugs and leather have shown decreases in their shares in the 1990s as compared to the early years of 1980s.

3.9.2 Structure of imports

Import structure is symptomatic of the protection structure prevailing in the economy, with the lowest share of imports in the consumer goods category while the highest in intermediate raw materials which is followed by capital goods imports (table 3.5, figure 3.3). The share of consumer goods imports has been fluctuating around 15 percent and during the 1990s it has shown a steady decline. Intermediate raw materials have increased their share, being the highest during the 1980s and later in 1990s only decreasing slightly. Capital goods imports have been fluctuating with peaks around 1991 and 1992 which was followed by a sharp decline in the coming years. This might be attributed to the stagnation setting in the manufacturing sector during the 1990s causing lower investment in capital equipment.

Figure 3.3
Share of Imports by economic classification (%)

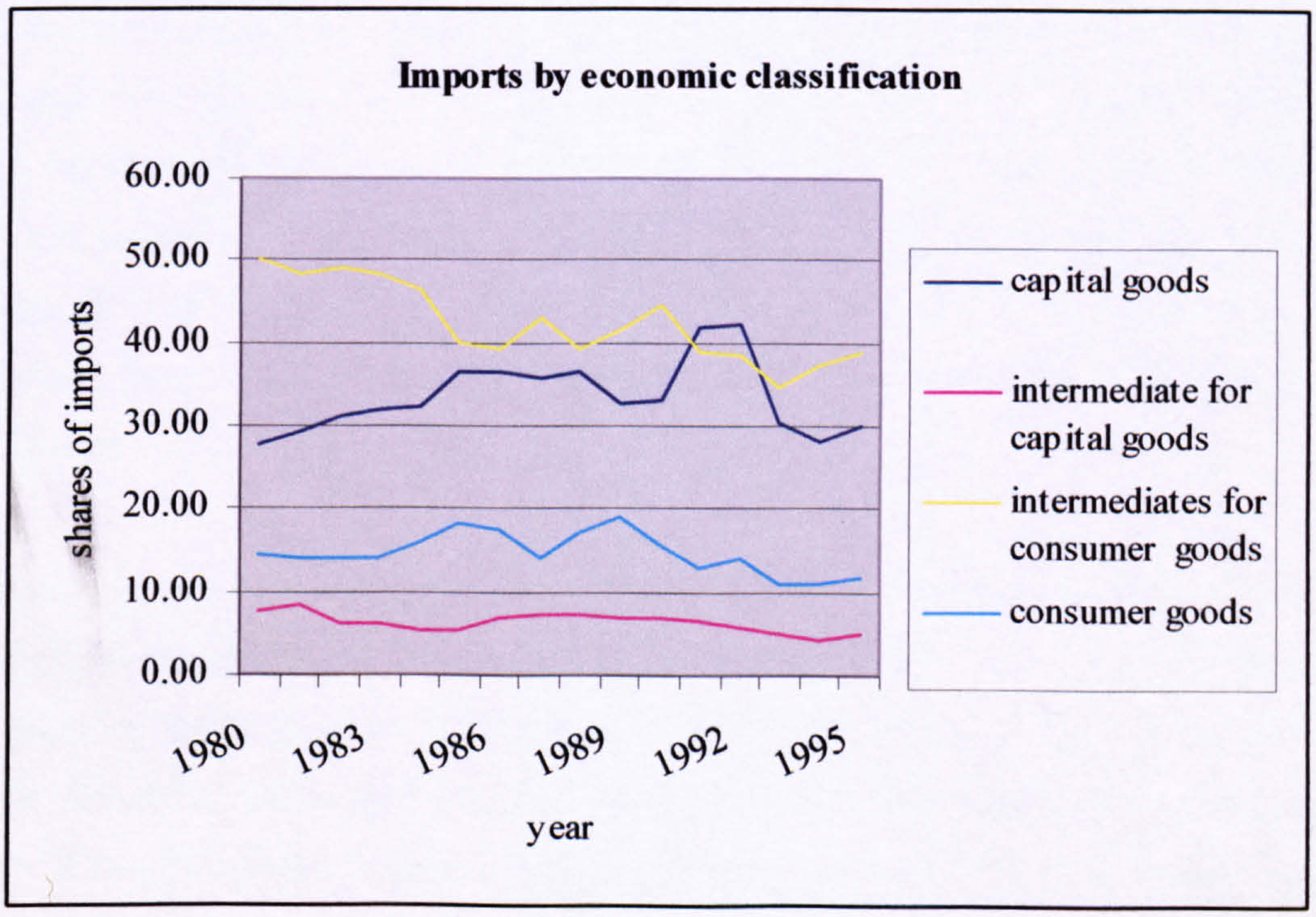


TABLE 3.5 : Percentage share of Imports in total imports, by Economic Classification.

year	capital goods	intermediate goods	consumer goods
1980	27.79	57.69	14.52
1981	29.43	56.44	14.13
1982	31.01	54.91	14.08
1983	31.83	54.16	14.01
1984	32.27	51.73	16.01
1985	36.50	45.43	18.07
1986	36.61	45.85	17.54
1987	35.85	49.91	14.24
1988	36.44	46.37	17.20
1989	32.53	48.37	19.10
1990	32.90	51.38	15.72
1991	41.96	45.22	12.82
1992	42.20	43.99	13.96
1993	30.32	39.26	10.90
1994	28.25	41.55	10.92
1995	35.32	51.08	13.60

Imports in the Chemical group, Metal products and Machinery group, Food group and Petroleum products together form more than fifty percent of total imports. If petroleum products are included in the Chemical group, the imports from this group are highest. Excluding petroleum products, Chemical group imports were just above 10 percent by the middle of 1980s but increased to nearly 20 percent during 1990s (figure 3.4). Petroleum and products as part of the Chemical sector is the single most predominant component. Petroleum products' share stood at its highest, 30.34 percent, in 1981 but has reduced in later years. Metal products which mainly comprise, electrical and non electrical machinery and transport equipment, has maintained a steady share around 30 percent in most of the years with the peak of 36.87 reached in 1992. There has been little significant variation in the share of food imports which has been hovering around 15 percent (table 3.6).

In each sector, imports are concentrated in particular goods. For example in the Food sector, edible oils and tea comprise the major share of food sector imports, and dominate the rest of the imports. Imports of grains and pulses, and refined sugar are also sizeable. Refined sugar imports are fluctuating and highly variable. Similarly machinery imports of both electrical and non electrical machinery are more than eighty percent of the imports from the Metal products group.

Figure 3.4 Effect of petroleum & products on chemical imports

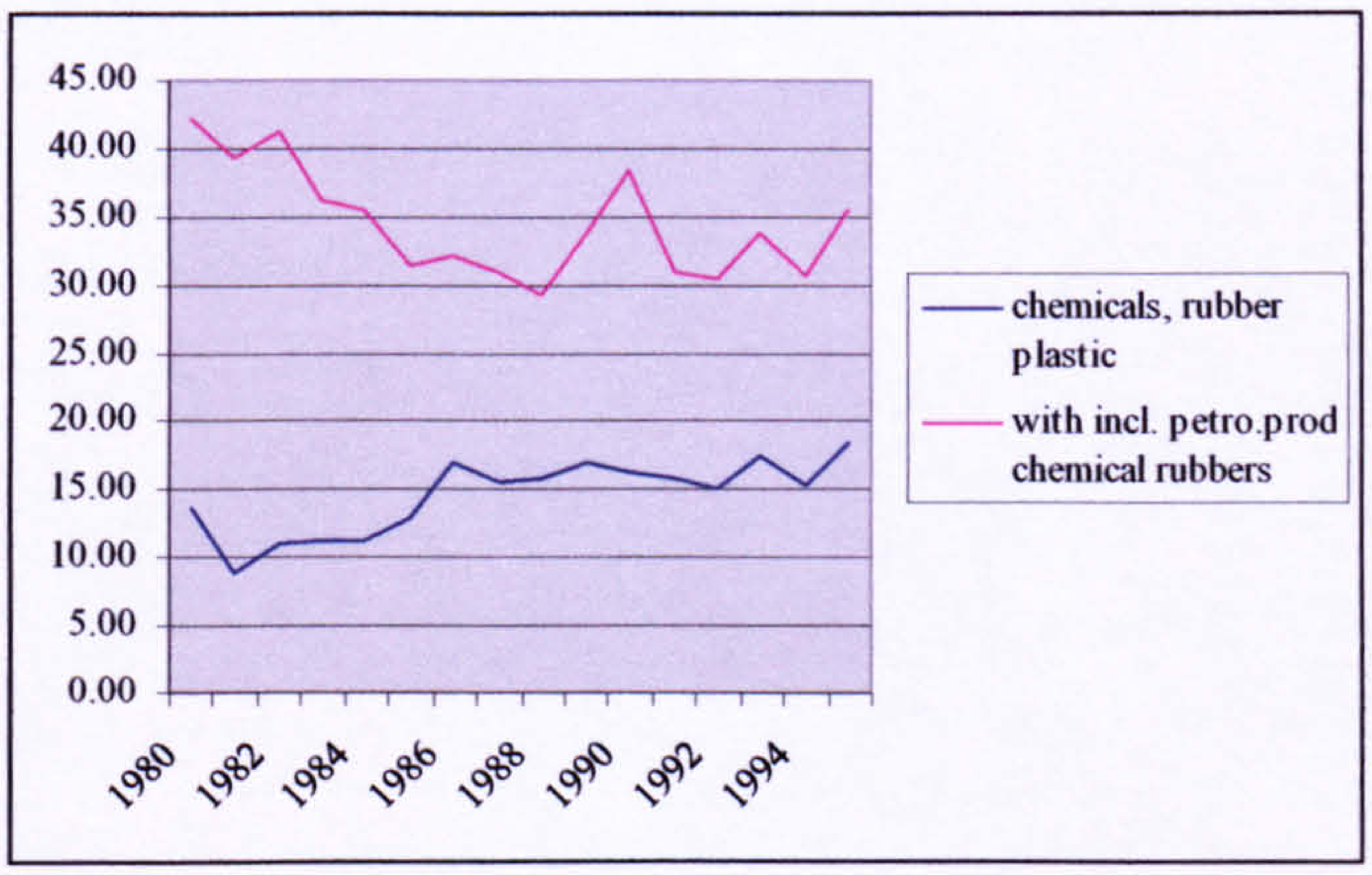


TABLE 3.6 : Share of imports by product groups in total imports (%)

year	Chemicals rubbers	petroleum products	metal products	basic metal	food imports	artsilk yarn	paper board stationary	other imports
1980	13.72	28.39	22.94	6.28	9.19	2.43	1.38	15.67
1981	8.92	30.34	23.04	8.07	8.99	2.64	1.55	16.45
1982	11.02	30.12	24.67	7.52	9.16	2.36	1.55	13.61
1983	11.13	24.98	25.46	6.22	12.97	2.07	1.53	15.64
1984	11.19	24.24	26.43	5.43	14.89	1.77	1.74	14.31
1985	12.82	18.45	29.96	5.74	15.72	1.45	1.79	14.07
1986	17.06	15.12	29.8	6.28	12.15	1.76	2.12	15.7
1987	15.65	15.34	29.2	6.01	11.84	1.93	2.12	17.9
1988	15.69	13.63	29.42	6.74	14.98	1.86	2.01	15.67
1989	16.99	16.75	26.75	6.44	15.65	1.54	1.93	13.94
1990	16.31	22.10	27.21	5.38	11.51	1.16	1.88	17.03
1991	15.87	14.97	35.95	5.66	10.85	1.13	1.75	13.69
1992	14.99	15.49	36.87	4.88	13.04	0.76	1.42	11.89
1993	17.45	16.33	31.74	5.81	10.78	0.68	1.49	15.03
1994	15.26	15.26	28.74	5.8	15.64	0.42	1.26	17.07
1995	18.53	16.94	26.33	6.71	13.27	0.49	1.36	16.3

3.10 Trade protection in Pakistan

The detailed background on the system of trade protection is provided in chapter 1. Here is a brief summary of the main trends.

The trade regime in Pakistan has been characterised by the dualistic structure of providing protection to a range of domestic industries by means of tariffs, quotas and licensing and promotion to many export oriented industries through export subsidies, export credit, concessions, and duty drawbacks. The major argument for providing protection was the famous infant industry argument advanced in the 1950's and 1960's on the basis that the nascent industries need support against international competition. Initially the manufacturing industries experienced a phenomenal growth rate and many import substituting industries started working in export markets.

The liberalization efforts undertaken in the first half of the 1960s concentrated on reducing the anti-export bias and relaxing some licencing requirements. The next phase in reforms came with the new government in 1971 who abandoned the export bonus scheme, devalued the currency and considerably simplified the licensing procedures. However both reform episodes did not alter the fundamental structure of protection. The non tariff barriers were still pervasive and the domestic prices of import substitutes were much higher than the international prices of their counterparts.

Protection was mainly provided through non tariff barriers and tariffs. Tariffs were very high but provided only revenue functions. It was the non tariff barriers which determined the price differentials between domestic prices and the prices of international counterparts. Tariffs like non tariff barriers were imposed in an escalated manner, higher tariffs on consumer goods followed by intermediate and capital goods. However, by the 1980s, intermediate goods were provided more protection than consumer goods.

There was a scarcity premium that domestic producers enjoyed by virtue of licencing procedures, quotas and bans. These restrictions helped create groups of large producers who were better placed to receive the import facilities and licences and this position allowed them to reap extremely high profits, further contributing to their powerful market positions.

Profits were kept artificially high because of tariffs and non tariff restrictions on imports and credit rationing by banks. Many entrepreneurs should have been attracted to the manufacturing industry and to some extent during early years of 1960s many new industrialists entered, earned huge profits and then diversified into new businesses. However in later years, once these earlier entrants had fully established their businesses and contacts, new entrants were effectively blocked by the failure to get quotas and permits. It was not strong market competition which hindered entrants to set up their business but the entry barriers. Just as entry was low, exits, even if desirable, were averted because established industrial firms and companies were helped to overcome their financial problems through bail outs provided by government in the form of rescheduling of loans and other assistance. Decisions to continue in business were to a large extent based upon connections which could turn the losses into tolerable financial distress.

More serious and consistent reforms started towards the end of the 1980s when in 1987 a major program of rationalization and reduction of tariffs started. Scope of import licensing was continually reduced until elimination of non tariff barriers in 1993. The price differentials and the level of protection were then determined by the level of tariffs. Tariffs were extremely high, but have been consistently reduced. As the average level of tariffs was gradually lowered, so tariff dispersion has been reduced. Various para tariffs, such as regulatory duty, import fee and Iqra (a duty levied to promote literacy) surcharges have been integrated into a uniform tariff.

The trade protection structure had by 1995 been substantially altered. The elimination of licensing and quantitative restrictions has removed a major source of distortion because such restrictions were difficult to measure, arbitrary means of charging high prices. Pakistan has been implementing piecemeal reforms from as early as 1960 but the reforms carried out in 1980 were consistent and comprehensive. Speed of reforms was inconsistent and very slow and apart from reductions in the level of restrictions until 1987, reforms never attempted to change the basic structure of protection.

3.11 Effect of trade liberalization on productivity in Pakistan

At the aggregate level of the economy, some studies have found evidence of a positive relationship between economic growth or industrial value added and trade liberalization in Pakistan. The evidence is inconclusive and is based on the analysis conducted at the aggregate economy wide level. One such study by Dutta and Ahmed (2001) found evidence of a positive relationship between the growth rate of industrial value added and its determinants such as real capital formation, the labour force and real exports. The industrial production function is composed of capital, labour and human capital while trade liberalization is measured by two alternative variables. These two measures are real exports and average collection rate of import tariffs. Human capital is measured as secondary school enrolment as a percentage of working age population in school. The production function is estimated with an error correction model and cointegration tests are applied to determine the long run relationship of the variables. The results of cointegration tests indicate a long run relationship between industrial value added and all these variables. However in the error correction model, the growth rate of the labour force, real exports and real fixed capital formation are the significant determinants of the growth rate of industrial value added. Human capital does not appear to be an important variable, nor does the average import tariff rate. The results are of limited value in interpreting a strong relationship between trade liberalization and growth because only one trade related measure is significant. It has been pointed out that the estimation is conducted on aggregate data which places constraints on drawing definite conclusions about the nature of the relationship.

Dollar and Kraay (2001) identify a large number of developing countries who have experienced substantial reductions in average tariff rates since 1980 and changes in their trade volumes measured as share of trade to GDP. The reductions in the average tariffs and changes in trade volumes for nearly a hundred developing countries are measured from 1970 till 1995. Pakistan appears as one of those countries which has implemented large tariff reductions but fails to show any increase in their average trade to GDP ratio. The tariff reductions have not been complemented by an increase in trade to GDP ratio. On the contrary this ratio has declined from the level in the 1970s. In 1970 the trade to GDP ratio stood at 47.6 percent while by 995 it decreased to 34.5 percent. After 1970 the ratio has never achieved anything approaching above the 40 percent figure but has hovered around 35 percent from 1975 onwards till 1995. Average tariffs however have consistently decreased, from 69.2 percent in 1985 to 41.7 percent in 1995. This anomaly can be attributed to the fact that non tariff barriers were only abolished in early 1990s and trade protection was not entirely determined by tariffs.

3.12 Modelling the relationship between total factor productivity and trade related variables

The econometric estimation was carried out in a two stage process, the first stage being conducted in the previous chapter when total factor productivity estimates for all sectors were extracted. In the second stage analysis those productivity variables are modelled as dependant variables to analyze the effect of various trade related variables in the presence of some industry specific correlates. The rationale for including industry specific correlates is to control for industry specific effects which might be influencing total factor productivity in conjunction with trade factors.

As discussed above, when numerous macroeconomic factors are included in a regression to ascertain the effect of trade liberalization on total factor productivity, it becomes extremely intricate and complex to segregate cleanly and sift through the combined effects of all the variables working together. In many such studies, some of the important macroeconomic and institutional factors are included such as law and order and quality of bureaucracy and the state of property rights in a country. On the macroeconomic side, the fiscal deficit to GDP is often included as an important factor. For Pakistan, the institutional variables could have performed an important role but these institutional factors have more or less remained constant or have changed only nominally over time. In contrast, the trade regime has undergone almost continual change, particularly since the end of the 1980s. The entire decade of the 1990s is characterised by flux mostly caused by the stabilization program and the importance of trade reforms as an integral and important component of this program cannot be overlooked.

Institutional variables are not included because the usual problems associated with cross country analysis following variegated institutional and macroeconomic settings are not assumed to plague the analysis of manufacturing sector in an individual country. Secondly it is assumed that the quality of institutional factors has not changed drastically so as to register an economically important effect on manufacturing industry. Political variables such as unplanned and sudden changes of government or political hostility of governments belonging to particular parties towards opposite political parties might have distortionary effects. These can be modelled through dummy variables for the years in which the unplanned change of government took place. Mainly these unplanned changes took place in 1989, in 1992, in 1995 and finally in 1999. All these changes in government took place before the scheduled time of general election as not a single government during this period completed its tenure. Though the changes were not smooth, they did not culminate in civil strife but the events preceding each were not free from severe political recriminations and avengeful actions from the respective governments against the economic agents considered being favoured by previous governments. In many of the cases these victimised parties belonged to the industrial sectors. Apart from this politically charged atmosphere, the instability and uncertainty created by frequent changes of government and expenditures incurred on respective elections each time might have substantially contributed to the deterioration witnessed in the performance of manufacturing industries. No doubt, the decade is named as a 'lost decade' by many economic analysts.

Fiscal deficit to GDP ratio was included in the econometric estimation because this has assumed an alarming proportion during the 990s and is a central issue affecting the economic decision making. However results showed that including or excluding the fiscal deficit to GDP ratio does not make any fundamental changes to the results.

Modelling the link between trade policies and other growth related factors is complicated since excluding these factors will result in omitted variables bias while including them will lead to multicollinearity. The overriding result seems to be that it is very difficult to adequately control for these factors and disentangle the effects of trade related policies on total factor productivity (Krueger and Berg 2003).

3.12.1 Variables

A list of all the variables used is provided below:

Sectradeshares : ratio of sectoral imports plus exports to sectoral output.
Secimpenetration : sectoral import penetration calculated as : sectoral imports/sectoral imports + sectoral output –sectoral exports.
Sectimpoutput: ratio of sectoral imports and sectoral output
Tradegdp : ratio of aggregate imports and exports to aggregate GDP
Impgdp : ratio of aggregate imports to aggregate gdp
Aggimpenet : aggregate import penetration ratio calculated as : aggregate imports /aggregate imports+ gdp – aggregate exports.
Avtariff : ratio of collected import duties to total value of imports.
Antiexpbias : ratio of effective exchange rate for imports to effective exchange rate for exports .
Lnmarket : log of number of establishments
Caplab : ratio of capital to number of employees
Impmatratio : ratio of imported intermediate materials to total value of intermediate materials.

Lnsubsidies : log of value of subsidies
Lnrebates : log of value of export rebates.

Industry specific variables included are size of the market and capital intensity of the industry. Size of the market is denoted by the number of establishments operating in a sector and represents the level of competition and market structure. Size of markets is included on the basis that it reflects the state of competition in an industry. Greater number of units or establishments might raise competition which can be healthy in terms of increasing productivity. However, if numerous firms enter the market, it can also cause excessive capacity since the domestic markets are limited in their size. In that case the number of firms might be negatively associated with total factor productivity. This variable is measured in logs.

Capital intensity is represented by the ratio of capital to number of employees and is simply shown as a ratio.
The equation is hence:

$$\ln tfp = \beta_0 + \beta_1 \ln market + \beta_2 caplab + \beta_3 matimp + \beta_4 \ln trade \qquad (3.5)$$

lnmarket denotes the log of number of establishments in the industry. Caplab is the ratio of capital to number of employees, matimp is the ratio of imported materials to total intermediate materials.

3.13 Trade variables used

In the above equation (3.5), lntrade indicates the trade variable and is represented by a variety of measures because various measures might reflect varying aspects of a complex trade regime. Several measures have been experimented with and the details of the measures finally used are summarised below :

1. The trade regime in Pakistan has undergone a process of evolution. We can identify liberalization episodes or greater momentum towards liberalization reforms in the 1960s and 1970s and at the end of the1990s but other than that during the entire decade of

1990s, it becomes difficult to identify phases. Pakistan has been consistently following various steps in liberalization, which involved reducing quantitative restrictions in the 1980s, replacing QR (quantitative restrictions) with tariffs, rationalizing and reducing tariffs and consolidating various levies into a uniform tariff. The last two decades can be characterised as a continuing, long drawn out reform process.

2. Since trade reforms are being carried out in a gradual fashion, the categorical indicators based on a binary classification at a particular point in time do not seem appropriate.

3. Output based measures of trade, trade to GDP ratio (exports+imports/GDP), imports to GDP ratio and import penetration measures calculated as imports/ (imports +domestic output-exports) are used. As the data is at the level of manufacturing sectors, it is imperative to use sectoral trade shares wherever corresponding data on imports or exports in a sector is available. Exports are concentrated in a limited number of products and sectors, mostly in textiles, and a limited share in sports, surgical instruments and leather garments. There are sectors which only produce for domestic markets and for some other sectors only import figures are available for them. Import values are available at the commodity level while manufacturing industry data are at sector level. Subjective assessment or judgment is involved in assigning imports of individual commodities to sectors. Aggregate trade ratios at aggregate economy wide levels have been also used for all the sectors. Sectoral trade measures/ratios are presented in Appendix tables 3.1 to 3.9. Aggregate trade shares are presented in Appendix table 3.10.

4. Direct measures or incidence based measures such as average tariff rates are also used. Tariff exemptions and underinvoicing of imports are present on a large scale, hence it is desirable to construct the ratio of collected trade taxes to total value of imports. The ratio of import duties collected to the total value of imports represents the average tariff rate applied.

5. Anti export bias can also be calculated by comparing the effective exchange rate for imports and exports. Following Krueger (1978) and Bhagwati (1978) the effective exchange rate for exports is calculated by nominal exchange rate plus any subsidy and incentive and subtracting any export duties. Effective exchange rate for imports on the

other hand is constructed by adding import tariffs, other import charges and premiums from quantitative restrictions to the nominal exchange rate. A ratio of effective exchange rate for imports to effective exchange rate for exports indicates the degree of bias against exports. If the ratio is equal to 1, the trade regime is termed neutral and considered biased against exports if it is higher than 1. The rare case when this ratio is less than 1, the trade regime is regarded as ultra outward oriented with the incentives biased in favour of exports. These measures of effective exchange rate and anti export bias has been taken from Khan (1998) and presented in Appendix table 3.11.

In addition to the main trade measures the ratio of imported materials to total intermediate materials has been used as well on the basis that in the presence of pervasive import controls firms will have difficulty in acquiring them. This ratio is included as an indication of the increased availability of imported raw materials due to increased openness. This availability might affect total factor productivity through enhanced capacity utilization as the establishments will no more be constrained in their use of imported raw materials. The easy and timely availability of imported intermediate materials will enhance the total factor productivity not only because firms might be realising higher capacity utilization but also through learning externalities involved in using foreign materials .

Export rebates and subsidies are also included in the model for some sectors, particularly for the textile sector on the assumption that they are regarded as tools creating deliberate distortions and meant to help domestic sectors to have a cost advantage in competition with foreign firms. Higher reliance on subsidies might have a negative effect on total factor productivity since it will create incentives to pay less attention to alternative means of reducing costs. Export rebates, however, might be beneficial for export industries to experience growth which can help them achieve higher productivity. This has been included only for the textile sector. For other sectors, the amount of export rebates and subsidies provided is negligible and can have no meaningful influence.

As in the econometric estimation of total factor productivity for each sector in the previous chapter, it is reasonable to expect the usual problems of heteroskedasticity. The statistics on heteroskedasticity are checked with the appropriate tests ('hettest') in STATA which is applied after ordinary least squares. For each sector the results of these tests are reported in the table on results .

The data is a panel of industries, hence, the presence of heteroskedasticity cannot be rejected except for those where the panel is very small, i.e. paper, board stationary, wood, cork and wood products. GLS (generalized least squares) is preferred to fixed effects with AR(1) procedure and simple fixed effects because it produces consistent estimates in the presence of both heteroskedasticity and autocorrelation. Nevertheless, the sector specific effects are assumed away in this procedure but as sector specific variables are already included, ignoring fixed effects ought not to be a serious omission. However it is possible still to check for the presence of fixed effects by including sector specific dummies in generalized least squares estimation. The results from this check has revealed in many cases that the presence of these fixed effects is either not significant or its exclusion does not affect the results in any fundamental manner.

Estimation is conducted for each sector separately, with alternative trade variables. For the sectors for which corresponding data on exports and imports belonging to the same sectors or sub sectors were available, the sectoral trade shares and sectoral import penetration ratios, or sectoral imports to sectoral output ratios, are used. However when such corresponding data are not available, aggregate economy wide trade shares, import penetration ratio and imports to gdp ratio have been relied upon.

Data on manufacturing industries is available at irregular intervals as the census was not conducted regularly. Most of this industrial data relates to 1980s because since 1990, census is conducted every five years. On the contrary most intense trade reforms started in the later half of 1990s. In order to rectify this anomaly, data was arranged at five years intervals such as 1980, 1985, 1990 and 1995 and an effort was made to gather total factor productivity estimates for these years. The idea was to relate these total factor productivity estimates with the trade variables of corresponding years. However dividing data in such distinct intervals reduced the already limited number of observatios. Levinsohn-Petrin procedure and even the Fixed Effects or Random Effects failed to generate any reliable and valid productivity estimates with such small data set. Levinsohn-Petrin procedure works most effectively with data sets containing large number of observations. Therefore, the existing available data was used in its entirety without any truncation. The fact that non-tariff barriers were almost eliminated by 1995 but tariff levels still required great reductions provides support that this mismatch of data would not have substantially affected the basic results.

3.14 Results

Five alternative measures were used to analyse the connection between changes in trade policy and total factor productivity. Three measures related to the sectoral or aggregate trade ratios, are output based and represent the effect of changing trade policies. Two measures illustrate the distortion induced by trade protection. The average tariff which indicates the ratio of collected trade taxes to total trade value is an incidence based measure. Anti export bias is the ratio of effective exchange rate for imports and exports. Output based measures are expected to have a positive relationship as increasing trade ratios are hypothesised to positively affect total factor productivity. The other two measures signify a departure from free trade policies as higher tariffs indicate greater restriction on international trade and higher ratio of bias indicates bias of the policies against exports and in favour of import substituting industries. These two measures are predicted to be negatively associated with total factor productivity.

The results of five regressions on eight sectors are presented below in tables 3.7-3.14. The results illustrate that the hypothesis of a positive relationship between openness and total factor productivity is weakly supported. Estimated coefficients on output based measures appear with expected signs and are statistically significant for only three out of eight sectors; Chemical, Rubber and Plastics, Paper Products, Printing and Publishing and Basic Metal Industries. For Chemicals, the output based measures consist of sectoral trade ratios, import penetration and sectoral imports to sectoral output ratios. Whereas for Paper and Basic Metal, because of no exports form this sector, there are only two sectoral ratios, import penetration and imports to output ratio. Chemical Rubber and Plastics shows consistent increase in all its sectoral trade ratios. Paper Products exhibit constant trade ratios until 1990 but register considerable increase in 1995. Basic Metal industries show similar trends with significant increase in trade ratios in 1995.

(** indicates significance at 95% confidence interval. Figures in parenthesis are standard errors.)

TABLE 3.7
Chemicals, Rubber and Plastics

DEPENDANT VARIABLE LOG TFP **VARIABLES**	(1)	(2)	(3)	(4)	(5)
Constant	.73	.65	.76	1.13	1.28
Sectradeshare	.68** (.23)				
Sectimpenetration		1.35** (.47)			
Sectimpoutput			.71** (.24)		
Avtariff				-.43 (.50)	
antiexpbias					-.25 (.40)
lnmarket	.23** (.031)	.23** (.031)	.23** (.031)	.25** (.035)	.25** (.035)
caplab	.105** (.016)	.104** (.016)	.104** (.016)	.1005** (.016)	.099 (.017)
impmatratio	-.065 (.11)	-.065 (.11)	-.072 (.11)	-.033 (.11)	-.026 (.12)
Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity					
Chi2	4.05	4.02	3.85	3.75	3.96
Prob	0.04	0.04	0.04	0.05	0.04
Log likelihood	-65.44	-65.66	-65.66	-68.88	-68.75
Prob>chi2	0.000	0.000	0.000	0.000	0.000
No.of observations	192	192	192	192	192
No. of groups	24	24	24	24	24

TABLE 3.8
Food manufacturing

DEPENDANT VARIABLE LOG TFP VARIABLES	(1)	(2)	(3)	(4)	(5)
Constant	1.00	.95	.99	1.34	1.65
Sectradeshare	.13 (.30)				
Sectimpenetration		.53 (.56)			
Sectimpoutput			.50 (.36)		
Avtariff				-.64 (.57)	
antiexpbias					-.44 (.50)
lnmarket	.054 (.04)	.048 (.04)	.037 (.04)	.053 (.039)	.051 (.041)
caplab	.077** (.02)	.078** (.02)	.076** (.02)	.076** (.02)	.076** (.02)
impmatratio	1.51** (.22)	1.48** (.22)	1.45** (.23)	1.49** (.22)	1.49** (.22)
Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity					
Chi2	2.66	2.09	2.01	2.28	2.45
Prob	.10	.14	.15	.13	.11
Log likelihood	-54.4	-54.30	-54.37	-53.76	54.16
Prob>chi2	0.000	0.000	0.000	0.000	0.000
No.of observations	144	144	144	144	144
No. of groups	16	16	16	16	16

TABLE 3.9
Textile manufacturing

DEPENDANT VARIABLE LOG TFP VARIABLES	(1)	(2)	(3)	(4)	(5)
Constant	-.08	.089	.13	.28	
Sectradeshare	.24 (.17)				
Sectimpenetration		-1.24 (.98)			
Sectimpoutput			-2.99 (-1.88)		
Avtariff					
antiexpbias				-.91 (.47)	-.84 (.37)
lnmarket	.22** (.17)	.23** (.044)	.22** (.039)	.26** (.037)	.22** (.044)
caplab	-.06** (.01)	-.063** (.011)	-.064** (.011)	-.066** (.009)	-.063** (.01)
impmatratio	-.24 (.15)	-.13 (.16)	-.135 (.155)	-.127 (.154)	-.194 (.14)
lnsubsidies	-.004 (.011)	.005 (.013)	.003 (.01)	-.009 (.012)	.001 (.011)
lnexprebates	-.036** (.006)	-.042** (.007)	-.037** (.007)	-.036** (.007)	-.048** (.006)
Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity					
Chi2	.23	.59	.74	2.05	1.01
Prob	.63	.44	.39	.15	.31
Log likelihood	22.30	17.93	19.72	18.69	19.96
Prob>chi2	0.000	0.000	0.000	0.000	0.000
No.of observations	120	120	120	120	120
No. of groups	11	11	11	11	11

TABLE 3.10
Metal products, machinery and Equipment

DEPENDANT VARIABLE LOG TFP **VARIABLES**	(1)	(2)	(3)	(4)	(5)
Constant	-.24	-.93	-.24	-.088	.74
Sectradeshare	.303 (.16)				
Sectimpenetration		1.92 (.98)			
Sectimpoutput			.31 (.15)		
Avtariff				.83 (.52)	
antiexpbias					-.44 (.43)
lnmarket	-.031 (.032)	-.032 (.033)	-.031 (.033)	-.046 (.033)	-.027 (.031)
caplab	.04 (.057)	.04 (.057)	.041 (.057)	.018 (.33)	.033 (.054)
impmatratio	.25 (.11)	.24 (.11)	.24 (.11)	.24 (.11)	.29 (.11)
Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity					
Chi2	1.08	1.44	1.04	.24	6.88
Prob	.29	.23	.30	.62	.008
Log likelihood	137.88	-137.91	-137.83	-138.81	-137.41
Prob>chi2	0.000	0.000	0.000	0.000	0.000
No.of observations	256	256	256	256	256
No. of groups	32	32	32	32	32

TABLE 3.11
Paper, Printing and Publishing

DEPENDANT VARIABLE LOG TFP VARIABLES	(1)	(2)	(3)	(4)	(5)
Constant	-1.42	-1.57	-1.41	.22	1.77
Sectradeshare	4.38** (1.19)				
Sectimpenetration		6.3** (1.7)			
Sectimpoutput			4.35** (1.1)		
Avtariff				-1.7 (1.0)	
antiexpbias					-1.8** (.49)
lnmarket	.30** (.06)	.28** (.06)	.29** (.06)	.207** (.07)	.26** (.-6)
caplab	-.007 (.04)	-.015 (.04)	-.01 (.04)	-.037 (.05)	-.013 (.03)
impmatratio	.44** (.16)	.48** (.16)	.46** (.15)	.54** (.20)	.37 (.16)
Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity **Chi2** **Prob**	.46 .49	.49 .48	.51 .47	.33 .56	.66 .41
Log likelihood **Prob>chi2**	4.78 0.000	4.55 0.000	4.87 0.000	-.155 0.000	4.25 0.000
No.of observations **No. of groups**	72 5	72 5	72 5	72 5	72 5

TABLE 3.12
Non metallic mineral products

DEPENDANT VARIABLE LOG TFP VARIABLES	(1)	(2)	(3)	(4)	(5)
Constant	.37	.32	1.08	-.63	-.058
Tradegdp	.47 (.23)				
Impgdp		.84 (.42)			
Aggimpenet			-3.6 (4.09)		
Avtariff				1.2 (.87)	
Antiexpbias					.18 (.79)
Lnmarket	.12 (.09)	.13 (.09)	.072 (.10)	.25 (.11)	.155 (.10)
Caplab	-.009 (.01)	-.008 (.01)	-.016 (.008)	-.017 (.008)	-.014 (.009)
Impmatratio	-.002 (.002)	-.002 (.002)	.003 (.001)	.003 (.001)	.003 (.001)
Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity **Chi2** **Prob**	6.14 0.01	5.93 0.01	1.30 .25	5.48 0.01	4.25 0.03
Log likelihood **Prob>chi2**	-5.22 0.002	-4.2 .001	.33 0.11	-2.3 .05	-1.30 .19
No.of observations **No. of groups**	56 7	56 7	56 7	56 7	56 7

TABLE 3.13
Basic metal industries

DEPENDANT VARIABLE LOG TFP VARIABLES	(1)	(2)	(3)	(4)	(5)
Constant	-2.1		-2.12	-.21	.66
Sectradeshare	.75** (.30)				
Sectimpenetration		1.94** (.80)			
Sectimpoutput			.75** (.30)		
Avtariff				-4.4 (2.6)	
Antiexpbias					-1.95 (1.59)
Lnmarket	.70** (.04)	.70** (.04)	.70** (.04)	.78** (.08)	.73** (.06)
Caplab	.67** (.07)	.67** (.07)	.67** (.07)	.65** (.06)	.65** (.07)
Impmatratio	-.47 (.25)	-.47 (.25)	-.47 (.25)	-.013 (.47)	-.25 (.37)
Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity **Chi2** **Prob**	 5.81 .01	 5.81 0.02	 5.81 0.01	 4.14 0.04	 4.74 0.03
Log likelihood **Prob>chi2**	-6.65 0.000	-6.87 0.000	-6.65 0.000	-11.64 0.000	-10.82 0.000
No.of observations **No. of groups**	32 4	32 4	32 4	32 4	32 4

TABLE 3.14
Wood, cork and products

DEPENDANT VARIABLE LOG TFP VARIABLES	(1)	(2)	(3)	(4)	(5)
Constant	-.16	-.22	-3.2	-.21	.55
Tradegdp	-.15 (.19)				
Impgdp		-.155 (-.43)			
Aggimpenet			.10.8** (3.1)		
Avtariff				-.46 (.98)	
Antiexpbias					-1.42** (.56)
Lnmarket	.36** (.12)	.37** (.12)	.81** (.13)	.41** (.14)	.72** (.16)
Caplab	.097** (.027)	.099** (.027)	.14** (.025)	.106** (..03)	.12** (.027)
Impmatratio	.01 (.40)	.055 (.40)	.48 (.31)	.168 (.41)	.49 (.34)
Breusch-Pagan/ Cook-Weisberg test for heteroskedasticity **Chi2** **Prob**	 1.82 .17	 1.77 0.18	 2.13 0.14	 2.11 0.14	 2.02 0.15
Log likelihood **Prob>chi2**	-3.62 0.0001	-3.91 0.000	2.80 0.000	-4.41 0.000	-.024 0.000
No.of observations **No. of groups**	32 4	32 4	32 4	32 4	32 4

The Chemical sector retains the highest amount of foreign direct investment, particularly in drugs and pharmaceutical and the fertilizer industry. Some 75 percent of the market share is dominated by multinational companies. Fertilizer is an important sub sector producing for a high domestic demand of fertilizers. Pharmaceuticals and other chemical products are reliant on imported raw materials, semi finished products and packing materials. These semi finished products and raw materials are formulated and packaged into finished products. This perhaps explains the significance of trade related measures as fertilizer and pharmaceutical industries predominate the production from the entire Chemical sector. The fertilizer sector is supported by the government by ensured supply of its main raw material feedstock and gas at concessional rates for ten years, deregulation of trade in 1986, tax holiday for a specified period and the import of plant and equipment for this sector is exempt from import duty. However these concessions are not passed to the domestic consumers and some analysts criticise fertilizer manufacturers for keeping domestic prices higher even in the wake of lower international prices. Domestic manufacturing of fertilizers however has taken full advantage of concessionary policies of the government and fertilizer plants are running at full capacity utilisation. The substantial expansion in manufacturing capacity in response to growing demand for fertilisers from the farmers who get credit and subsidies for these, has contributed to the greater competition causing robust growth. The Chemical sector is dominated mostly by these two key players and the rest of the sub sectors produce medium quality chemicals and plastic products for domestic consumption. These two sub sectors hold the potential to develop into internationally competitive sectors as pharmaceuticals has started reaping benefits from the spillover effects of multinationals operating in the sector. The fertilizer sector is continually improving performance by achieving higher capacity utilization and taking maximum advantage of government support policies.

In Paper products, the reliance on imported material is high as the limited forest area which is important for paper production hampers the development of the sector. The basic ingredient, pulp is imported to produce paper products and is subjected to import duties which increase the cost of producing paper. The significant association between trade measures and total factor productivity implies positive improvements in the sectoral performance with changes in trade policies. It is also one of the two sectors in which the coefficient on antiexpbias is statistically significant implying that the bias is negatively affecting the total factor productivity of the sector.

For the rest of the five sectors the results do not support the hypothesis of positive effect of trade liberalization on total factor productivity. The estimated coefficients on the trade ratios for these sectors are statistically insignificant. The signs on all three trade ratios are according to prediction in Food manufacturing and the sectoral trade shares present an increase only in 1995, particularly for ratio of exports plus imports to sectoral output. For Textiles only sectoral trade share appears positively associated with total factor productivity while the other two import ratios are negatively signed and insignificant. Perhaps this is because the trade shares are constructed with exports and imports and exports from this sector form the major source of manufactured exports. However the sector depends on indigenous raw materials in which the economy has comparative advantage and which are priced to the advantage of Textile manufacturing at the cost of agricultures. There are export taxes to be paid on exports of its raw materials, raw cotton. This factor can explain the relatively low levels of import penetration ratios and the negative signs on them.

The signs on estimated coefficients for sectoral trade ratios for Metal products, Machinery and Equipment are positive but statistically insignificant. The sectoral ratios (Appendix tables 3.4 and 3.4.1) of this sector fluctuate with no consistent trend but overall they are stagnant with no substantial increase. The remaining two sectors, Non Metallic Mineral Products and Wood Products, have no sectoral measures and aggregate trade ratios are relied upon. For Non Metallic Mineral Products, the coefficient on trade to gdp ratio and imports to gdp ratio are positive but statistically insignificant while aggregate import penetration appears negative and insignificant. Wood and cork products have negatively signed coefficients on two aggregate measures, trade to gdp and imports to gdp and both are insignificant. While the third measure, aggregate import penetration is positively associated with the dependant variable and is statistically significant.

The results for the two other trade related measures, average tariff rates and anti export bias demonstrate that the rates are negatively signed in six out of eight industries according to expectation. In Metal Products, and Non Metallic Mineral Products, the signs on the coefficient for average tariff are positive. However anti export bias appears negatively signed in Metal Products but positive in Non Metallic Mineral Products. The coefficients on these two variables are insignificant in nearly all industries except Paper and Wood products. In these two sectors, the coefficient on antiexport bias is negative and statistically significant.

The results for the Textile sector show the trade measures of all types to be statistically insignificant. Interestingly, the Textile sector is the recipient of the most generous subsidies and export rebates but both these variables do not appear to be contributing to enhancing the total factor productivity of the sector. Subsidies appeared with a positive sign but are only nominally important. Export rebates on the other hand, in all the regressions, show up with a negative sign but appear statistically significant. This is curious as it suggests that export rebates provided as an incentive to encourage exports actually decreased total factor productivity of the sector. Ratio of imported materials to total intermediate materials, shows up with a negative sign and is statistically insignificant. This is due to the fact that most of the raw materials used in the production of the sector are indigenous.

In all estimations, lnmarket, caplab have appeared as statistically significant. Lnmarket denoting the market structure or the level of competition seem to be positively and significantly associated with the total factor productivity implying that the higher competition in this sector has positively contributed to improving the total factor productivity. Capital intensity, denoted by ratio of capital to employees is unanimously negative but seems to have statistically significant association with the total factor productivity.

The Textile sector has always received the most favoured treatment because of its dominance in employment generation and its position as the biggest foreign exchange earner in exports. This position is achieved partly by relying only on the static advantage that lies in domestic cotton production and largely also on numerous supporting incentives provided by the government. In fact no other manufacturing sector has received such generous favours as Textiles. These favours include availability of cotton at a level below international prices, duty free imports of machinery and equipment, complete ban on imports of textile products, prohibitive tariffs, and financing at lower rates. These incentives have been provided for decades but the required response of diversifying textile exports into higher value added products, greater forward linkages from spinning to weaving, dying, printing and garment making do not appear to have materialised. The producers became dependent on subsidies and export rebates for easy profitability instead of devising means to improve total factor productivity through better production methods and improved quality products.

In the Food sector, coefficients on capital intensity, and ratio of imported materials to total materials are positive and statistically significant. Both are surprising because Pakistan being an agricultural economy, the food sector mostly relies on agro products and labour instead of capital, these two could be expected to be less important. Perhaps this could be explained with regard to the presence of multinational firms which might not be relying much on indigenous raw materials and importing most of their processing methods. The coefficient on the variable indicating market structure is positive but in all regressions it is not statistically significant and not affecting the independent variable.

The dominant sub sectors, sugar, edible oil and vegetable ghee have failed to demonstrate improvements in performance, rather edible oil is one of the major food imports and there are fluctuations in the production of sugar. Refined sugar consists of both mill and traditional non mill sector. The traditional sector carries an incentive to produce 'gur' as compared to refined sugar by the milling sector, as the milling sector has to face price controls on sugar and an excise duty to pay. The traditional sector also extracts lower sugar content from cane while the mill sector extracts more. This is important in the context of lower yield per acre from available cane growing land. Research on this side has not kept pace with the increasing demand and consequently in some of the years the sugar producers failed to meet the domestic demand. In the years leading to 1995, there has been increasing expansion in the sector as the manufacturers were offered long term loans generously and in response to freeing the sales price of sugar. The large number of mills failed to realise full capacity utilisation due to factors related with pricing of cane and shortage in availability of cane. Most of the machinery used in sugar manufacturing is locally procured and hence dependence on imported machinery and equipment is not an issue.

The role of the trade regime in enhancing productivity or causing a positive change seems to be limited because the Food sector is mired in problems created by overcapacity, high cost of production and low productivity of the major sub sectors, edible oil and refined sugar.

Except Non Metallic Mineral Products, Food manufacturing and Metal Products, log of market, proxying the level of competition in the sector by number of establishments, has shown up with positive sign and is highly significant. Metal Products is the only sector in which the coefficient on lnmarket appears with an insignificant negative sign. This holds true irrespective of the use of different trade variables. Similarly capital labour ratio appears to have positive association with total factor productivity in a majority of the sectors except Textiles, Paper products and Non Metallic Mineral products. The coefficients are statistically significant in Chemicals, Food manufacturing, Textiles, Basic Metal Industries and Wood products.

The coefficient on the ratio of imported materials to total intermediate materials is statistically significant and appears with positive sign in only two of the sectors, Food manufacturing and Paper Products. In rest of the sectors the results on this variable do not seem to follow any consistent pattern. The coefficient is negative and insignificant in Chemicals, positive but insignificant in Metal products, Wood and Cork products.

Insignificance of capital labour ratio in Metal Products is incomprehensible in view of the higher dependence of the sector on imported capital equipment and machinery. The sector performance is determined mainly by such segments as, electrical and non electrical machinery and automobiles. The Machinery sector is unable to provide for domestic demand which is met largely by imports. Secondly domestic production of electrical and non electrical machinery is not preferred by consumers because of the lower quality of its products. Capital intensity for basic metal industries is positive and highly significant regardless of which trade measure is being used.

Overall the hypothetical relationship between total factor productivity and changes in trade policies at sectoral level is not unanimously supported for all the sectors. The results appear to vary from sector to sector and, although the predicted positive association between trade shares and dependent variable is found to hold in a majority of the industries, they are statistically insignificant in most of the cases. Similarly the incidence based measure, average tariff rate and the indicator variable, anti export bias, appear to have expected negative relationships with the dependent variable but only anti export bias is significant in only two cases.

3.15 Conclusion

The trade regime in Pakistan has come a long way, but over a period of nearly four decades. The protection level has changed and been drastically reduced, not just in terms of elimination of quantitative restrictions and rationalization of tariffs but also reducing subsidies and export taxes. Theoretically, the positive effect of trade liberalization is assumed to work through increasing the level of competition faced by means of discipline exerted by foreign imports. Rationalization occurs provided there are no entry and exit barriers. Greater exposure to foreign imports and increased exports can also cause spillover effects due to learning by seeing. The effect of all this would result in improved total factor productivity by adopting innovations and improving technical efficiency.

The results suggest that trade liberalization has not affected the total factor productivity of manufacturing industry. The consequent product of the reforms in the shape of better, more competitive, more technically efficient manufacturing industry with improved total factor productivity has yet to surface. So far, the trends on this side are not impressive, and total factor productivity of manufacturing industry on average, as worked out in the previous chapter has not improved over the years.

The sector specific milieu, with particular policies impinging upon the performance of a sector plays an equally important role in affecting its efficiency. Nearly all the sectors receive some kind of concessions or support from government policy, be it low priced raw materials, exemptions from import duty on capital equipment or tax holidays but some sectors have been able to respond and perform better than others. Textiles, the largest beneficiary of all kinds of fiscal, financial and trade incentives does not appear to be reflecting any significant positive effect of these incentives being received over the entire history of economy.

If trade reforms are carried out in isolation without any effort to create an enabling environment by means of complementary reforms in the areas of education and infrastructure, it will be difficult to get the fullest effect of these reforms. Human capital and infrastructure are important in creating this environment. Human capital needs to be improved in order to adapt and implement the changes and innovations caused by trade openness. Education levels and quality improvements are crucial to equip the workforce for the competitive pressures of foreign exposure. However this complementary factor was lacking as the educational standards and level did not keep pace with the trade reforms. Spillover effects of openness have failed to materialise because human capital was slow to respond. Complementary reforms in the education sector were not carried out and conscious, consistent efforts to enhance the educational levels were not made.

Secondly infrastructure related improvements are vital for the manufacturing sector to realise the total factor productivity. However as the fiscal deficit was high and in order to contain the deficit while continuing with reducing tariffs, the development works and projects were substantially reduced. Consequently infrastructure related developments suffered and this might have hindered the efforts of manufacturing industry in improving its productivity.

The trade reforms have been piecemeal until 1987 and lacked the commitment of a well thought out plan. Secondly by 1995, the reforms were far from complete and industry was going through a transitional phase. For most part of the period 1980-1995, tariffs and non tariff barriers were being used to provide protection to the domestic industries. Unfortunately measures of non tariff barriers cannot be used because the studies to determine the effective protection rates pertain to a particular point in time and do not span the entire period

Tariffs were not the principal determinant of protection for most of the period under analysis and served a revenue function. Gradually the tariffication has been increasing and non tariff barriers are declining in importance. It is only at the end of the 1980s and early years of 1990s that tariffs could fully represent the price differentials between domestic and c.i.f prices of comparable products. These factors could also have contributed to the failure in establishing clearly positive effects of trade policy changes on the total factor productivity of the manufacturing sectors.

Chapter 4

Technical efficiency of the manufacturing industries and trade liberalization

4.1 Introduction

Total factor productivity is considered synonymous with technological progress assuming that producers are technically efficient and it does not distinguish between technological progress and technical efficiency. However producers may differ because of their efficiency despite using identical inputs and it is hence reflected in different costs and profits. How efficiently the inputs are converted so as to achieve the maximum possible output from them, is referred to as X-efficiency (Leibenstein 1968).

Recent developments emphasise the importance of measuring technical efficiency as distinct from total factor productivity or as a constituent part of total factor productivity where the other component is the technological progress. Technological progress indicates the innovations or inventions which cause the frontier to shift over time while technical efficiency causes the firms to move towards achieving the maximum possible output from the resources available. The improvements in technical efficiency can be achieved by reorganizing work or production in a better manner, reducing waste and costs or introducing superior management techniques aimed at reducing frictions between objectives of firm owners and the workers.

Calculating technical efficiency of the manufacturing industries of Pakistan is relevant because most of the industries were plagued by the non competitive environment prevailing under the restrictive trade regime. This environment dampened their incentives to exert full efforts in order to reduce costs. Rather it encouraged the producers to engage in rent seeking activities as this provided a trade off between efforts to reduce costs for increasing profits or efforts to get policies to discourage competition. The profits received through protectionist policies in place were easier to earn and lessened the need to pay attention to better production methods. It is hence useful to know the degree of technical efficiency of the manufacturing industries.

Secondly, given the fact that technical efficiency is a relative concept and measures the deviation of actual output from the maximum possible output, it allows one to analyze change over time within the same sector and to compare it with other sectors. This comparison among sectors reveals information about the inter sectoral variation of efficiency which further facilitate analysis for the underlying factors causing it. This in turn carries policy implications to focus on the improvement in technical efficiency.

Among factors which influence the technical efficiency of manufacturing industry, trade related measures are perceived to be highly significant as they shape the particular market structure. The complexion of the market in turn influences the behaviour and organizational methods of the business establishments. Oligopolies in Pakistan did not consider it important to work towards devising ways and means in order to implement operationally efficient production methods. With the gradual opening of trade, reduction and subsequent elimination of restrictions, it is presumed that the industrial sector will have come under pressure to introduce changes in order to face the less protected trade regime. Whether these changes have affected the technical efficiency of all or some of the industrial sectors of Pakistan and the relative role that trade related policies have played in the improvement or otherwise, is the subject of this chapter. Technical efficiency of the manufacturing sectors is derived using stochastic frontier production functions and in the second step, these efficiency parameters are analyzed in terms of its association or its lack with various trade measures along with sector specific measures.

4.2 Literature survey on the concept of technical efficiency

The concept of technical efficiency is in simple terms based on the deviation of observed production from some ideal or potential production frontier. Farrell (1957) pioneered the idea and he explained technical efficiency to be distinct from price efficiency which he labelled as allocative efficiency. Technical efficiency allows the firm to produce the maximum output attainable with any specific combination of inputs. Price efficiency, on the other hand, takes into account the prices of input factors and a price efficient firm uses the best combination of inputs given their prices. The model presupposes that an efficient production function to serve as a reference point is known. However, the best production function could be a theoretical point according to engineering concepts or it could be empirically constructed from the observed units. Given the complexities involved in firms or units, an empirical method of finding the efficient frontier instead of a theoretical engineering construct is argued to be the most pertinent and appropriate.

Farrell experimented with constructing isoquants to make clear the concept of efficiency and the distinction between price and technical efficiency. Technical efficiency, he argued, also reflects the quality of inputs or management efficiency. Price efficiency is related to "choosing an optimal set of inputs"(p.250 Farrell 1957). However he pointed out that price efficiency is unsteady because of the difficulty involved in measuring prices of inputs accurately. Technical efficiency can be attained by improving the management or production methods and easier to implement and achieve.

Farrell suggested that it is possible to extend this analysis to the level of industry with minor caveats. Firms in an industry differ in their choices of inputs and, when aggregated, an industry's technical efficiency will be slightly decreased by this heterogeneity or distribution because of averaging out the technical efficiency of the individual firms.

Leibenstein (1978) further elaborates upon the factors responsible for a given level of efficiency or inefficiency and recognizes the peculiarly important role that the existing state of competition plays in aligning the incentives and efforts of managers and consequently the workers with those of the firm itself. His work finds its parallel in the insight of organization theory that aligning the interests of workers and managers and motivating the workers is required to contribute towards enhancing efficiency of firms. Organizational theory emphasises the social system view of the firm because firms are complex organizations and there is need to coordinate work between the management and production. This social system is as important in setting and enforcing norms as the formal management rules and procedures. Workers' morale and loyalty to the organization are regarded as important factors influencing their efforts at their job. The particular way of designing their work is found to affect their effort. The feelings of workers for their jobs and organization are thought to influence the absentee rates and productivity as well. All these issues in the field of organizational theory have a direct bearing or effect on productivity which has entirely been neglected in the mechanistic view found in the neo classical growth accounting mechanism. Economists have subsequently started considering the effect of behavioural and organizational factors on the productivity and profitability.

In a comment on Stigler's (1976) critique of X-inefficiency, Leibenstein (1978) argues that the existence of X-inefficiency should not be ignored and assumed away. The basis of his argument is that motivation to exert maximum effort is variable and discretionary and more so where firms are run by managers instead of owners. Because of the friction of interests contained in principal agent theory, workers exert variable effort levels depending upon their personality, peer group and management styles. The owners or owner-managers try to trade off cost minimising efforts for efforts to 'shelter' firm activities from price competition. This is possible through cartelisation or product differentiation. Leibenstein (1978) defends the conceptual association between X-inefficiency and competition arguing that competition puts pressure on the firm members to increase efforts and reorganize and adjust so as to reduce costs. In case of lesser competition, there is little pressure for such an adjustment. Competition serves as an impetus for firms to initiate change in their production processes.

Leibenstein (1966) emphasises the importance of such issues as the style of management, motivation of workers, reorganization of work place and materials handling in increasing productivity. He distinguishes between allocative efficiency and 'X-efficiency' and endorses the findings of those researchers who argue that benefits from removing allocative inefficiency are small as compared to removing technical inefficiency. X-inefficiency, in his opinion causes greater distortions and he argues that if managers are efficient and motivated, it is possible to get better output per man hour despite the persistence of allocative inefficiency.

Leibenstein is of the view that it is not just the technology or sophisticated machines which are primarily responsible for increasing productivity. Other factors such as superior selection methods providing appropriate workers for the firms, improving production procedures and budgeting techniques greatly affect the efficiency at factory or firm level. He has mentioned an ILO study in which firms in developing countries were suggested various ways to reduce costs such as reorganising the work places, waste control and giving incentives to workers. It was found that cost reductions achieved were in the range of twenty five percent or above.

He discusses that the 'residual' reflecting productivity might be caused by these above mentioned factors and might be shaped by efforts to reduce costs not necessarily related with any invention or innovation. There can be pressure for this cost reduction in difficult periods, 'adversity' and in competition as they both force and demand change. The change involving this kind of cost reducing effort requires pressure but in imperfect competition there will be little need for change towards reducing costs since profits would be high enough even with high per unit costs. He points to the study of Cyert and March (1963) which analyzed the fact that when profits are high, costs per unit are allowed to increase or are taken for granted.

Technical efficiency assumes even greater importance in the context of capital scarce developing countries because with a given technology level, efforts should be directed towards narrowing the gap between the 'best practice' level of efficiency and actual efficiency. Nishimizu and Page (1982) are credited with identifying different policy implications arising from the distinction between technological progress and technical efficiency. They evolved the methodology for synthesizing the technological progress and technical efficiency change into total factor productivity. They indicated the weakness of the conventional approach of total factor productivity which considers technical change synonymous with TFP change and its failure to differentiate or decompose the total factor productivity into technical change and technical efficiency change. In this view, technological progress shifts the production frontier while technical efficiency is the product of changes in managerial practices, adjustment to external shocks etc. So it is important to distinguish between the two as they involve different policy implications. It is possible to have a high rate of technical progress, i.e. innovation and new technology, with low technical efficiency or vice versa. Knowing the relative position and level of the two can help policy makers target the relevant weak area and avoid misdirected policies.

Following Aigner and Chu (1968) Nishimizu and Page used the method of linear programming with the constraints that all observations lie on or below the frontier and impose the constraint of constant returns to scale. A translog gross production function for a panel data of 26 sectors in six republics of Yugoslavia was estimated for each sector with capital, labour and materials as inputs.

Nishimizu and Page concluded that technological progress played a more important role than technical efficiency. This was supported by the fact that most of the sectors exhibiting a dominant role of technological progress were also either the priority sectors or characterized by active efforts to get foreign technology.

As the authors pointed out, technological progress and technical efficiency are not 'neatly separable' and it becomes a problem to distinguish between the two. They used the definition that technological progress results in the movement of the 'best practice' production frontier over time. Technological progress may refer to explicit innovations and inventions while technical efficiency may require better management and organizational practices, improved organization of inputs, or better methods to adapt the existing technology to the working environment such as training about the new technology use.

Since the initiation of this method, it has been extensively used for firms or individual economic units but for aggregate production function analysis such as at the level of country or industry, its use is relatively less frequent. Sharma et al (2003) indicate that the possible reason for this is that it is easier to apply the technique at firm level with greater confidence. However there is no dearth of the frontier production function analysis being carried out at the aggregated level of regional economies (Wu 1997, Deliktas 2002), states (Sharma et al. 2003), economic sectors (Kraipornsak 1999) and manufacturing industries (Green and Mayes 1991, Mahadevan and Kalirajan 2000).

Sharma (2003) applied the stochastic frontier production to US states to examine time varying technical efficiency from 1977-2000. The study yielded efficiency measures for each state in each year. This study provides support for the use of the stochastic production function at the industrial or sectoral level as here a separate Cobb Douglas or translog production function is fitted for each state separately because each may have its own specific characteristics or technology necessitating a separate production function instead of a single function for all the states. Sharma (2003) relied upon a translog production function and carried out the estimation with the maximum likelihood method.

In a second stage analysis, average technical efficiency is then related with state specific characteristics such as human capital, ratio of state exports to gross state product, urban to total population ratio, industrial differences across states which categorise each state as either agricultural, mining, manufacturing or one of financial, insurance and real estate. The results demonstrate that these state specific measures explain nearly half of the variation in technical efficiency measurement over time.

Application of the Stochastic Frontier Production Function at the industrial sectoral level is not uncommon. Onder and Deliktas (2002) computed the technological change and technical efficiency change for Turkish manufacturing industries' in a panel data study for 18 provinces. They employed the time varying efficiency methodology devised by Battese and Coelli (1995) and derived the technical efficiency by estimating a translog production function.

The error is composed of two components, one representing the stochastic random component while the other is the inefficiency component. Maximum likelihood estimation was applied to gather the parameter estimates and technical efficiency of a particular industry in a particular time.

Generalized likelihood ratio tests were used to choose between Cobb Douglas or Translog production functions. Likelihood ratio statistics were also relied upon to check whether the stochastic frontier function was more appropriate than ordinary least squares which assume that there is no technical efficiency and to check the time variance of the technical efficiency estimates. Likelihood ratio tests suggest preference for a translog production function with time varying technical efficiency effects. Efficiency, technical change and productivity for public and private manufacturing firms for each province were calculated separately.

Deliktas and Balcilar (2002) applied almost the same framework and methodology for examining 25 transitional economies over the period of 1991-2000. The difference with their earlier work is that instead of being at industry level, it is at the aggregate macroeconomic level where each country is treated as a producer. The Stochastic production frontier method is supplemented by DEA, data envelopment analysis. The variables considered for influencing the total factor productivity of the economies are related with the liberalization and democratization process as opposed to the industry specific variables used in the above referred study.

Real GDP is taken to represent output, labour is represented by total labour force and capital stock is measured from gross capital formation. A time trend is also included in the production function. Efficiency is to be explained by numerous variables, most of which characterize the period of transition such as a liberalization index, level and degree of reforms, foreign direct investment as a percentage of GDP, export of goods and services as a percentage of GDP and domestic credit provided by the banking sector. All these variables depict the change in policies while others such as population size, natural resources, income distribution and school enrolment are included to indicate country specific characteristics.

A translog stochastic frontier production function is specified for a panel of 25 transition countries for a period of ten years. Likelihood ratio tests are conducted to determine whether Cobb Douglas or Translog functional forms should be used, and whether OLS or the stochastic frontier technique is preferred, depending upon the significance of inefficiency effects. Results demonstrated the appropriateness of the Translog stochastic production function.

The results show Slovenia, Turkmenistan and Poland to be the most efficient and Tajikistan, Ukraine, Russian federation and Uzbekistan to be the least efficient. Average efficiency for all twenty five countries is 0.559 for the entire period of ten years. Efficiency change has also been measured to represent the growth rate of technical efficiency of the respective countries. Technical change is measured using the parameters of the stochastic frontier production function by taking a partial derivative of output with respect to time. The results show negative average technical change for the period. Overall TFP estimates show negative trends and it seems that negative technological progress has dominated and caused negative total factor productivity and has restricted the reflection of any positive changes in technical efficiency within TFP. These results were supported by confirmatory results of Data envelopment analysis.

In most of the studies the measurement of technical efficiency is not an end in itself but is a step towards determining the factors that might be influencing directly or indirectly the decrease or improvement in the level of efficiency. The next section deals with the issues that crop up in an effort to appropriately model the relationship between technical efficiency and its possible correlates.

4.3 Technical efficiency and covariates

The models used to study the effect of various factors on technical efficiency follow either a two steps or a one step procedure. In two step estimation, technical efficiency estimates are derived from the production frontiers and these are then regressed on a set of variables believed to be influencing sectoral or firm level efficiency. Kumbhakar and Lovell (2000) recognise the importance of exogenous variables or factors which are associated with performance although they are not directly included in the production process in the strict sense of the word. However, they are responsible for the environment in which firms operate and hence indirectly become related with the results of the production process. For these reasons, these factors are often referred to as the 'environmental factors' because they may affect the actual production technology or the efficiency of the process of transforming inputs into outputs. These might be related with the degree of competition in the market, ownership characteristics or management related variables.

Of these, degree of competition is directly related to the trade related policies. In the literature on the link between trade liberalization and productivity and efficiency, it is argued that increased exposure to international markets by reducing the trade restrictions or through increased export activity, opens the door to opportunities and challenges to implement better production methods in order to be internationally competitive. This can either take the form of learning superior management and marketing techniques when exporters establish contact with international markets or through transfer of technology.

These are referred to as structural variables in the Green and Mayes (1991) study and also cited as conditioning variables in Kumbhakar and Lovell (2000) affecting the production process. Kumbhakar and Lovell argue that despite the fact that these exogenous factors are beyond control of management, they exert considerable influence on the production process and hence it is preferable that they should form part of the stochastic production frontier:

$$\ln y_i = f(x_i, z_i; \beta) + \upsilon_i - \mu_i \tag{4.1}$$

In the equation (4.1) i represents producer, υ indicates random noise and μ is technical inefficiency. Here z denotes the environmental factors and is included on the assumption that it directly influences the output by affecting the production process. In other words environmental factors are treated similarly to other fixed inputs and have a direct effect on the structure of the production frontier.

Kumbhakar and Lovell (2000) argue that incorporating environmental factors in this way precludes them as explanations for varying levels of efficiency because factors embodied in x and z are assumed to be uncorrelated with both μ and υ. Environmental factors are hence not correlated with efficiency but with the production process.

However, this seems paradoxical because exogenous factors are correlated with the level of efficiency and might be influencing it in many instances. For example, an endeavour to produce better quality goods as a result of the strong competition in the market caused by a large number of producers is a factor affecting efficiency of an industry. This might form part of the strategy of the management of the business units in response to the competitive pressures and might result in a rethinking of the existing methods of production or reorganization of the workplace, but might not directly form part of the production process in a literal sense.

Kumbhakar and Lovell (2000) discuss two stage estimation in which environmental factors are not part of the frontier production function but appear in the second stage as independent variables determining technical efficiency and so are indirectly related to the production process. In this two stage estimation, variations in efficiency are explained with the help of these exogenous factors.

In the first stage, exogenous factors are assumed to be independent of μ, technical inefficiency. In the second stage, correlation between the two is assumed. Kumbhakar and Lovell criticize two stage estimation, firstly because it is imperative that in the first stage estimation no correlation is assumed between fixed inputs of the frontier production function and environmental factors included in the second stage. However, if the two kinds of variables are in fact correlated, the efficiency estimates gathered from the first step are biased owing to omitted variables. Secondly, efficiency, being a component of the composed error term is assumed to follow an identical and independent distribution, but in the second stage estimation it is supposed to vary with the variables included in the regression. For this reason whether exogenous factors should appear as part of the production process directly affecting it, or be regarded as factors influencing efficiency indirectly depends on the reasoning applied in either case. Despite the criticism levelled at two stage estimation they point out that there is no definite answer to its inclusion in a particular estimation.

In order to overcome the drawback of two stage estimation identified above, some researchers have tried one step estimation in which firm specific factors are included in the estimation of the frontier (Kumbhakar et al (1991) and Reifschneider and Stevenson (1991) Battese and Coelli (1995), Huang and Liu (1994).

Reifschneider and Stevenson (1991) formulated a stochastic production function model as:

$$\ln y_i = \ln f(x_i;\beta) + \upsilon_i - \mu_i \tag{4.2}$$

and specified the technical inefficiency model as:

$$\mu_i = g(z_i;\gamma) + \varepsilon_i \tag{4.3}$$

where υ represents the random element which is independently and identically distributed as $N(0,\sigma_\upsilon^2)$. The second error component μ captures the technical inefficiency effects and is composed of systematic component γ which is related with the exogenous factors affecting efficiency. Substituting μ_i into the earlier equation yields:

$$\ln y_i = \ln f(x_i;\beta) - g(z_i;\gamma) + \upsilon_i - \varepsilon_i \tag{4.4}$$

Kumbhakar and Lovell (2000) comment that this formulation is structurally no different from the composed error stochastic frontier production function and hence the same Maximum likelihood function is applied as in a model without exogenous factors.

Huang and Liu (1994) also experimented with a little variation of the stochastic production frontier model incorporating environmental factors with the difference that their model could incorporate the interaction between exogenous factors and fixed input variables. It was also estimated by the maximum likelihood method.

The stochastic frontier production function is now increasingly used to study technical efficiency in many diverse areas such as manufacturing, agriculture, water management and banking because of its usefulness to isolate the effects of factors lying beyond the control of producers. These factors arise because of random elements such as weather, luck, breakdown of machinery or measurement errors, as has been indicated by Kumbhakar and Lovell (2000).

Notwithstanding the reservations expressed by Kumbhakar and Lovell (2000) about two stage estimation, numerous studies have modelled the technical efficiency derived from the first stage frontier formulation and regressed it on explanatory variables in the second step. Estache (2002), Sleugwaegen et al(2003), Abidin and Bigsten (1998) apply the stochastic frontier production functions to analyse the technical efficiency of manufacturing industries in Cote D'Ivoire and Malaysia respectively. Estache (2002) has empirically assessed the technical efficiency of twenty one water utilities in African countries covering a period of 1995-97. In a two stage estimation, efficiency scores derived from SFA (stochastic frontier analysis) are then regressed in a tobit model on institutional factors in order to analyse the relative roles of each in influencing the efficiency of water utilities.

A large amount of literature refers and adapts the insight and the procedure developed by Pitt and Lee (1981) who examine the relationship between firm efficiency and its covariates, size, age and ownership. They analyzed fifty Indonesian weaving firms for the years 1972, 1973 and 1975. The variables used were value added representing output, electricity consumption as capital and wage payments representing the labour variable.

Assuming that there might be some kind of relationship between efficiency and firm characteristics they experimented with both types of model. In one model they incorporated these variables into the main stochastic frontier Cobb-Douglas functions with other fixed inputs. In the other model, separate firm intercepts were regressed on these firm specific characteristics. After comparison of the variance due to inefficiency and due to random error, it is found that after adding extra regressors in the main stochastic formulation, the variance due to inefficiency falls substantially while the variance due to random error is not significantly altered. The appropriateness of either to use a time invariant inefficiency model or time varying efficiency was tested by Chi-Squared tests. The test supported estimating time varying technical efficiency as the hypothesis based on time invariant efficiency was rejected.

Firm characteristics, ownership, age and size are included. It is commonly believed that foreign owned firms are more efficient but dissenting voices point to the operation of foreign owned firms in an unfamiliar situation which impedes their efforts to exploit their superior organizational and management capabilities. The relationship between age and efficiency is also not without controversial reasoning. Older firms can be more efficient due to their experience but may be less flexible to adapt new technology as it entails replacing capital equipment of old vintage requiring considerable investment. Younger firms may be more efficient on the grounds that they have more advanced equipment. Size is expected to be positively related with efficiency as large firms have the advantage of economies due to organization and technical know how. The results demonstrate that the most efficient firms have higher capital intensity.

Sleuwaegen and Goedhuys (2003) identified age, ownership and size of the firms as potential characteristics contributing to the technical efficiency of the firms. Firms with formal status, (whether the firm is officially registered and is recognized and reputed in the market) gain more access to credit or other government incentives. In developing countries, large firms acquire such formal status and are able to demonstrate higher technical efficiency. Various characteristics are incorporated as binary variables. For age, firms over 5 years of age are given a value of one and zero otherwise. Foreign ownership is also a binary variable, with value of 1 if ownership is European and zero otherwise. Formal status is indicated by value of 1 for officially registered firms and zero otherwise.

For measuring technical efficiency and exploring the relationship with firm attributes, they adopt the Pitt and Lee method. In the basic model, firm characteristics of ownership, age and size are not included but, in a complementary regression, these variables are included as part of the main stochastic production function. The empirical results show positive relationships between foreign ownership, formal status and efficiency, while age does not appear to be an important factor.

4.4 Technical efficiency and trade liberalization

In most of the literature trying to capture the effect of trade liberalization reforms on technical efficiency, the procedure discussed in the earlier section is applied. Firstly technical efficiency estimates are drawn from a panel data set comprising firms in particular industries or at the level of aggregate industries. These efficiency estimates are correlated with factors indicating trade liberalization and other control factors to account for firm specific or industry specific variables. This is either done in a two stage procedure or in one step estimation which includes all these trade related and control variables in the basic model estimating the technical efficiency. In one step estimation however the variations in technical efficiency can then not be explained with the help of these factors as they form part of the production process directly influencing the process and there is assumed to be no correlation between the inefficiency term as part of the error term and explanatory variables.

The debate about the effect of trade liberalization on technical efficiency, technological progress and total factor productivity revolves around efficiency increase attributed to liberalizing policies that can be realized through one of many channels. It may be caused by comparative advantage and subsequent specialization, a neoclassical perspective; a political economy viewpoint that trade liberalization reduces the deadweight loss caused by rent seeking activities inherent in a protectionist regime; or endogenous growth theories' perspective that trade liberalization leads to benefits caused by learning effects in greater import penetration and export exposure leading to adoption of modern technologies.

Bigsten (1998) endeavours to establish an association between degree of openness indicated by export activity and the change in efficiency that can result from this openness. He tests whether the source of differential in relative performance between exporting and non exporting firms is the difference in their exposure to international trade. The work demonstrates that the relationship between export activity and technical efficiency depends upon the prevalent technological level in an economy and degree of trade restrictiveness. The market in which firms operate has an effect on their capacity to reap positive benefits from the openness of trade.

Experience of four African countries, Cameroon, Ghana, Kenya and Zimbabwe, shows that exporting activity causes improvements in efficiency which increases with time. New entrants venturing into export markets experience large increases in efficiency attributable to their operations in their export markets. The paper constructs firm level efficiency measures from the firm level panel data over a period of three years from 1991-1995 for four manufacturing sectors, Food, wood , textiles and metal. In order to establish the causality from exporting to efficiency, the firms are divided between initial exporting firms and non exporters and time varying efficiency is measured in panel data. The results unanimously support the hypothesis that exporters show high yearly efficiency improvement as compared to non exporters. The relationship is modelled in a two step procedure where technical efficiency is estimated first and then regressed on a number of firm characteristics. Dummies for foreign or public ownership, location in the capital city and dummies for size such as micro, medium and large are included.

In order to deal with the causality issue, a dynamic model is estimated to establish the causal association between exporting and efficiency :

$$Y_{it} = \alpha_1 Y_{it-1} + \alpha_2 DC_{t-1} + \alpha_3 DE_{t-1} + \beta X_{it} + e_{it} \tag{4.5}$$

Y_{it} indicates the efficiency of firm i at time t and Y_{it-1} is the firm's efficiency at time t-1. X represents the firm characteristics discussed above, while *DC* represents continuous exporters while *DE* indicates new exporters. Continuous exporters have been exporting in both periods while new exporters exported in period 2 but not in the first period.

The results unambiguously show that both continuous and young exporters experience large increases in efficiency. Other variables, such as foreign ownership are positively associated with technical efficiency while public ownership does not have any determining effect on the growth rate of efficiency. Large firms are less likely to show any growth in efficiency as compared to small firms.

The above study related to developing countries in Africa, but trade liberalizing policies are equally effective in influencing the technical efficiency of the manufacturing industries in an entirely different setting of a comparatively developed economy such as Australia. In a comprehensive work, Karunaratne (2001) successfully establishes that there exists an empirically positive association between trade liberalization and the technical efficiency of eight manufacturing sectors in Australia over a time period of twenty six years. The reduction in effective rate of protection corresponds with technical efficiency improvements in the manufacturing sectors.

The stochastic frontier production function is used to gather the parameters in a panel data set and maximum likelihood technique is applied for estimation. Here again the variables affecting the efficiency of the industries are modelled as part of the production process with fixed inputs, capital and labour simultaneously, and it is maintained that this method produces simultaneity bias free parameter estimates. A battery of likelihood ratio tests is applied to decide between stochastic or deterministic production functions and between Cobb-Douglas or translog functional form.

The trade related measures used are effective rate of protection for the industries in the sample, and intra-industry trade index to measure international transfer of technology through trade. Other measures included capital intensity denoted by capital labour ratio, and time dummies indicating time varying technological progress of the industries.

The empirical results thoroughly supported the hypothesis that trade protection resulted in inefficiency. The industries receiving the highest effective protection exhibited lowest average technical efficiency scores while the most efficient sectors were not receiving the highest effective protection. To test whether the gradual reduction in protection affects the change in technical efficiency score, it is found that average technical efficiency scores increased with decreased protection and the increase was maximum around the period when reforms had gathered full momentum. The effect of reducing protection also culminated in substantial increase in capital intensity and intra industry trade index. There is a negative correlation as well between effective rate of protection, capital intensity and intra industry trade which further endorses the positive link between trade reforms, technology transfers from abroad and increased capital intensity.

Green and Mayes (1991) examine technical inefficiency in manufacturing industries of the UK, using the stochastic production function by fitting a translog production function. In a two stage analysis, industries' technical inefficiency measures were correlated with a number of factors including trade related variables that might explain the variations in technical inefficiency of the industries. The variations in efficiency of the industries might be due to variations in scale of operations or different technologies. Trade related measures are included but do not represent a major influence on the technical efficiency.

Green and Mayes defend the use of the translog production function on the basis that industries included in the analysis are quite heterogeneous favouring the use of a general formulation. The basic specification they used is:

$$LnQ = a_0 + a_1 \ln L + a_2 \ln K + a_3 (\ln L)^2 + a_4 (\ln K)^2 + a_5 (\ln L \ln K) + \Sigma_i a_{i+5} X_i + e \qquad (4.6)$$

Q, K, L measures output, capital and labour inputs while X is a vector of other influences which affect the production process. These *X* variables are included to account for the heterogeneity of inputs and outputs in the production process. The rationale Green has given is that they differentiate for the nature of capital stock (by proportion of plant and machinery in total capital), for differences in labour input (by number of production workers as a percentage of total labour, wages and salaries per head of production workers and non production workers) and the amount of output which is not converted in the production process (by cost of goods for resale as a proportion of total material costs). The 'e' is composed of a random error μ and υ, υ identifies the firm specific inefficiency .

Two kinds of problems have been identified which arise either due to sample size or inappropriate choice of the model. In the first case, firms appear to be super efficient and entire variance seems to be caused by random error. In the second case firm's inefficiency component is so large as to reduce random error to insignificance. Of the originally planned 151 industries, 72 were finally used for estimation because the rest of the industries showed signs of either one or the second type of failure indicating the inappropriateness of the model or the inadequacy of the sample for them. However, Green and Mayes emphasise that the industries with case one or case 2 failures do not demonstrate a sampling problem. Rather the industries for which the skewness of random error is positive are in fact very efficient and those for which the variance of firm specific inefficiency component is larger than the variance of residuals are in fact highly inefficient. Cement, dyes and pigments, weaving and footwear appear among the ten most efficient or least inefficient industries.

In the second stage of analysis these efficiency measures were related with structural factors such as those determining the market conditions, nature of competition, and rate of technical change, geographical and organizational factors. It was possible to account for half of technical inefficiency by means of these structural factors. Openness to international trade also influenced technical inefficiency, however in some cases the effect was opposite to the predicted one. The rate of change affected efficiency most, with growing industries experiencing higher efficiency. Capital intensity is found to have a weak effect on efficiency and the probable explanation forwarded is that capital intensive industries find it hard to adjust in response to changing technology demands as they have larger commitments in the form of sunk costs. (Capital intensity hence turns out to be a negative factor in changing the behaviour of the producers towards the most efficient ways of production or organization and hence is a sort of barrier to improving efficiency.)

The literature exploring any kind of association between liberalizing policies and technical efficiency includes a number of control variables along with the trade related measures so as to account for the sector specific or country specific factors. The most frequently used control variables included in cross industry or firm level studies are capital intensity denoted by capital labour ratio, age and size of the firms. The empirical evidence points towards the conclusion in many such studies that reduced levels of protection and increasing exposure to international trade result in improvements in technical efficiency. The method of modelling this relationship differs and the studies carry out two stage as well as one step estimations. In the next section, the methodology of estimating the stochastic frontier production function is discussed.

4.5 Methodology of stochastic frontier production function

All producers try to optimise with the given inputs and technology but not all succeed. Some turn out to be more efficient than others. Deviations of observed output levels from the optimal ones can be either because of inefficiency or random shocks. Stochastic frontier analysis models the producer behaviour. It specifies the relationship between outputs and input levels using two error terms. Various modifications have taken place to the methods used to construct technical efficiency of the producers based on the frontier functions.

Earlier approaches popularized by Schmidt and Sickles (1984) used cross sectional data modelling time invariant technical efficiency. In the time invariant model, each firm's productivity shock is constant for all time periods. It is somewhat analogous to a fixed effect-it has the same effect for all time periods. Time invariance failed to take into account the changes in technical efficiency over time and later researchers modified the modelling to take account of this weakness. Pitt and Lee (1981) argue that the time invariant models provide an average measure of inefficiency and are based on the assumption that same level of firm inefficiency persists permanently and does not change over time. They argue that inefficiency cannot persist permanently as firms will eventually seek a more efficient combination of inputs. If inefficiency changes over time, it will not be easy for firms to acquire accurate information about it in time to influence their input choices and hence this fact will be consistent with the assumption of no correlation between inputs and inefficiency. However Pitt and Lee do not rule out correlation between inputs and the inefficiency term, concluding that there can be no single specification which can take care of this correlation problem and at the same time provide unbiased estimates.

In the new approach technical efficiency is allowed to vary over time and is estimated as a function of time. Currently, the stochastic production function approach constructs a theoretical limit that can be achieved with each of the possible combinations of inputs. It includes an error component which consists of a symmetric random component and a non symmetric element which refers to the technical inefficiency of the firms and the industries. Both these components are assumed to be independent of each other and of the covariates in the model. By including a symmetric random component, inefficiency is modelled as under the control of firms or industries and a product of its knowledge or ability of its workers or management. In its current form, the stochastic production function provides panel data estimation in which it is possible to compare technical efficiency of a particular unit not only across the observations but also over time.

The stochastic frontier allows assessment of maximal output subject to input levels. This maximum possible output is a construct from the combinations of inputs present in the data. It looks at the technically feasible output and compares with what has been achieved. In order to calculate efficiency, it is imperative to know production function of fully efficient firm. To estimate fully efficient production function in the absence of inefficiency, the production function for each firm and industry is represented by:

$$\ln y_i^* = \ln x_i \beta \tag{4.7}$$

If the inefficiency is affecting the production function it is shown as:

$$\ln \hat{y}_i = \ln x_i \beta - \mu_i \tag{4.8}$$

Firms attempt to maximise the observed output (ln$y$) produced by inputs (x) given the technology. Usually observed output is less than the frontier output and technical efficiency can be obtained in the following manner:

$$\ln TE_i = \ln \hat{y}_i - \ln y^* = -\mu_i \tag{4.9}$$

$$TE_i = e^{-\mu_i} \tag{4.10}$$

Earlier works by Aigner and Chu (1968) and Richmond (1974) did not differentiate between the truly random error which can be beyond the control of managers and the inefficiency component under the control of managers. In these studies programming techniques were used to determine the frontier of best performance by means of identifying outlier observations resulting in miscalculation of the maximum achievable output. Timmer's (1971) method of dealing with this issue was to remove some percentage of observations and is now regarded as arbitrary.

Credit goes to Aigner, Lovell and Schmidt (1977) and Meeusen & Broeck (1977) for directly tackling this by incorporating an explicit firm inefficiency term as part of the composite error. One error term is traditional normal error term capturing 'noise' while the other term represents technical inefficiency term of the form:

$$\ln y_i = \ln x_i \beta + (v - \mu_i) \tag{4.11}$$

where y is log of production, x is log of vector of inputs while v is an identically and independently distributed random variable with $N(o, \sigma^2 v)$ and μ accounts for technical inefficiency which are also iid with $N(o, \sigma^2 u)$.

Battese and Coelli (1992) extended the original model to allow for unbalanced panel data where firm effects are modelled to vary with time. Battese & Coelli (1992) suggested time varying inefficiency measure:

$$TE_{i,t} = u_i e^{-\eta(t-T)} \tag{4.12}$$

η is the rate of change in technical efficiency over time and this has to be estimated. If η is positive, μ_{it} or inefficiency decreases with time, while if η is negative, μ_{it}, the inefficiency term is increasing with time.

Estimation with Stata returns values for other terms such as sigma squared and gamma, sigma squared μ and sigma squared υ which denote :

$$\sigma^2 = \sigma_u^2 + \sigma_v^2 \tag{4.13}$$

$$\gamma = \sigma_\mu^2 / \sigma^2 \tag{4.14}$$

Sigma squared represents the total error variance of the combined model and consists of the sum of the variance due to the inefficiency term and the truly random error. Gamma indicates the proportion of total error variance due to inefficiency and it lies between zero and 1. Having a high value of gamma, nearing 1, indicates that the greater percentage of error variance is caused by technical inefficiency.

According to Battese and Coelli (1988):

If $\gamma = 0$ (4.15)

then deviations due to technical inefficiency are zero because in this case the variance due to σ_u^2=0 and the technical efficiency score would be one. In case of gamma equal to one, all deviations are because of inefficiency and $\sigma_v^2 = 0$. According to Battese and Corra (1977), having a value between zero and one for gamma is a situation where deviations are due to both technical inefficiency and a random stochastic component. According to Kumbhakar and Lovell (2000), when gamma approaches zero, it implies that either variance due to μ is approaching zero or variance due to the stochastic component is approaching infinity. In this case estimation is equivalent to OLS. Whereas if gamma approaches 1, it means, all the variance is dominantly due to μ and variance due to the stochastic component is nearly nil. This is nearly equal to the deterministic production function which is based on the absence of a systematic stochastic component.

Both μ and υ are assumed to be independent of each other and of the other variables in the model. Kumbhakar comments that the distributional assumptions regarding μ does not matter much and favours the use of simpler distribution assumptions such as half normal and exponential, rather than truncated normal ones.

Frontier production functions are further segregated into parametric and non parametric production frontiers using Data envelopment analysis. DEA has certain advantages over the stochastic production function in that it does not require the imposition of an explicit functional form and distribution on data and it does not take into account random error. However, if production is highly stochastic, the technical efficiency reached with DEA would be biased because DEA does not acknowledge and model the presence of a stochastic element or noise in the process. Therefore DEA can be used successfully only with those situations where stochastic elements are largely absent.

4.6 Model

Following Battese and Coelli (1995) the technical efficiency of Pakistan's industrial sectors is analyzed by a stochastic frontier production function for a panel of 4 industrial sectors, Food and Allied, Textile manufacturing, Chemical, Rubber and Plastics, and Metal Products and Machinery, each comprising of further sub sectors. The list of these sectors and their subsectors is already presented in the Appendix. In this model the inefficiency effects are modelled to vary systematically over time.

These four industries have been selected as the number of observations in each average about 120. To get reasonable parameter estimates and specify an appropriate model it is imperative that the number of observation should exceed one hundred. If sample size is less than one hundred observations, the total variance inappropriately appears to be caused either entirely by random error or by firm inefficiency. Green and Mayes (1991) have suggested that in order to get reasonable estimates, the sample should on average comprise of 100 or possibly more observations.

The basic specification can be written as :

$$\ln y = \beta_0 + \beta_1 \ln employee + \beta_2 \ln capital + e \tag{4.16}$$

$$e = \upsilon_{it} - \mu_{it} \tag{4.17}$$

Here y is the output produced by firm or industry i, *lnemployees* is the log of number of employees and *lncapital* represents the log of fixed assets including, buildings, equipment, machinery, furniture and fixtures. υ_i is an idiosyncratic error term and μ_i is time varying panel level effect denoting technical inefficiency estimate for industry i at time t.

μ_{it} can be calculated as follows:

$$\mu_{it} = \exp\{-\eta(t - T_i)\}\mu_i \qquad (4.18)$$

T_i is the last time period in the ith panel, and η, eta is rate of change in technical efficiency and this has to be estimated. If η is positive, technical inefficiency is decreasing with time and vice versa. When eta becomes equal to zero the model is not different from a time invariant model.

Many researchers have developed varieties of this model by using various restrictions. Battese and Coelli have themselves mentioned that imposing the restriction of η, eta to be zero is equivalent to time invariant model suggested by Battese, Coelli and Colby (1989). Imposing restriction of T equal to 1, produces the original cross section, half normal model of Aigner, Lovell & Schmidt (1977).

In a two stage procedure, technical efficiency from the basic frontier estimation is regressed on one of several trade measures along with three control variables, capital labour ratio, log of market indicating the nature of competition by the number of establishments in the market, ratio of imported material to total raw materials. The trade measures and their construction have been discussed in great detail in chapter 3 and they comprise output based measures such as aggregate and sectoral trade ratio, incidence based measure denoted by effective average tariff rates and export bias.

Stata can perform the above estimations with its 'xtfrontier' command which can fit a stochastic frontier model and can be used for both time invariant and time varying models. Currently the parameter estimates of the production function and technical efficiency are being measured by time varying model.

4.7 Results

The estimated parameters of a stochastic frontier production analysis are presented below in table 4.1.

TABLE 4.1

Panel estimation of Stochastic Production Frontier

Dependant variable: log value added	Textile	Food	Chemical rubber plastic	Metal products machinery&equip
lnemployee	.250 (2.94)	.577 (5.97)	.149 (1.99)	.323 (4.25)
lncapital	.56 (7.67)	.227 (4.17)	.518 (9.10)	.628 (13.46)
σ^2	.259	.683	1.27	.520
γ	.398	.712	.872	.581
σ_μ^2	.10	.487	1.11	.30
σ_υ^2	.15	.196	.161	.217
η	-.011	.018	-.003	-.022
Log likelihood	-70.90	-115.01	-122.29	-191.05
No. of Observations	120	143	171	245

(Figures in parenthesis are z-statistics.

σ^2 = Comprises the combined variance due to random error v and and industry specific inefficiency μ_{it}.

γ = ratio of variance by asymmetric inefficiency component and combined variance.

σ_μ^2 = variance due to the inefficiency error term

σ_υ^2 = variance due to the systematic component of error term , caused by noise.

η = eta is rate of change in technical efficiency over time.

(Figures in parenthesis are z-statistics)

For the four major sectors, the results indicate that the coefficient on capital for three of them (Textile manufacturing, Chemical, and Metal Products) is much higher in size and significance as compared to the coefficient for the labour variable. Only the Food sector appears to have a smaller coefficient on capital than labour. These results are consistent with those derived in the second chapter. There too, these three sectors appeared to have a larger capital coefficient . Secondly, all these four sectors exhibit constant returns to scale as the coefficients on capital and labour do not exceed 1. This result is in conformity with the one gained in estimating total factor productivity estimates by the Levinsohn-Petrin procedure by chapter 2.

As far as the components of variance are concerned, the proportion of variance caused by inefficiency in total variance, denoted by γ, is quite high in all sectors except textile manufacturing. The highest ratio of variance caused by technical inefficiency to total variance is found in the Chemical sector where it is nearing 1, followed closely by food manufacturing. The variance by inefficiency lies in the range of above fifty percent for Metal products, Machinery and Equipment. The least technically inefficient sector emerges to be textile manufacturing. In all the sectors except Textiles, the component of stochastic error is smaller in magnitude as compared to that of inefficiency. Eta, η, rate of change of technical efficiency is negative in three sectors indicating the decrease in technical efficiency over time. Food manufacturing appears with positive eta implying that technical efficiency might be improving over time.

Looking at the scores of average technical efficiency (Appendix tables 4.1-4.4) it is clear that the textile manufacturing sector has the highest average technical efficiency, followed by metal products. Chemical, Rubber and Plastics shows the third highest average technical efficiency and the lowest average is for food manufacturing. However, the averages conceal important differences, as the Chemical sector has much higher standard deviation of efficiency of its subsectors, while that of food is much lower. Rather, Chemical, Rubber and Plastics have the highest standard deviation of the technical efficiency estimates of its subsectors. The lowest is for textile manufacturing, while Metal Products and Machinery comes close to food manufacturing.

Within Textile manufacturing, cotton spinning, knitting mills, other textiles, ready made garments and ginning, pressing and bailing of fibres seem to have higher technical efficiency than the average for the sector. Narrow fabrics and carpets and rugs are much less efficient with their average efficiency being much lower than the sector average. Overall technical efficiency appears stagnant.

In Metal Products, Machinery and Equipment, seventeen sub sectors out of thirty two exhibit higher than sector average of technical efficiency, with nearly all the subsectors of electrical machinery having more than sector average of efficiency. Electrical industrial machinery and radio and television have the highest efficiency scores while ship building, surgical instruments, textile machinery, other industrial machinery and other metal products are among the least technically efficient.

In Food manufacturing just five sub sectors have higher than sector average of efficiency and these five include some of the most prominent sub sectors of Food manufacturing such as, vegetable ghee and other vegetable oil, refined sugar and beverages. In Chemicals, nearly half of the sectors out of twenty three, depict more than average technical efficiency scores. Medicines and basic drugs, perfumes and cosmetics are the most efficient of these with paints, varnishes, soaps&detergents, and fertilizers appearing also with moderately higher efficiency scores.

Looking at the gradual progression or change in efficiency over the years (Appendix tables 4.5-4.8) it can be seen that the figures obtained for η, eta, rate of change in technical efficiency, from the frontier estimations, indicate declining technical efficiency and is supported by the analysis in the years from 1980 to 1995. In the Textile, Metal Products & Machinery and Chemical sector, the scores of technical efficiency are either decreasing over the years or are constant. The highest decrease lies in the last year of 1995. In all the Textile subsectors, the TE (technical efficiency) is gradually eroding with each year and the greatest decline is found for the year 1995. Similarly for Metal Products, for majority of the sub sectors, TE shows a declining trend. Chemical, Rubber& Plastics, presents a mixed picture, with some of the sectors exhibiting a constant trend, with some declining but none on the increase. The only sector showing steady improvements in nearly all the sub sectors is Food manufacturing, a fact consistent with the positive value for eta from frontier estimation. Although relatively this sector has the lowest average technical efficiency relatively and the ratio of variance due to technical efficiency in table 4.1 is also quite high, but positive value for eta implies that in absolute terms, the sector is improving.

In the second step, technical efficiency scores are correlated with a variety of trade measures and sector specific control variables.

TABLE 4.2

Panel estimation of Technical efficiency and correlates

Generalized Least Squares
Textile manufacturing

Dependant variable: Time varying technical efficiency	Estimations with alternative trade measures				
Sectradeshare	-.037 (-1.39)				
Sectimpenet		.29 (2.41)			
Sectimpoutput			1.27 (11.91)		
Avtariff				-.005 (-0.16)	
Antiexpbias					-.032 (-0.68)
Lnmarket	.032 (3.68)	.032 (3.16)	.037 (4.53)	.038 (4.75)	.031 (3.39)
Caplab	- .001 (-0.96)	-.0007 (-0.34)	.0014 (.81)	-.003 (-1.99)	-.002 (-.1.53)
Impmat	-.045 (-1.49)	-.0704 (-1.99)	-.11 (-7.34)	-.056 (-1.71)	-.054 (-2.49)
Lnsubsidies	.002 1.95)	.0029 (1.88)	.00.28 (1.89)	.003 (2.07)	.004 (2.80)
Lnexprebates	.003 (1.05)	.0048 (1.375)	.005 (1.24)	.0025 (1.07)	.002 (.70)
Log likelihood	126.6	122.74	131.80	124.61	122.28
Prob>chi2	0.0004	0.000	0.000	0.000	0.000
Breusch-Pagan test for Heteroskedasticity : Ho: constant variance					
Chi2(1)	.01	.02	0.07	.16	.08
Prob	.919	.883	.82	.69	.78
No. of observations	120				
No. og groups	11				

TABLE 4.3

Food manufacturing

Dependant variable: Time varying Technical efficiency	Estimations with alternative trade measures				
Sectradeshare	.011 (.81)				
Sectimpenet		.057 (2.20)			
Sectimpoutput			.65 (3.43)		
Avtariff				-.033 (-1.09)	
Antiexpbias					-.055 (-2.16)
Lnmarket	-.009 (-1.96)	-.011 (-2.44)	- .025 (-5.83)	-.013 (-3.12)	-.009 (-2.16)
Caplab	.0004 (.47)	.0002 (.29)	.0014 (1.69)	.0004 (.43)	.0003 (.36)
Impmat	.124 (4.96)	.094 (3.90)	.229 (9.81)	.113 (4.18)	.008 (4.40)
Log likelihood	312.66	319.85	316.99	305.79	316.15
Prob>chi2	0.000	0.000	0.000	0.000	0.000
Breusch-Pagan test for Heteroskedasticity: Ho: constant variance					
Chi2(1)	1.90	1.90	.47	.58	.72
Prob	.167	.167	.49	.44	.39
No. of observations		144			
No. of groups		16			

TABLE 4.4

Metal products, Machinery and Equipment

Dependant variable: Time varying technical efficiency measures	Estimations with alternative trade measures				
Sectradeshare	.007 (1.08)				
Sectimpenet		.018 (.42)			
Sectimpoutput			.011 (1.53)		
Avtariff				.042 (2.39)	
Antiexpbias					.090 (6.47)
Lnmarket	.002 (.89)	.001 (.59)	.003 (1.13)	.0002 (0.10)	-.001 (-0.41)
Caplab	-.002 (-0.99)	-.002 (-1.10)	-.002 (-0.98)	-.003 (-1.64)	-.003 (-1.69)
Impmat	.019 (3.54)	.019 (3.51)	.020 (3.54)	.0175 (3.63)	.015 (3.66)
Loglikelihood	638.11	636.32	637.77	643.95	674.55
Prob>chi2	0.000	0.011	0.003	0.0005	0.000
Breusch-Pagan test for Heteroskedasticity : Ho: constant variance					
Chi2(1)	7.98	8.22	7.92	11.68	13.64
Prob	.0047	0.0041	0.0049	.0006	.0003
No. of observations	256				
No. of groups	32				

TABLE 4.5

Chemical, Rubber and Plastics

Dependant variable: Time varying	Estimations with alternative aggregate trade measures				
Sectradeshare	-.020 (-1.49)				
Sectimpenet		0.042 (-1.84)			
Sectimpoutput			-.024 (-1.84)		
Avtariff				.006 (0.18)	
antiexpbias					.006 (.24)
Lnmarket	.026 (3.53)	.025 (3.46)	.023 (3.35)	.033 (4.27)	.037 (4.52)
Caplab	.005 (2.16)	.005 (2.23)	.004 (2.18)	.006 (2.50)	.006 (2.27)
Impmat	-.008 (-0.87)	-.008 (-0.81)	-.007 (-0.74)	-.0115 (-0.92)	-.013 (-1.05)
Loglikelihood	383.35	385.73	391.61	364.65	359.30
Prob>chi2	0.001	0.001	0.002	0.0001	0.000
Breusch-Pagan test for Heteroskedasticity : Ho: constant variance					
Chi2(1)	5.14	5.17	5.19	4.95	4.94
Prob	.023	.022	.022	.026	.026
No. of observations	192				
No. of groups	24				

The results (tables 4.2-4.5 above) produce a weak association between technical efficiency and trade policy variables largely irrespective of the use of a specific trade variable. However for each sector, one or two of the six alternative trade measures appear as significant, albeit not always with positive signs. Regarding sectoral measures, sectoral trade shares appear to be positively associated with the dependent variable in two out of four sectors, Food manufacturing and Metal products. For the other two, Textiles and Chemicals, the coefficient is negatively signed and against expectation. In none is the coefficient on sectoral trade shares statistically significantly.

The sectoral import penetration rate is positively correlated with technical efficiency in all the sectors but is not statistically significant. However in Textiles and Food manufacturing the statistical significance is enhanced with respect to z-statistics in parenthesis and p-values. Coefficient on sectoral imports to sectoral output is positive in all except Metal products and is statistically significant in Textile and Food manufacturing. In these two sectors the size and statistical significance of the coefficient is according to the hypothetical expectation that increased imports' penetration results in increasing technical efficiency. In Chemicals, the relationship is negative, insignificant and is difficult to interpret. In Metal products, the coefficient for all three trade ratios has appeared to be positively correlated with technical efficiency but is insignificant.

With the incidence based measure, the relationship between technical efficiency and average tariff rate in two sectors is negative and according to expectation in two sectors, Textile manufacturing and Food manufacturing. But it is insignificant in all the sectors. Similarly antiexpbias is negatively associated with dependent variable in these two sectors and appears with positive sign in Chemicals and Metal Products. Statistically, it is not significant except in Metal Products, Machinery and Equipment.

Overall, for Food and Textiles manufacturing the trade variables representing the sectoral imports penetration and sectoral imports to sectoral output ratios appear to be positively and significantly associated. For the other two sectors Metal Products, Machinery and Equipment and Chemicals, Rubber and Plastics, the relationship does not lend itself to meaningful interpretation.

Regarding other sector specific variables, in Textile manufacturing and Chemical sectors, log of market signifying the competitive conditions of the sector is hugely positive and statistically significant. In Food and Metal products, the coefficient on this variable is negative in Food but positive in Metal Products but in both sectors the log of market does not appear significant in influencing efficiency.

The Capital labour ratio indicating the capital intensity of the sectors, appear to be positive in both Chemical and Food manufacturing. However in the Chemical sector, capital intensity is significantly contributing to the improvements in technical efficiency while the Food sector coefficient is not statistically significant. For Textile manufacturing and Metal products, the coefficient on capital labour ratio is negative and barely significant in some of the cases only.

Ratio of imported materials to total raw materials is positive and statistically significant in both Food manufacturing and Metal Products. For Textiles, it is negatively associated with technical efficiency while for the Chemical sector the coefficient is negative and insignificant. The two measures, log of subsidies and log of export rebates, represent the incentives provided to the Textile sector for export promotion for a very long time period. Subsidies specifically appear to have a positive and statistically significant association with technical efficiency. The role of export rebates in contributing to technical efficiency is negligible and the coefficient on this variable is at best positive but insignificant in all the specifications.

4.7 Conclusion

Estimation of technical efficiency was feasible for only four relatively bigger sectors because of the sample size limitations involved in the frontier estimations. The technical efficiency measures appeared to be consistent and appropriate when analyzed with the parameters of η, eta and the ratios of variance due to inefficiency to total variance. The sectors showing higher average productivity, show less improvement in terms of change of technical efficiency over the years. Their higher average productivity is not accompanied with consistent increases in the rate of change in efficiency. Within each sector, the sub sectors appearing with higher than average efficiency are the major contributors to manufacturing activity. Some of these also receive favourable incentives for production, such as fertilizers in the Chemical sector, vegetable ghee, oils and refined sugars in Food manufacturing, cotton spinning in the Textile sector. The relationship with the trade policy measures represented by sectoral trade shares, one incidence based measure and a single indicator measure, presents a mixed conclusion, with either two or three of the variables appearing significant for all sectors except for Chemical, Rubber and Plastics. The trade related changes seem to have some effect on the changes in technical efficiency and the fact that this effect is less pronounced can be explained by the limitation of data which stops at year 1995. The major liberalization of tariffs and non tariff measures started in 1987 but did not end in 1995. Rather in 1995, there were some major reductions in trade barriers and the effect of these policies might appear in the years after 1995 depending upon the kind of response and adjustment undertaken by manufacturing industries.

Chapter 5

Import penetration and price cost margins

5.1 Introduction

Theoretic research argues that trade liberalization reduces price cost margins of the protected domestic industries. It is also found in empirical works that the higher the concentration in a given sector, the greater is the effect of opening up the imports. We have examined that in Pakistan, protection is maintained by a complex web of protection instruments, ranging from import restrictions by quotas, licensing procedures and higher import tariffs to a variety of paratariffs such as surcharges and import fees. The worst consequences of protectionist policies emerge by insulating the domestic producers from competition. Domestic industries are thereby enabled to create oligopolies or in some cases near monopolies.

The structural features of manufacturing industry which are largely the result of import protection policies give rise to non competitive behaviour among the producers. It permits firms to charge a considerable mark up on costs, as their abnormal profits are protected by the trade regime. The trade regime can not only protect domestic firms from foreign competition, it can also provide a barrier to the entry of domestic competition.

Concentration and profitability traditionally are found to be positively associated in many empirical studies. In Pakistan's manufacturing industry, price cost margins and concentration levels were high, reinforcing and preserving the market structure. Particularly relevant was the high proportion of share of production dominated by large sized producers. Opening of trade was expected to introduce the pressure of competition not just by opening the domestic markets to foreign products and imports but by removing all pervasive entry barrier of the licensing and quotas. Tariffs limit the extent to which firms can raise their prices. Non-tariff barriers can permit greater freedom to raise prices as non market forms of protection act as barriers to non favoured producers.

In this chapter, sections 5.2 to 5.4 deal with literature on price cost margins and their determinants and highlights the importance of concentration affecting profit rates in the context of developing and transition economies. The issue of causality between concentration, profitability and productivity is discussed by studies focused on developed countries. The relationship between price cost margins and import penetration is also explored in these sections. Sections 5.5 and 5.6 detail the characteristic features of the manufacturing industries and analysis of the price cost margins of the manufacturing sectors. Section 5.7 and 5.8 deal with calculation of price cost margins and the model specifications as well as the relevant variables included. Results and interpretation are included in section 5.9 while section 5.10 concludes the chapter.

5.2 Price cost margins, concentration and trade liberalization in developing countries

Empirical evidence suggests that mark ups fall in response to increased import intensity and empirical studies explore interaction among import liberalization, profitability and market structure. The traditional literature focused on the structure conduct performance model and S-C-P holds that structural features of the market affect the behaviour of firms influencing the competitive process in a market itself. The stylized facts emerging from this body of literature emphasise that capital intensity, product differentiation, seller concentration are highly important determinants of the profitability of the establishments. All these characteristics are positively associated with profits but it is emphasised that the relationship of import penetration with profitability is negative implying greater import penetration can reduce the price cost margins of the domestic producers. There is a strong suggestion that concentration and import protection highly interact and determine the conduct and performance of domestic firms.

Meller (1978) in an empirical study measured the industrial concentration of eighteen two-digit ISIC manufacturing industries for 10 Latin American countries. He used employment entropy measures as indicators of industrial concentration because of the ease of availability of data on employment and because this measure provided information on number of firms in an industry and distribution of employment among them. The information utilized for measuring entropy indicators was taken from the census' of ten Latin American countries for the years 1963-1968, which provide the number of establishments and number of persons employed in each class size. These eighteen industries were rank ordered in each country and then simple average rank ordering was conducted across countries. The results suggested similar concentration levels among these countries, the industries with higher concentration in one country show the same trends in other countries as well. The four industries exhibiting the highest levels of concentration were Tobacco, Basic metal, Rubber Products and Paper. While the four industries indicate lowest concentration were clothing and footwear, Food manufacturing, Metal Products, and furniture. The fact that Metal Products shows the least concentration is explained by diverse sub sectors such as hand and edge tools, locks and other hardware. Rank ordering of countries according to the level of concentration reveals that smaller countries such as Costa Rica and Uruguay demonstrate higher levels of concentration while bigger countries have lower concentration levels. It was suggested that low levels of exports in small countries explain this variation as it constrains manufacturing activity to the small domestic market.

Effect of increased international competition in the context of S-C-P model can appear in any form. An almost stylized fact emerging from empirical studies is that increased import penetration results in lower seller concentration and reduced profits. However, many factors have to be taken into account such as cases where importers are also major sellers in domestic markets or where there are important business links between importers and domestic producers. At the same time, exporters may also be domestic producers and may be getting export subsidies. Hence correcting for exports may lower the measure of seller concentration. Two opposite effects may be at work: international markets offering prospects for economies of scale and increased profit margins while at the same time increased foreign competition from imports in domestic production lowering profits.

An exhaustive work by Tybout (2001) explores the possible effect of changed commercial or trade policy on price cost margins, firm sizes, profitability and exports of domestic producers.

In another work (Tybout 1996) with empirical studies of a number of developing countries such as Mexico, Columbia, Morocco and Chile found that increased competition in the form of liberalized trade which resulted in increased imports tended to decrease price cost margins, particularly so in larger plants. The measures used to denote liberalized trade varied from effective protection rates to import penetration and license coverage ratios. Highly concentrated industries enjoyed market power and were more vulnerable to foreign competition. However in his later work, Tybout (2001) offered the alternative explanation that the onslaught of foreign competition can pressurise the firms to contract their output particularly in the industries marked with high sunk costs.

The standard formulation used by Tybout (1996) to measure the relationship with other factors and import intensity is:

$$PCM_{ijt} = f(H_{jt}, IMP_{jt}, H_{jt}IMP_{jt}, KQ_{jt}, DI_j, DT_t \qquad (5.1)$$

PCM is price cost margin, *H* represents Herfindahl index of concentration to denote the structure of the industry, *IMP* is the import penetration rate, *KQ* represents capital output ratio, *DI* and *DT* represents industry and time dummies respectively. Capital output ratios and Herfindahl index are used to control for the differences in technology. Import penetration and the interaction term between import penetration and concentration are expected to be negative and the results in four out of five empirical studies are according to the predictions. Import penetration negatively affects the margins and this negative effect is more pronounced in highly concentrated industries.

The level of concentration is frequently used with the assumption that there might be a positive relationship between profitability and concentration. Higher concentration implies oligopolistic market structure where handful of firms and business units enjoy large market power imparting excess profits. The near absence of competition results from a number of entry barriers such as high capital intensity and product differentiation. In case of protected trade regimes, the rare access to licensed imports enjoyed by oligopolistic producers can keep new entrants shy of entering the market perpetuating oligopolistic structure even further. In various studies, price cost mark up is taken also to indicate the market performance which is shown to be influenced by the level of competition prevalent in the market.

Empirical evidence of a positive relationship between concentration and price cost margins abound and holds true in a number of studies. It is found that the effect of import intensity on price cost margins varies with the level of concentration. Import penetration affects the profitability most in the most highly concentrated industries while the profitability of already competitive sectors is affected the least or there is not a clear effect. Similarly if the economy overall is sufficiently competitive, the reduction of import restrictions will not result in dramatically reduced profit rates or the relationship might appear positive. This effect is more likely for manufacturing sectors of developed countries and is discussed in a later section. It might appear positive as well if the domestic industry greatly relies on imported intermediate inputs which become available at reduced costs following liberalization as is seen in the empirical work on Turkish manufacturing industries below.

Contradicting the findings that price cost margins are pushed downwards by foreign competition in concentrated industries, Yalcin (2000) found that greater import penetration in Turkey increased the price cost mark ups in highly concentrated industries. Although for entire private sector industries the results were in conformity with traditional empirical findings of reduced profitability following increasing import intensity. For public sector, however, the mark up decreased in concentrated industries. His simple descriptive analysis showed that during the period 1983 to 1994, when trade liberalization measures were implemented, the price cost margins in public and private sector manufacturing industries increased alongside rising import penetration rates.

This result is not consistent with widely accepted 'imports as market discipline' hypothesis but the explanations justify the findings. Other factors such as concentration rate, capital intensity, advertising expenditure, market size play an important role in affecting mark ups. It is suggested that implicit collusion between domestic and foreign firms or manufacturing and importing firms resulted in the increase in price cost margins after import liberalization. Greater availability of imported inputs at cheap rates reduces costs which might enhance profitability. Given imports of inputs are larger than that of final consumer goods in Turkey, these led to cost reductions and higher price cost margins.

The model to measure the effect of foreign trade on price cost margins is adapted from structure-conduct–performance model of Lee (1991). Price cost mark-ups are regressed on a number of variables. Some of these variables represent competition within an industry and are indicated by four firm concentration ratio, import penetration, interaction between concentration and import penetration, and export sales ratio respectively. Other important variables included real value added per employee, intra industry trade, advertising expenditure to sales ratio as an indicator of product differentiation or entry barrier. The share of administrative, clerical and technical staff indicates the production technology and skilled labour ratio.

Theoretically he defends his results on the basis that the disciplining effect of imports through reduced mark ups works best in case of no implicit collusion among domestic producers. However if domestic producers collude with foreign producers, the mark ups following import penetration can actually increase. He suggests that perhaps private producers and foreign firms engaged in collusive behaviour causing profitability to increase.

In developing countries, firms often work in an oligopolistic fashion because domestic markets are highly protected and support only a small number of producers. In this imperfectly competitive market, the existing producers enjoy extremely high profits. With trade liberalization, these producers are confronted with foreign competition and pressure mounts to behave competitively. Levinsohn (1993) named this phenomenon as 'the imports-as-market-discipline' hypothesis. He investigates whether international trade imposes competitive pressure on oligopolistic firms who were previously extracting monopoly profits. He empirically tests on Turkish manufacturing plant level data which spans 1983-86, a period when Turkey implemented large scale elimination of protectionist policies. By analyzing the magnitude of the price cost margins, six industries appeared to be competitive with prices equal to marginal costs. In three industries, prices were above marginal costs while for one price was below cost. In order to check the validity of imports as market discipline hypothesis, the industries were divided into three groups. One group comprised of those import competing industries in which level of protection underwent substantial change. In this group, mark ups following liberalization experienced decline. The second group of industries consisting of two industries witnessed an increase in protection level which caused an increase in mark ups. The third group of industries included those industries which before liberalization were pricing competitively, prices being equal or below marginal costs. This group of industries were not affected in any significant manner as they were already competitive prior to liberalization. The fact that rest of the five industries exhibited changes in the mark ups which were consistent with the theoretical predictions about the effect of international competition on the market power of the firms, substantiates the hypothesis.

5.3 Trade policy, profitability and market structure in transition economies

Empirical works which investigate the links between trade policy and profitability in the context of transitional economies are relevant for liberalizing developing countries as well. Although other developing countries are not transiting from communism to market economy systems, they are also opening up to international trade by reducing protection, privatization and other reforms. Transition economies are also in the phase when their manufacturing industry is in the process of adjustment to liberalized trade regime. Transition economies were more isolated from developed economies but so far as the process of liberalization in developing countries is concerned, comparison can be drawn.

How trade policy interacts with the market structure in the context of transition economies is studied by Konings et al (2000). Their work is an effort to understand and explore the factors behind the increased or lower market power denoted by price cost margins. More precisely they examined the effect of ownership, concentration and competitive pressure introduced by opening of trade on the firm performance. They focus on manufacturing firms of Bulgaria and Romania and found that increasing import competition lowered the price cost margins of the manufacturing firms in the more concentrated industries. The results showed that increased openness in trade exposed manufacturing industries to international competition which pruned the excessive profits. The producers were then forced to make efforts to initiate cost reducing methods to make up for the lost margins.

Two hypotheses were empirically tested. One is that following privatisation firms engage in restructuring which result in reduced costs and hence increased mark ups. The second hypothesis, more relevant for the purpose of current study, regards the effect of competitive pressure on price cost margins. Two proxies are used to indicate the degree of both domestic competition and international competition: Herfindahl index of concentration measuring domestic concentration and import penetration indicating international competition. Import penetration is expected to have a negative relationship while index of concentration is predicted to be positively associated with price cost margins.

Price cost margins of a large number of Bulgarian and Romanian manufacturing firms were calculated. These firms included private, state owned and foreign owned firms for a period of five years, 1994-1998. The data is taken from the commercial data base of company accounts relying on information from balance sheets and income statements of the companies.

To test the hypothesis, Herfindahl index and import penetration are used separately and an interaction term between the two is introduced to check the difference of the effect of import penetration with the degree of concentration. Separate dummies for private ownership, and foreign ownership are also included. The sectors with higher concentration appear to have higher market power as both are positively associated. However the effect of import penetration is not statistically significant for Bulgaria while for Romania it is positive and significant. This seems to suggest that international competition does not reduce the price cost margins of the domestic firms. However the interaction term between Herfindahl index and import penetration is negative and it has been interpreted to indicate that where concentration positively affects margins, this effect is lessened with increasing import penetration. This indicates that the degree of competition prevalent in a sector determines the particular effect of trade openness . In sectors characterised by high concentration level, increased import penetration disciplines firms' behaviour by altering their pricing strategies reflected in lower margins. Whereas in sectors with high levels of competition, opening up of trade forces the firms to work towards reducing costs and hence mark ups might increase. Complementary result on firm ownership and market power favours higher margins for privately owned and foreign firms and dichotomous explanations have been offered. This can be either due to the profit maximization behaviour of the private and foreign owned firms increasing the prices. It could also be due to actual better performance and restructuring of firms which cuts costs and increases market power of firms.

Halpern and Korosi (2001) also deal with a transitional economy. They explore the possible link between competition indicated by import penetration, concentration, market share and efficiency. The performance of corporate sector of Hungary is estimated in two models. One is adapted from Nickell (1996) where main frontier production function is augmented by the above mentioned variables denoting the state of competition. Import penetration and market share is predicted to positively affect efficiency while concentration is expected to have a negative effect. This is explained by the fact that with increasing competition, firms become highly efficient and increase their market share while at the same time increased market power leads to weakening of competition.

The second model consists of a simple production function to derive efficiency estimates and another dynamic market share equation. This model is based on a recursive system of two equations. Simple production function is first used to derive estimates of efficiency which are then included in the second dynamic equation :

$$S_{t,i} = \gamma_0 + \gamma_1 S_{t-1,i} + \gamma_2 \widehat{u}_{t,i} + \gamma_3 C_{t,i} + \gamma_4 I_{t,i} + \varepsilon \tag{5.2}$$

where μ is the efficiency variable from stochastic production frontier, S stands for market share, C for concentration and I denotes import penetration.

The system of these two equations is applied to small, medium and large scale manufacturing industries and five ownership types for two sub periods, 1990-93 and 1994-97. Single equation model did not generate the expected results. Import penetration showed negative effect in the first period but turned positive afterwards. This is explained by arguing that firms have been going through an adjustment process but after exposure to foreign competition for a considerable period of time, the improved efficiency created by competition turns it into a positive relationship. Similarly market concentration does not appear to have the expected effect and is not very significant in majority of the cases. It is suggested that market structure variables do not affect the production function and their contribution is negligible.

Second model s preferred as the results were more consistent with the theoretical expectations. Import penetration appeared to reduce the market power in many cases. Concentration appears to have a positive effect but not statistically significant. Efficiency always come out to be a fundamental factor as its coefficient is always highly significant and positively associated with market shares implying that efficient firms are in a position to increase their market powers.

Role of efficiency or total factor productivity in the relationship between import liberalization, market power and concentration is not clearly defined and academic literature presents divisive conclusions. Traditional structure conduct and performance paradigm states the causality from the structure to conduct of the firms. Contemporary literature considers that higher total factor productivity causes firms to increase their profitability and affects the market structure. Causality runs from efficiency to profitability or both have a feed back effect on each other.

Next section discusses empirical studies in a number of developed economies exploring this causality issue.

5.4 Causality between concentration and profitability in developed countries

Role of competition and incentives in the context of a protectionist trade regime have gained increased attention in the literature. Trade protection, serving as an entry barrier, explains the lower levels of efficiency and productivity but higher levels of price cost mark ups. As new entrants are discouraged from entering market, this lowers competition and producers in such non competitive environments enjoy discretion in their pricing strategy ensuring higher profits. Competition which can pressurise management into taking cost reducing efforts and adopting efficient management methods is conspicuous by its absence. In non competitive market setting the incentives for increasing efficiency are not present as Nickell (1996) has pointed out that competition is a very significant factor determining the nature and direction of corporate performance.

Nickell (1996) provides an appealing alternative explanation of how the lack of competition can induce slack. This happens because incentives' system to pressurise owners or managers to exert more efforts works more effectively in a competitive market setting. This is due to the fact that competition makes it possible to compare the performance with large number of players and this results in producing sharp incentives responsive to the performance measures. He argues that in competitive markets, it becomes easy for firms to take measures to reduce slack. Secondly, competition ensures that profits are susceptible to managerial actions and incentives and payoffs to owners for extracting high level of efforts to managers are more pronounced.

Nickell (1996) empirically investigated 676 manufacturing firms in UK for the period 1972-86 to asses the extent to which competition indicated by a number of variables influenced the performance of the companies. The measures used for competition included, market share of the firms, concentration measures, and import penetration. A measure of competition was also constructed from a survey from the managers of the firms. The findings suggested that market power is associated with decrease in productivity and competition measures appear to cause increases in total factor productivity. However the channel through which competition increases efficiency, he argues, might work through the ability of many firms to enter the market and trying various methods of production. Eventually only the best firms survive and stay in the market. This is where monopoly or oligopoly contributes negatively in restraining entry and maintaining the less efficient producers who enjoy higher profits.

Efforts to determine the relationship between profits and concentration level of an industry point towards conflicting conclusions. The consensus achieved by previous studies that causality runs from the level of concentration or market power to profitability: higher market share transforming into higher profits. However this conclusion was questioned and it was proposed that the link is tenuous and the causality lacks another factor. It was suggested by Demsetz (1973,1974) that it is higher efficiency which leads to higher profits and causes increases in market power. According to his view, some firms become highly efficient, increase profitability due to efficiency and achieve supremacy over competitors due to this efficiency.

There are conflicting opinions regarding the causality running from technical efficiency to market power as a number of studies maintain that an endogenous relationship exists between total factor productivity and market power. At the same time, there is no dearth of empirical studies on the contrary which argue that the causality runs from the structure to the market power as higher concentration, capital intensity and the level of competition proxied by the import penetration determines the profitability of the firms.

Go et al (1999) followed the traditional structure conduct and performance model initiated by Lee (1991). The market structure was indicated by the size distribution and the number of firms in operation and entry barriers were indicated either by capital intensity or cost structure or product differentiation. The maintained and traditionally established line of argument implies that the effect of structure on performance occurs through pricing strategy and technological change. The relationship between structure and performance might be endogenous implying that performance can also influence the shape of the market structure as profits earned through higher efficiency levels can give rise to higher market shares and hence alter the structure. Even if monopoly profits are present already, they can be used to consolidate and strengthen the market share by investing the profits in R&D and greater advertising. This fact has been emphasised in the work of Demsetz (1973,1974) as well that in the traditional structure, conduct and performance model, factor of efficiency is missing which can lead to feedback effect from performance to conduct.

Go et al (1999) maintain that variations of price cost margins are largely explained by market structure and the state of trade policies. They analyzed this hypothesis by examining and regressing the price cost margins for 1986 for four manufacturing industries of Philippines on sellers concentration, capital output ratio and industry growth rate. Two variables indicated foreign competition, the ratio of imports to total industrial output and the ratio of exports to total industry output.

Census value added was used to measure concentration arguing that this represents the economic power most appropriately. The regressions included Herfindahl and Hirschman indices of concentration as the later covers the entire size distribution of the firms by adding together the sum of the squared market shares of all firms and not just the four or eight largest firms. This index showed high monopoly power in the form of highly concentrated industries in the major groups. Capital output ratio was included to take account of the differences in capital intensity in different industries and its potential role as an entry barrier. Higher capital output ratios deter potential entrants since it entails higher set up costs which can be 'sunk' in the risk of failure of the firm.

Seller concentration and capital output ratio appeared to have a positive and significant relationship with price cost mark ups in nearly all specifications. Capital intensity appeared highly significant in explaining the inter industry variations in mark ups. Variables measuring foreign competition, import penetration and export measures seemed to exert negative influence on the mark ups, the industries marked with greater import levels showed lower profits. However the coefficients were not statistically significant.

Clarke et al (1984) empirically tested the correlation between concentration and profitability at the cross industry levels within UK and argued that causality runs from the former to the later. They developed a theoretical model adapted from Clarke and Davies (1982) and introduced collusive behaviour in an oligopolistic setting, which might affect the profitability even much higher. They argued that in the absence of collusion in an oligopolistic market, concentration results in high profits but if oligopolistic producers are colluding with each other, the profitability prospects are much further enhanced.

Empirical work proceeded by analyzing average margins for small and large firms in concentrated and less concentrated industries for two years 1971 and 1977. Top five firms were treated as large sized firms and rest were categorised as small firms. They made an effort to test Demsetz hypothesis that differences in margins between large and small firms will be higher in case of higher concentration. This is because large firms are assumed to be more efficient and likely to increase their profitability resulting in higher concentration. Clarke, could not find support for this hypothesis and found that differences in profitability in small and large sized firms are not very substantial. Rather small firms functioning in high concentration industries exhibited higher margins. The results demonstrated positive association between collusive behaviour and concentration leading to the conclusion that collusive behaviour in concentrated industries led to positive correlation between industry profitability and concentration.

Kettle (1999) approached the question of the link between profitability, productivity and market power of firms from a different angle reflecting the effect of profitability on incentives for improvement. His study focused on whether higher market power actually helps towards improving total factor productivity or dampens the incentives of the firms to initiate any such efforts. He found that firms in the Norwegian manufacturing industries enjoying high market shares were less productive in an economic environment characterised by greater exposure to foreign competition in export sectors and higher level of imports. The sample consisted of 14 different industry groups covering nearing all manufacturing sectors for 1980-90. The source of monopoly power or low levels of competition are strict anti-competitive regulations which hamper the free entry in many sectors. Although on average, the mark ups in fourteen industries were moderate and small but using random coefficients framework, it was possible to detect variations in market power across firms within the same industry which were much higher than between industries. The result that plants with higher mark ups tended to be less productive suggests that greater market power reduces incentives for efficient organization and encourages inefficient pricing. The correlation between mark ups and Herfindahl index and between import penetration and export shares, revealed insignificant relationships.

The general state of competition in an economy appears as an important factor in realising the established effect of increasing import penetration on price cost mark ups, particularly in a developed economy. Thomas (1999) work deals with Canadian manufacturing industries' cross sectional data for two periods, early 1970 and late 1970s. There appears an overall increase in average mark ups with 29 % of industries registering an increase while 15% of industries experience a significant decrease in their mark ups following increased import penetration. The result that import penetration appears to negatively affect the degree of competition seems inconsistent as compared to many studies on developing countries to the contrary. The result is justified by the presence of sufficiently competitive conditions in the Canadian economy rendering the effect of imports penetration less important. Interaction between concentration level in the industry and import penetration is important as trade reforms in the form of increased imports are likely to have greater effects in weakly competitive industries.

Traditional theory linking structure and performance lacked certain dimensions. The possibility that efficiency causes increases in market power and the presence of endogenous relationship among efficiency, profitability and market structure did not form part of the old literature. Similarly, increased importance of the competitive conditions in a sector or economy is another addition. There certainly is agreement that concentration can result in higher profits but the effect of collusive behaviour adds new dimension. In a concentrated structure characterised by collusive behaviour among the producers, increased import penetration can lead to increased price cost margins and further consolidate the market power of oligopolistic producers.

5.5 Market structure of manufacturing industries in Pakistan

In Pakistan, oligopolistic market structure developed in the initial decades of severe trade restrictions' and has survived even though protectionist measures have been considerably loosened. In the beginning established producers that gained the benefits of quota and licenses soon entrenched themselves in manufacturing production in various sectors to continue reaping the benefits in the ensuing wave of slow and gradual liberalization as well. The trade protection structure first created explicit entry barriers which later on changed to implicit entry restrictions when an oligopolistic market structure emerged.

Appendix table 5.3 describes the shares of industrial production controlled by establishments employing more than hundred employees. It clearly shows that this size distribution is dominating the entire production at the level of a sector.

Although there are sectors in which even much larger establishments employing, 500+ or 1000+ employees might be considered the largest size category. However if we use the criteria usually used for concentration as to how many establishments are controlling 70-80 % of the total production, the firms employing 100+ seems relevant. Appendix tables 5.4.1 and 5.4.2 list the number of establishments in various size categories such as 200+ 250+ and 500+ for specific sectors and the proportion of production controlled by these size classes.

In many sectors such as Textile manufacturing, drugs & pharmaceutical products, industrial chemicals, other Non Metallic Mineral Products and transport equipment, units employing 100+ employees control nearly 90 percent of the total production of the sector at three digit level (Appendix table 5.3). Even in industries such as Wood Products, Printing and Publishing, Paper Products, glass products, the ratio of production dominated by larger sized establishments is clearly not modest. In glass products, this has increased in recent years from 44 percent in 1985 to above 90 percent in 1990. Only in ginning and bailing of cotton fibres, the share of output produced by large sized establishments has never been above 18% while in scientific and measuring instruments it fluctuated between 42-48%. By 1990 the ratio for both ginning and scientific instruments decreased even further to 6% and 25 % respectively .

The above refers to the percentage of output controlled by establishments employing above hundred employees and in most of the sectors it comes to nearly 70-80 %. However, in many sectors, there is clear divergence about the size distribution, for example in Textiles, the largest sized establishments could be those employing above 2000 employees and in some of the sub sectors of Chemical, Rubber and Plastics such as drugs&pharmaceuticals and industrial chemicals, the establishments employing 500+ employees could be considered the largest (Appendix tables 5.4.1 and 5.4.2). The ratio of output controlled by establishments either employing 250+, 500+, 1000+ and 2000+ is described for sixteen sectors at three digit level in Appendix table 5.4.1 while the number of units in each size class are listed for each of these sectors in Appendix table 5.4.2. It is clear that taking different size classes in each sector as the largest size indicates the nearly the same pattern of market share positions. If the number of establishments in the largest size class employing 100+ employees and those employing 250+ ,500+ or 2000+ are taken into account, the concentration by the later size classes appears even higher.

In Chemicals, Rubber and Plastics, the concentration of largest sized establishments appears quite high. In three of the sectors, Industrial chemicals, Other chemical products and rubber products respectively, a small number of establishments control more than 60%, 50% or 70% of sectoral output. Number of establishments in each of these sectors (Appendix table 5.4.2) controlling this high output are never more than 12 in case of other chemical products, 11 in industrial chemicals and 8 for rubber products. In drugs and pharmaceutical products, percentage of output dominated by largest units is above 30% in 1984 and 1985. In 1986 and 1987 this percentage decreased to nearly 20 percent. Only 7 units of the largest size in this sector produce 27% of the total output in 1990. Even in plastic products the ratio of output by largest sized firms is 26% in 1990 which was above 40 percent in 1984 but reduced to 39% in 1985.

In wearing apparel, Printing and Publishing, glass and glass products, other non metallic mineral products, the proportion of output concentrated in the largest sized is above 50% and for two sectors glass products and non metallic mineral products even 70%. However, the ratio was highest during the middle years of 1980 and has slightly decreased in 1990. Manufacture of textiles, which include such sub sectors as cotton spinning and weaving, and made up textile goods, the number of establishments employing 2000+ employees (Appendix table 5.4.2) is the highest while the ratio of output in this largest size class by these units is modest as compared to other sectors. In 1990, 20 largest units in Textile manufacturing produced 18 % of the total output of the sector. In wearing apparel , 5 largest units were producing 34% of output in 1980 and this ratio hovered above 50% until 1987. However the number of units in the largest size steadily increased and by 1990, 20 largest units were producing 38 % of the output. Food manufacturing appears the least concentrated sector but in Beverage industries only 6 establishments are controlling nearly 29% of the total output in 1990. This ratio shows a substantial increase as compared to the earlier years of 1980s.

In most sectors, large sized units attained dominant market positions which engendered oligopolistic market structure in most of the industries. Due to the larger size itself these establishments would have been at a clear advantage to avail the industrial incentives. Size imparted a legitimacy which enabled them to gain favourable treatment. Differential access to industrial and trade incentives such as industrial loans, support pricing of inputs and other import facilities led to increased profitability. Increased profitability of the established large producers served as an entry barrier, perpetuated their hold and enabled them to take benefits of the import exemptions and other such facilities provided from time to time by the government.

This dominant position was not independent of the restrictive trade policy which not only served as an entry barrier but in its wake created many other barriers as an offshoot. Ahmed (1980) comprehensively described trends found in the manufacturing industries during 1960 and 1970. Import restrictions created monopolies of industrialists who took full advantage of their large size establishments in securing permits and quotas to import. He has even mentioned that collusion and price fixing was accepted in those days as part of the efforts to realise growth. This deterred the entry of new entrepreneurs and discouraged the competition. Once the structure of concentrated manufacturing industries got established, it kept preserved itself by sheer force of market power.

Amjad (1977) and Ahmed (1980) both mention the close links between importers and industrialists. The structure persisted and Ahmed (1980) argues that industrial producers enjoyed such enormous market power as to exercise economic and political influence to get a way around the non tariff barriers. When government officials were involved in administering the non price import controls such as quotas and licenses, it was possible for powerful industrial groups to influence the administrative machinery as compared to a new entrant trying to set up a new venture.

Profitability was highest in the early years of protection policies which helped some of the indigenous producers to explore export markets. In the initial phases, the domestic industries successfully started operations in the export market with the help of export incentives. Export activity is expected to weaken monopoly power by its competitive pressure, but Ahmed (1980) argues that even exports supported the monopoly power of the producers because domestic producers entered the market only when they were sure of high profits.

An earlier study by Amjad (1977) also established the effect of concentration on the profitability of industry. He experimented with different alternatives in his effort to clearly determine the effect of imports on the price cost margins on 25 industries for 1965-70. The main equation included price cost margins as the dependant variable with the capital output ratio and four firm concentration ratio as the independent variables. Concentration ratio always turned out to be positively and significantly associated with price cost mark ups.

Ownership by groups of large industrial producers has been highlighted by White (1974), Amjad (1974), Sharwani (1976). They argue that limited number of families controlled major proportion of the assets of non financial companies. White refers to 43 such families who controlled 53% of the total assets of such companies. Ahmed (1980) outlined the all pervasive power of industrial groups who were interlocked by their operations in both the manufacturing and financial sectors. These leading families controlled large portions of the total assets of the majority of commercial private banks, leading to the allocation of credit to these groups themselves. With outright nationalization of the financial institutions and industries in 1970, the joint ownership of financial and business centres which gave rise to monopoly of domestic credit might have weakened but was never eliminated completely. Nationalization bureaucratised the banking sector and sanctioning of loans under administrative pressure emerged as a far more potent phenomenon. In that era, the links forged between politicians, businessmen and bureaucrats (Rehman 1997) facilitated the concentration of financial resources. In the post nationalization period, the group ownership continued and favourable allocation of scarce resource to the influential groups of manufacturing industries persisted during 1990s. This can be surmised from the fact that in 1990, out of total advances of Rupees 230 billion, loans of Rs. 10 million and above, amounting to 48% of the total advances, were granted to only 1200 persons (State Bank of Pakistan annual report).

Group structure underwent a change in diversifying to many branches of industry. The market positions of these groups are sometimes traceable because they are listed on stock exchanges of the country but in many instances it is hidden because of their unlisted status. The groups are synonymous with families; originally White pointed out 22 families (1974) but these family groups have doubled to 44 according to informal sources. In 1995, they owned 43% of total manufacturing assets and represented 212 of the 522 non financial companies listed at Karachi stock exchange. Even the characteristic feature of 1960s, dual ownership of the industrial and financial firms such as banks, modarbas, leasing and insurance companies continued in 1990s, and 76 such financial institutions out of 175 listed financial companies belonged to these groups. The specific sectors in which these groups were most active and dominant are textile, sugar, cement, insurance, banks and modarbas.

The groups increased in numbers and have diversified and dispersed in a number of sectors. Rehman (1997) and monthly magazine Herald (1990) have added to the original list of groups described by White (1994). Some of these new groups include, Ittefaq (iron and steel), Dewan (textile), United (textile), Saphire-Gulistan (textile), Atlas (auto), Chakwal (cement), Fecto (cement) Rupali (polyester fibre), Sitara, Nagina, Tatta, Shahnawaz and Zahur and Monoo group (textile, sugar, livestock, poultry).

Rehman gives details of many families who have not listed any of their companies but have maintained them unlisted or in private limited form but they are ranked as the biggest industrial families such as Tabanis, Haroons, Kasim Dada, Chaudhrys, Raja group of industries and Jaffer Bros. Some of the historically renowned groups such as Habib group owns 90 public and private limited companies; Fazal group owns 5 listed companies and 24 industrial units and Adamjee group controls 15 private limited companies but only 4 of these are listed companies. Nishat group is considered by Rehman to be the biggest industrial and financial conglomerate owning 21 companies with 13 listed companies with presence in Textile, Cement , electrical equipment, banking and leasing companies. Saigols, another prominent industrial group, have diversified in chemicals, engineering, auto industry, synthetic fibres, cooking oils, sugar, construction and banking. Crescent Group, Dewan Group, Sharif group, Chakwal, Atlas, Hashwani and many more have been described as maintaining a powerful position and operating in many sectors such as textile, cement, steel sugar, glass products, auto industry with sizeable simultaneous activity in financial sector owning banks, leasing and insurance companies. The details of selected families controlling financial and industrial assets and operating in nearly all sectors, substantiate the picture emerging from the statistical description above that industrial sectors were heavily concentrated and represented the powerful positions of the small number of producers.

5.6 Analysis of the price cost margins of manufacturing industries of Pakistan

Profitability of individual 5-digit sectors over 1980-1995 reveals (Appendix tables 5.1.1 to 5.1.8) that price mark ups are in the range of twenty to forty percent for majority of the sectors. For industries where number of producers is large and the sector has become fairly competitive over the decades, the price cost mark ups are lower. Textile manufacturing, for example, has an average margin of 18 percent (Appendix table 5.2.3) over the period which is the lowest of all the other sectors. This average conceals variations though, with some sectors experiencing higher than average mark up, like jute textiles, silk &artsilk and narrow fabrics. Knitting mills, carpets and rugs also exhibit higher than average profitability. Over the years cotton spinning, cotton weaving, silk and artsilk textiles show increasing profitability from 1984 to 1990 (Appendix table 5.1.2). Rate of price cost mark up decreased in 1995 for these sectors.

Metal Products, Machinery and Equipment and Non Metallic Mineral Products have the highest average mark ups. Within Metal Products half of the sub sectors show mark-ups much higher than the average, some experience mark ups in the range of 51 percent (electrical bulbs and tubes), 59 percent (metal and wood working machinery) and 57 percent (structural metal products). Similarly in Non Metallic Mineral Products which is a much smaller sector than Metal Products as it consists of only 7 sub sectors the mark ups are as high as 49, 38 percent and 49 percent for cement, cement products and bricks and tiles respectively. These are the most important contributors to the sector and many cement companies distinguish themselves by their prominent presence in the stock markets of the company.

Drugs and pharmaceutical products is the largest sub sector within Chemical sector and have the largest number of establishments. Perhaps because of the competition generated by large number of producers, mark ups in this sector are not so high (Appendix table 5.2.1). Until 1985 mark ups fluctuated between 31-34% but declined sharply in 1986 and gradually increased to sectoral average in 1995. Price controls on medicines are maintained by the government which can also partly explain the lower mark ups. In contrast fertilizers exhibits one of the highest mark ups of the sub sectors and are much above the sectoral average. Perhaps the small number of firms in this sector enjoys the benefits of near absence of competition in the form of higher profits while they obtain their main raw materials at subsidized rates as part of support policy of the government. Some of the other sub sectors such as dyes colours and pigments, paints and varnishes, perfumes and cosmetic also enjoy higher profits than the sectoral average.

Refined sugar within Food manufacturing is a sizeable industry as are also vegetable ghee, vegetable oils and cotton seed oils. However, the mark ups in refined sugar are the highest in the sector while for vegetable ghee and oils they are much lower than even the sectoral average. Refined sugar sector is able to get the main raw materials at lower support prices from farmers and its higher profits indicate some kind of advantages that the large producers avail by virtue of their entrenched position. Mark ups or rice milling and wheat and grain milling are among the lowest of the other sub sectors while these sectors contain the largest number of establishments. The averages (Appendix tables 5.2.1-5.2.4) show high price cost margins for most of the industries except for Textiles, Paper and Wood products as the profits for these sectors are between 18 and 40 percent. Observing the movement of the profit rates, it is apparent that in many sectors, the rates declined in 1995. For example, many sub sectors in Chemicals, Rubber and Plastic enjoyed much higher margins in 1980 as compared to their level in 1995.

In Textiles, profit rates for cotton spinning and weaving fluctuated around 20% or above. Price cost margins in spinning registered an increase in later half of 1980s but decreased in 1990. Profit rates for weaving remained nearly 20% or above for most of the period. Likewise, silk & artsilk textile, finishing of textiles, carpets & rugs and manufacturing of textile exhibited margins in the range of 15-25 percent in the decade of 1980s but the position changed to a decreasing trend in 1990. Same is true for rest of industries, refined sugar in Food manufacturing and cement and cement products show phenomenal mark ups of up to 50 percent and in some of the years even higher than that. Cement and cement products have not suffered any decline in profits while refined sugar has experienced a slight decrease in 1990 which was recovered in 1995. Overall the level of price cost mark ups is much higher. Sectors with large number of establishments, indicating relatively competitive atmosphere in the industry, show lower margins relatively. However in absolute terms, the mark ups for these can still be considered high.

5.7 Model and calculation of price cost margins

Usually price cost margins are calculated by deducting variable costs (employment costs and costs of raw materials) from value of output and dividing by value of output.

$$Price\ cost\ margin = \frac{output - \text{variable costs}}{output} \tag{5.3}$$

The same procedure is applied here with few changes. The variable costs here include the cost of raw materials (imported and locally produced), cost of fuel consumed (fuel includes the cost of oils used, natural gas and other fuels), cost of electricity purchased and consumed, payments for repairs and maintenance and contract commission work by others. All these costs are lumped together under single category of industrial costs in the census of manufacturing industries. These are all variable costs, hence the data on industrial costs' figure is used instead of simply the costs of materials.

The basic model used in the regression is of the following form:

$$pcm_{it} = \alpha + \beta_1 imp_{it} + \beta_2 l\arg eshare_{it} + \beta_3 \ln size_{it} + \beta_4 \ln market_{it} + \beta_5 caplab_{it} + \varepsilon \qquad (5.4)$$

Where pcm_{it} is independent variable and represents price cost margin. There are five explanatory variables, imp_{it} is sector specific import penetration rate, $largeshare_{it}$ is a proxy for concentration, $lnsize_{it}$ indicates the average size of establishment in an industry (log of ratio of number of employees to total number of establishments, $lnmarket_{it}$ is log of total number of establishments and $caplab_{it}$ is the ratio of capital to labour (number of employees). i, is the sector subscript and t is the time subscript.

5.8 Explanation of Variables

Two types of measures are used to indicate import penetration. One is the rate of import penetration calculated as the ratio of imports in a specific sector to the combined value of imports and domestic production minus exports of that sectors. Second measure is simply the ratio of sectoral imports to sectoral output. It is assumed that increasing the intensity of imports will negatively affect the price cost mark ups. Liberalization and increasing exposure of domestic markets to international competition will remove the shelter for domestic industry which allows them to charge much higher prices. Secondly, liberalization eliminates non tariff barriers and the lowering of tariffs which remove the discretion of producers to increase prices much above world prices. The signs on these variable are expected to be negative.

Sectoral import penetration rates are not available for all the sectors and for those sectors, the aggregate trade shares are relied upon to construct the import intensity measures. For Wood products, Basic Metal and Non Metallic Mineral products the aggregate import ratios and import penetration rates are included instead of sectoral import penetration rates

Other explanatory variables are included to serve as control variables (Table 5.1 below).

Table 5.1

VARIABLES

Sectimpenet : sectoral import penetration rates as :

sectoral imports/ sectoral imports+ sectoral output – sectoral exports .

Sectimpoutput: ratio of sectoral imports to sectoral output.

Largeshare : ratio of output produced by large sized establishments in a specific subsector to the total output produced by corresponding 3-digit subsector.

Lnsize : log of average size of establishment in an industry as : ratio of number of employees to the total number of establishments.

Lnmarket : log of total number of establishments in an industry.

Caplab : ratio of capital to number of employees.

Adexpratio : ratio of advertising expenditure to the total production.

TFP : Total factor productivity estimates derived in chapter 2.

Specification (1) : includes sectoral import penetration rate as the trade indicator where available or alternatively aggregate import penetration . It does not include ratio of advertising expenditure to total production, and total factor productivity estimates..

Specificaiton (2) : includes ratio of sectoral imports to sectoral production as import penetration and excludes advertising variable and total factor productivity variable.

Specification (3) : includes all the variables including total factor productivity while the trade indicator used is sectoral import penetration or aggregate import penetration where sectoral measure is unavailable.

Specification (4) : includes ratio of sectoral imports to sectoral output or aggregate imports to gdp ratio as trade variable and rest of the control variables including TFP variable.

Specification (5) : includes effective average tariff rates as the trade indicator while control variables also include TFP for all sectors and rest of the control variables.

Figures in parenthesis are standard errors.

** significant at 95%confidence interval .

These include share of large sized establishments in total production at the 3-digit level. Share by size distribution is only listed at 3-digit and not at five digit level. The variable is an important indicator of concentration of the production in the small group of large producers. Constructing a measure to indicate concentration proved highly difficult as the largest size category is different for each sector. In some sectors, establishments employing 250+employees are the largest while in others, those employing 2000+ are largest size. This inconsistency makes inter sectoral comparisons difficult. To maintain consistency and facilitate comparison, establishments employing 100+ employees are treated as large sized establishments for all the sectors. Naqvi and Kemal (1991) used the same criterion to indicate the large sized units.

In academic literature, level of concentration is regarded as being highly significant for its positive effect on profitability and it is maintained that in highly concentrated sectors the opening of imports has the largest effect on the price cost mark ups. Share of largest sized establishments in the total output of a sector is assumed to proxy for concentration. The proxy may be far from perfect but is the only available measure representing level of concentration in all the sectors and is expected to carry a positive sign.

Log of size is used as a proxy indicating the average size of the establishment in an industry. Size of individual units is not available as census presents aggregate data. Size is expected to have a positive relationship with profitability as larger sized firms may be more profitable, because of their prominence and advantageous position to apportion the higher share of resources as has been mentioned in earlier sections.

Log of market (total number of establishments in a sector) is included to take account of the level of competition in a given industry. The larger number of units operating in an industry is assumed to give rise to a competitive environment and exert negative pressure on the price cost margin. Lower number of establishments in a particular sector indicates the weakening of competitive forces imparting discretionary power to producers in charging higher prices. Capital intensity (ratio of capital to number of employees) is assumed to contribute positively to the price cost mark ups and in many studies this assumption has been empirically found to hold true.

These are the main explanatory variables for which data is available for nearly all the sub sectors. However another specification is also used for those sectors for which these are considered important. In this model, in addition to above variables, two more variables are included. These are, the ratio of advertising expenditure to total output and the level of total factor productivity. Advertising ratio is used as in some sectors it can serve as an entry barrier, giving rise to product differentiation. This is important in only the large sectors and hence is being used for only four sectors Chemicals, Textiles, Food manufacturing and Basic Metal. It is expected to positively influence the price cost mark ups. Other additional variable, total factor productivity, are the estimates gathered from chapter 2. Purpose of including this variable is to check whether technical efficiency contributes positively to profitability. In the theoretical literature, many researchers test whether it is the higher technical efficiency of the firms which increases their profits and allows them to gain market shares. However the literature has not reached a unanimous conclusion and opinion is still divided.

Heteroskedasticity is checked by Breusch-Pagan test and statistics reported in the tables. Estimation is conducted by Generalized Least Squares in STATA.

5.9 Results

The results for Generalized Least Square regression for all eight sectors are presented in tables 5.2-5.9 of the chapter. There are four specifications for all sectors. Specification 1 and 2 is the basic model which includes sectoral or aggregate import ratios as trade variables and four control variables, largeshare, lnsize, lnmarket, caplab. Specifications 3 and 4 include additional total factor productivity variable for all sectors and advertising ratio variable for four sectors.

In majority of the sectors coefficient on import penetration measures do not seem to support the proposition that increasing import intensity exerts negative pressure on the pricing behaviour except in chemical sector. Only in Chemical sector the relationship appears to be consistent with the hypothesis that import intensity variables reduce margins and are statistically significant. In all four regressions, the sectoral import penetration rates and ratio of sectoral imports to sectoral output is highly significant and predominantly appearing with a negative sign except in model (2) where ratio of imports to sectoral output is used. This is the expected result that import penetration or greater import openness introduces pro-competitive effect by increasing exposure to foreign competition and reduces the price cost margins.

In Textile sector, Food manufacturing, Metal products, Machinery and Equipment, the import variables are positive and insignificant. The explanation for each of these sectors might vary. For example Textile manufacturing is characterised by a large number of producers and hence considered fairly competitive. The lesser concentration might have resulted in the lowest average price cost mark ups for this sector and modest profit rate for rest of the sub sectors. The fact that sector is already fairly competitive with large number of producers and open as it is the major contributor to the country's exports, increasing the intensity of imports might not dramatically affect the margins.

Concentration and margins for Food manufacturing as well are not as high as compared to other sectors such as Metal products, Chemical, Rubber and Plastics and Non Metallic Mineral products. Proportion of output controlled by largest size establishments (employing 100+) is small. Although the ratio of output produced by size employing 100+ employees high but lower relative to Chemicals, Metal products and Non Metallic Mineral products and so is the average sectoral margin. Individual price cost margins for sub sectors are also modest except refined sugar, beverages, canning of fruits and vegetables. Insignificance of import measures for these sectors seem to correspond with the tendency indicated in theoretical literature, that import penetration does not affect margins substantially in less concentrated industries which explains the lesser effect of trade opening.

As far as Metal products are concerned, import intensity is positive and insignificant, with all the four specifications. Concentration and margins in this sector, however are highest among all, and it seems difficult to find any reasonable explanation. Perhaps import of machinery was already fairly liberalized and the percentage of import of capital goods in the total imports has remained second highest after the imports of intermediate raw materials.

Table 5.2
Generalized Least Squares : Panel estimates
Manufacturing of Textile and Wearing Apparel

Dependant variable: Price cost margin Variables	(1)	(2)	(3)	(4)
Constant	.048	.046	-.068	-.132
Sectimpent	.268		.34	
	(.17)		(.16)	
Sectimpoutput		.45		.73
		(.25)		(.24)
largeshre	.097**	.097**	.159**	.15**
	(.02)	(.02)	(.03)	(.03)
lnsize	.01**	.01	.018**	.017**
	(.004)	(.004)	(.003)	(.003)
lnmarket	-.012	-.012	-.006	-.007
	(.007)	(.007)	(.006)	(.005)
caplab	.01**	.009**	.012**	.013**
	(.003)	(.003)	(.003)	(.003)
adexpratio			-.016	-.002
			(.40)	(.35)
tfp			.033**	.034**
			(.004)	(.004)
Breusch-Pagan/ Test for heteroskedasticity				
Chi2	.25	.07	3.79	33.97
Prob	.616	.78	0.05	0.000
Log likelihood	152.02	152.59	161.37	164.15
Prob>chi2	0.000	0.000	0.000	0.000
No.of observations	120	120	120	120
No of groups	15	15	15	15

Table 5.3
Generalized Least squares : Panel estimates
Food manufacturing and Beverages

Dependant variable: Price cost margin Variables	(1)	(2)	(3)	(4)
Constant	-.19	-.18	-.24	-.33
Sectimpent	.14		.28	
	(.11)		(.071)	
Sectimpoutput		.073		.15**
		(.07)		(.04)
largeshre	.34	.36	.29	.46**
	(.21)	(.19)	(.16)	(.14)
lnsize	.039**	.038**	.027**	.03**
	(.011)	(.01)	(.009)	(.008)
lnmarket	-.004	-.007	-.009	-.012
	(.01)	(.013)	(.012)	(.012)
caplab	.025**	.027**	.032**	.035**
	(.01)	(.009)	(.008)	(.008)
adexpratio			1.06**	.93**
			(.32)	(.32)
tfp			.014**	.014**
			(.001)	(.01)
Breusch-Pagan/ test for heteroskedasticity				
Chi2	1.63	2.16	1.45	1.79
Prob	.202	.14	.22	.18
Log likelihood	116.96	117.80	143.51	140.38
Prob>chi2	0.000	0.000	0.000	0.000
No.of observations	144	144	144	144
No. of groups	18	18	18	18

Table 5.4
Generalized Least squares : Panel estimates
METAL PRODUCTS, MACHINERY & EQUIPMENT

Dependant variable: Price cost margin Variables	(1)	(2)	(3)	(4)
Constant	.303	.35	.23	.29
Sectimpent	.159		.16	
	(.14)		(.18)	
Sectimpoutput		.019		.022
		(.025)		(.032)
largeshare	-.127**	-.128**	-.11	-.11
	(.04)	(.047)	(.04)	(.05)
lnsize	.041**	.043**	.041**	.042**
	(.009)	(.009)	(.01)	(.011)
lnmarket	-.043**	-.04**	-.035**	-.034**
	(.009)	(.01)	(.01)	(.011)
caplab	.018	.019	.016	.018
	(.015)	(.016)	(.018)	(.019)
adexpratio				
TFP			.021**	.024**
			(.008)	(.008)
Breusch-Pagan/ test for heteroskedasticity				
Chi2	.34	.52	.13	.25
Prob	.56	.47	.71	.16
Log likelihood	220.14	217.30	217.22	214.43
Prob>chi2	0.000	0.000	0.000	0.000
No.of observations	256	256	256	256
No. of groups	32	32	32	32

Table 5.5
Generalized Least squares : Panel estimates
Basic Metal Industries

Dependant variable: Price cost margin Variables	(1)	(2)	(3)	(4)
Constant	.086	.084	.30	.38
Aggimpenet	-.022		-.22**	
	(.14)		(.071)	
impgdp		-.019		-.045**
largeshre		(.05)		(.007)
lnsize	.089**	.09**	.054**	.048**
	(.023)	(.023)	(.014)	(.01)
lnmarket	-.04**	-.04**	-.049**	-.047**
	(.011)	(.011)	(.009)	(.007)
caplab	-.033	-.034	-.055**	-.053**
	(.016)	(.016)	(.009)	(.006)
adexpratio			1.21	.98
			(1.32)	(1.02)
TFP			.004**	.004**
			(.0006)	(.0005)
Breusch-Pagan/ test for heteroskedasticity				
Chi2	3.39	3.09	.02	.00
Prob	.06	0.07	(.89)	.95
Log likelihood			35.31	40.70
Prob>chi2			0.000	0.000
No.of observations	32	32	32	32
No. of groups	4	4	4	4

(The variable largeshare could not be constructed for this sector as the data on this was inconsistent.)

Table 5.6
Generalized Least squares : Panel estimates
Non metallic Mineral Products

Dependant variable: Price cost margin Variables	(1)	(2)	(3)	(4)
Constant	-.74	.73	-.34	.59
aggimpenet	5.5**		3.7**	
	(1.4)		(1.19)	
impgdpratio		-.66		-.53
		(.31)		(.25)
largeshre	.032	.064	-.027	-.033
	(.048)	(.089)	(.026)	(.058)
lnsize	.053**	.045**	.003	-.019
	(.012)	(.015)	(.019)	(.019)
lnmarket	-.029	-.058	.005	-.025
	(.044)	(.053)	(.039)	(.051)
caplab	.009**	.004	.008**	.005**
	(.002)	(.003)	(.002)	(.002)
adexpratio				
			.019**	.025**
TFP			(.005)	(.005)
Breusch-Pagan/ test for heteroskedasticity				
Chi2	1.43	.16	2.34	1.7
Prob	.23	.69	.12	.19
Log likelihood	38.50	33.68	44.04	43.03
Prob> chi2	0.000	.026	0.000	0.000
No.of observations	56	56	56	56
No. of groups	5	5	5	5

Table 5.7
Generalized Least squares : Panel estimates
Paper , Printing & Publishing

Dependant variable: Price cost margin Variables	(1)	(2)	(3)	(4)
Constant	-.22	-.23	-.14	-.20
sectimpenet	.58		.85**	
sectimpgdp	(.28)	.45**	(.19)	.65**
		(.15)		(.12)
largeshre	.18	.19	.055	.097
	(.09)	(.079)	(.064)	(.06)
			.012	.016**
lnsize	.024**	.026**	(.005)	(.005)
	(.008)	(.007)	.01	.015
lnmarket	-.035	.037	(.006)	(.006)
	(.013)	(.021)	.012	.019
caplab	.03	.031**	(.01)	(.01)
	(.013)	(.012)	.098**	
adexpratio			(.005)	
TFP				.097**
				(.005)
Breusch-Pagan/ test for heteroskedasticity				
Chi2	11.74	11.58	.31	.35
Prob	.0006	.0007	.57	.55
Log likelihood	78.42	80.69	98.27	101.21
Prob>chi2	0.0007	0.000	0.000	0.000
No.of observations	72	72	72	72
No. of groups	5	5	5	5

Table 5.8
Generalized Least squares : Panel estimates
Wood, Wood products & Furniture

Dependant variable: Price cost margin Variables	(1)	(2)	(3)	(4)
Constant	.22	-.037	1.14	.60
aggimpenet	-1.9		-4.33**	
	(2.6)		(1.7)	
impgdpratio		-.50		-.35
		(.35)		(.18)
largeshre	.38	.16	.47**	.18
	(.29)	(.20)	(.15)	(.097)
lnsize	.014	.056	-.11**	-.095**
	(.038)	(.031)	(.034)	(.03)
lnmarket	.021	.032	-.061**	-.051**
	(.026)	(.025)	(.017)	(.018)
caplab	-.011	-.012	.012	-.003
	(.008)	(.005)	(.006)	(.003)
adexpratio				
TFP			.06**	.047**
			(.009)	(.006)
Breusch-Pagan/ test for heteroskedasticity				
Chi2	1.38	.37	3.02	.01
Prob	.24	.54	.02	.92
Log likelihood	25.18	26.62	38.44	39.37
Prob>chi2	.62	.12	0.000	0.000
No.of observations	32	32	32	32
No. of groups	4	4	4	4

Table 5.9

Generalized Least Squares : Panel estimates

Chemical Rubber and plastics

Dependant variable: Price cost margin Variables	(1)	(2)	(3)	(4)
Constant	.085	-.04	.19	.078
Sectimpent	-.33		-.23*	
Sectimpoutput	(.15)	.037**	(.103)	-.16**
		(.01)		(.07)
largeshre	.174**	.140**	.139**	.13**
	(.041)	(.033)	(.036)	(.03)
lnsize	.025**	.034**	.017**	.018**
	(.007)	(.006)	(.005)	(.005)
lnmarket	.0086	.018	-.011	-.011
	(.009)	(.008)	(.006)	(.006)
caplab	.014**	.015**	.006	.007**
	(.002)	(.002)	(.003)	(.003)
adexpratio			.006**	.006**
			(.001)	(.001)
tfp			.146**	.016**
			(.032)	(.001)
Breusch-Pagan test for heteroskedasticity Chi2	.86	1.07	.02	.04
Prob	.354	.30	.89	.83
Log likelihood	154.28	161.16	184.64	181.53
Prob>chi2	0.000	0.000	0.000	0.000
No.of observations	192	192	192	192
No. of groups	23	23	23	23

Remaining four sectors, Basic Metal Industries, Non Metallic Mineral products, Wood products and Paper, Printing and Publishing, import variables mostly appear with the expected negative signs although not all are statistically significant. For Paper,Printing&Publishing, sectoral import variables are used while for the rest aggregate variables are included. For Basic Metal both the variables have appeared negative in all four specifications. In two specifications both the import penetration measures are negative and statistically significant. For Non Metallic Mineral products, the relationship between import intensity and the price cost margin does not conform to the expectation. Aggregate import measures appear to be negatively associated in two models but positive in the other two. In Wood products import intensity captured by aggregate import variables is negatively associated with price cost margins in all specifications but significant in only one model. Given the localised nature of production and relatively small scale domestic production, it seems likely that margins remain unresponsive to the general increase in the level of imports.

Most of the additional variables represent sector specific characteristics. They can also serve as entry barriers such as large size, capital intensity and product differentiation by means of advertising expenditure. These characteristics also define the market structure shaped under the influence of restrictive trade policies. Size is the most uniformly and highly statistically significant. Coefficient on this variable is positively associated with the price cost margins for all the sectors except wood products. This finding is consistent with the earlier studies conducted on manufacturing industries of Pakistan such as Amjad (1976) and White (1980) who mentioned the importance of the size of establishments in determining the profit rates of the sectors. Larger establishments have preferential access to trade and fiscal incentives . Access to import licenses and quotas was easier for larger producers and allowed them to strengthen their domination of market shares. Market power put them in a position to exercise political clout for influencing the government policies to impede entry of new producers.

Variable indicating industrial concentration appears to be positively associated with the price cost mark ups in all sectors except one. Coefficient on the variable is positive and statistically significant for Chemical, Rubber & Plastics and Textile manufacturing. For rest of the sectors, except Metal products, Machinery and Equipment, coefficient is positive, however insignificant. Amjad (1976), Wizarat (1992), White (1980) and Kemal (1980) have all unequivocally found the concentration to be very high in nearly all the industrial sectors. Ahmed (1981) authoritatively related the structural features of the market to the pricing behaviour of the industries and mentioned that small number of large establishments were holding the markets captive to their profit considerations which were not reigned in because of virtually non existent competitive pressures. The initial importers who ventured into industrial activity were at a clear advantage as they were holding the licenses and import permits. This served as a severe entry barrier resulting in a highly oligopolistic structure in which groups of industrial producers diversified production in various branches of not only manufacturing but entered in the financial sector as well. Increasing expansion in demand during the high growth period of 1960s allowed them to improve productivity and reduce costs but these reductions were never reflected in lower prices but rather converted into excess profits.

Simultaneous control of the industrial and financial sector allowed these producers to allocate themselves financial credit. This resulted in highly capital intensive production in nearly all the sectors. The fact that capital intensity variable is positive and statistically significant in majority of the sectors suggests that domestic producers were able to reap exceptionally high profits partly because of the level of their capital intensity as the new comers were made wary of the prospects by high capital requirements.

Competitive pressure seems to positively influence profit rates as the coefficient on log of market (total number of establishments) appears with expected negative sign and is significant in many sectors.

Estimations including total factor productivity show a statistically significant coefficient on total factor productivity and it appears to positively influence the price cost margins of respective sectors. The result suggests that any improvements in total factor productivity have a feed back effect on the market position of the firms. It results in higher profits of manufacturing industry and given the higher concentration of production, contributed to the powerful market position of the producers. In theoretical literature, it is found that in oligopolistic markets, increase in profitability following total factor productivity improvement results in strengthening the concentrated positions of established producers. Ahmed (1980) argues that manufacturing industry in Pakistan was characterised by 'technological discontinuity' that arose due to differential access of powerful producers to new technologies. Easier acquisition of import licenses and control of financial credit enabled them to acquire technological edge, increase profitability and fortify their market share. Total factor productivity gains were not reflected in downward price adjustments but led to increases in price cost margins. Prices remained inelastic to changes in costs caused by technological improvements. The interaction between severe trade restrictions, oligopolistic market structure with firms having power to set prices and unequal access to technology resulted in increasing profits. Entrenched producers were not wary of the new local or foreign producers that might enter the market lured by high profits as formidable entry barriers prevented it.

Overall it appears that the main explanatory variables, the sectoral or aggregate import rates weakly support the hypothesis that increasing the openness to imports can result in disciplining the domestic industry by reducing profits margins. However when considered in conjunction with additional variables all representing aspects of the market structure purported to be associated with price cost margins, it can be asserted that import protection has played a direct role in shaping the structural features of the market which are now driving the profitability. High level of concentration, importance of a large size, and capital intensity have all resulted from shielding the domestic industries from the competitive pressure. This policy was most noticeably working through restricting the imports through non tariff and tariff barriers and a variety of other restrictions.

The result that import rates are not unanimously playing any decisive role in reducing the mark ups may be due the particular trade variables used. As the construction of trade variables is notoriously complex and difficult in precisely measuring the policy. For purposes of measuring the effect on profits, using effective protection rates could be more appropriate but unfortunately the data on effective protection rates is not available for this long time period. Amjad (1977) though has tried effective protection rates as constructed by Lewis and Guisinger (1971), he could not find any assertive and meaningful result and attributed the weak results to the difficulty in precisely and accurately measuring the import variable.

Perhaps trade controls fostered non competitive market characteristics which hindered the reductions in price cost mark ups following import liberalization. Competition allows many firms to try different methods of production and only the best method and firm survives and that is not possible in oligopoly. Competitive environment can prevail if there are no entry and exit barriers. However despite the large scale trade liberalization, structural and policy related barriers profoundly affected the market. Different governments at different times have tried to support and bail out the large producers to avoid their exits. Normal competitive mechanism which forces the unsustainable units to exit the markets have been hindered and is not allowed to work freely.

5.10 Conclusion

The result for the effect of increased import intensity on the price cost margins for eight sectors present a mixed picture. For highly concentrated sectors, the effect appears as expected with a negative sign on import penetration variables, though not always significant. For fairly competitive and less concentrated sectors such as Textiles and Food manufacturing, opening of trade does not appear to affect the price cost margins. For Chemical, Rubber and Plastic the effect of import penetration appears negative and statistically significant .

Although empirical results do not always support the negative relationship between import penetration and profitability, this does not imply that increasing import intensity does not have any effect on the profitability. The structural features of the markets caused by the trade controls, appear to impede the desired and expected relationship. Control by large sized producers and highly capital intensive production exerted substantial entry barriers. It also facilitated the unequal access to technology improvements by groups of producers who are in a position to maintain their control by increased profitability due to improvement in total factor productivity. Despite the gradual liberalization of imports, entry and exits are still not free which are creating obstacles in creating the competitive environment. Consequently, large size, capital intensity and group structure with diversified activities in various branches of industry and financial sectors contributed to the weaker effect of import liberalization on the price cost margins.

Conclusion

6.1 Conclusion and Recommendations

This thesis has investigated effect of evolving trade policies on the total factor productivity, technical efficiency and profitability of the manufacturing industries of Pakistan. The accurate calculation of total factor productivity was a prerequisite to determine the effect of trade liberalization measures and to pursue analysis in subsequent chapters. Previous studies (Ahmed, M 1981, Majid, N. 2000 ILO discussion paper 33, Ahmed, S. 1993) to explore the link between productivity and trade liberalization were limited because partial productivity measure was used at the level of the aggregate economy or at the level of large scale manufacturing. Large scale manufacturing in such studies comprised a broad aggregation of all the plants in all industries and did not recognise inter-industry differentials in productivity. Therefore these studies were inadequate in their efforts to document the differing responses of various sectors to trade policy regimes. Additionally, their weakness lies in the use of partial productivity measures, such as labour productivity measures. Even when total factor productivity is derived, it is biased because estimation lacks consideration of important methodological issues.

This study exerted immense effort to the precise computation of total factor productivity measures. Obtaining consistent production function estimates in the presence of methodological problems was imperative. These problems stem from the possibility that input choices are endogenously determined with the productivity level of a manufacturing unit. In other words, firms/factories hold a particular assessment about their efficiency and productivity, according to which they decide about the use of inputs. Input choices respond positively to a favourable productivity assessment. There is then a contemporaneous correlation between input levels and productivity, particularly for variable inputs that can be more adjusted. Ignoring this endogeneity can result in biased estimates of the production function, and consequently inaccurate measures of TFP. The thesis adapts a pioneering procedure, renowned for its ability to deal not only with this contemporaneous correlation but also the related issues of heteroskedasticity and autocorrelation. This procedure implements semi-parametric estimation of production functions and is based on the intuition behind the works of Olley-Pakes (1996) and Levinsohn-Petrin (2003).

Panel data for 8 major industrial sectors was used and since each sector comprises of sub-sectors a total of 113 sectors were analysed. Data is taken from the census of manufacturing industries at the level of five digit Pakistan Standard Industrial Classification over a period of fifteen years 1980-1995. A separate production function is used for each sector to account for sector specific characteristics. This contrasts to previous work that fit one production function for the entire manufacturing industry. The Levinsohn-Petrin procedure is applicable for panel data sets.

The results of production function estimation broadly confirm the contemporaneous correlation as the coefficient on labour is generally smaller using the Levinsohn-Petrin method than when estimated by OLS. The precise direction of bias is difficult to determine because the correlations between labour, capital and productivity are complicated.

Productivity is estimated with the parameter estimates from the above production functions. Total factor productivity for all the sectors is presented and analysed. The most striking result emerging from this analysis is the relatively low productivity of the Textile sector, a sector which is recipient of the most government support, persistent trade protection and export promotion policies. Textile is the largest sector in terms of contribution to manufacturing employment, output and value added. It is relatively open to international competition as it is the largest contributor to the exports of the country. This dominant position has historically endowed it with the most favoured status for getting generous incentives as an export oriented industry. However, the long period of support and protection made the sector dependent on the incentives and impeded the capability to shift production from low to high value added products and to improve efficiency. Chemical, Rubber & Plastics, and Food manufacturing are the most productive industries. Metal products, Paper, Printing and Publishing are the least productive sectors. Non-metallic mineral products and Wood products exhibit relatively moderate total factor productivity.

Descriptive statistics show that the manufacturing structure has not diversified and that manufacturing production is concentrated in a few sectors such as spinning and weaving, drugs and pharmaceuticals, refined sugar, vegetable oils, cement and cement products. There is no substantial change to this pattern over the entire period of this study. Just as production is concentrated in few sectors, so is the share of large sized units in total manufacturing output, employment and value added. Establishments in the largest size class, though lesser in number, contribute the highest proportion of production.

The effect of liberalized trade on sectoral productivity was examined in a regression framework in the presence of sector specific control variables. Sectoral productivity estimates were regressed on a variety of trade variables. The results suggest that trade liberalization (measured by sectoral trade ratios, average tariff rates and anti export bias) does not enhance productivity in the majority of sectors. The relationship appears to be statistically insignificant. The only exceptions can be found in Chemicals sector for which productivity shows a highly positive, sizeable and significant association with trade policy changes. Perhaps this could be attributed to the presence of multinationals operating in the sector which have contributed to the improvement of total factor productivity of the sector. Trade liberalization also positively affects productivity in Paper Printing and Publishing and Basic Metal industries as well. Sector specific measures appear to play more important roles than trade in contributing to the productivity, as evidenced by the significantly positive association between productivity and industry specific market competition measure and capital intensity in many sectors.

Overall trade liberalization does not appear to have any effect on the total factor productivity of the majority of industrial sectors despite using the sophisticated econometric techniques. This could be explained by the fact that trade liberalization in Pakistan has been carried out in isolation without any complementary reforms in other sectors or areas which could have enabled the manufacturing industry to fully respond to the opening up of trade policies. Education has been a neglected area and an excellent educational system is vital to create the quality workforce equipped and educated to absorb and implement the changes of a liberalized trade regime. Spillover effect due to increased exports and import penetration can be fully realised with the help of an educated workforce. However in Pakistan human capital has been stagnant and did not keep pace with the trade reforms.

Secondly improved infrastructure such as rail and road transport links, other supplementary facilities such as power supply to the industrial sector, are also crucial to help industrial sectors in reflecting improvements in production methods. However, infrastructure has remained badly managed and not maintained properly. This was due to the paucity of development funds which were substantially curtailed in the presence of huge fiscal deficit. Instead of reducing non development expenditures to compensate for the loss of revensue due to tariff reductions, development projects were reduced in size and scope. Consequently infrastructure suffered badly and contributed negatively in the effect of trade liberalization reforms on total factor productivity of manufacturing industry.

Prompted by suggestions in previous works that trade protection policies in Pakistan did not result in allocative inefficiency as much but in X-inefficiency (Noman, A 1992), time varying technical efficiency of four major sectors were estimated. Selection of these sectors was determined by the requisite number of observations as Stochastic Frontier Production Function to compute technical efficiency requires a specific number of observations to perform accurate estimation. The academic literature points towards the negative effects of trade protection which hinder competition and create incentives to shirk. The lack of a competitive environment might dampen efforts to reduce costs and increase the reliance on windfall profits as a result of protectionist measures. Trade liberalization is believed to be pro-competitive which forces firms to work hard and implement efficient ways of managing production and business. Findings of the thesis indicate high level of technical inefficiency in the four sectors and that technical efficiency is decreasing over time in three of the sectors. Results suggest that trade liberalization contributes positively but insignificantly to technical efficiency.

Increased import penetration following trade liberalization is expected to increase competition, which negatively affects the profitability of domestic producers. Price cost mark ups are kept high when there are trade restrictions but with the opening of trade, producers have to take a hit to their profits. Mark ups in the industrial sectors of Pakistan have remained very high over the entire period and this trend has persisted. Sectors which show moderate price cost margins relative to other sectors are Textile and Food manufacturing industries. Despite changes in trade barriers, mark ups do not show any substantial decline which can be associated with the effect of increased import penetration.

However, the ratio of output controlled by large sized units significantly affects profitability. Average size of the unit positively contributes to the price cost margins, and so does capital intensity. Size, capital intensity and ratio of advertising expenditure to sales all serve as entry barriers and are positively related with profitability in many sectors. Most importantly, total factor productivity improves the price cost margins of all the sectors, implying that greater improvements in productivity contributes to enhanced market share by increasing profits. This can also imply that the incidence of increased productivity does not result in the lowering of prices even if costs have decreased.

Industrial sectors are characterised by entry barriers caused by direct trade control measures. Trade restrictions engendered concentrated market structures which have outlived the end of trade protection. This has been possible because incentives encouraged capital intensive production and discouraged competition. Trade policies also favoured large producers because of their market positions and therefore size became another entry restriction. These structural features of the market have persisted despite large scale removal of protectionist policies. Trade liberalization did not result in improved productivity and reduced profitability because pro-competitive effects could not work due to the resilient oligopolistic market structures. Although there is no statistical and documented evidence of collusive behaviour among the domestic producers, but it has been suggested in academic literature (Clark et al 1984) that oligopolistic manufacturers might collude in the wake of trade opening. Collusion tends to increase price cost margins, lets the structure persist and hence the industry fails to demonstrate the positive benefits of the trade liberalization. The fact that entry barriers are substantial and important, suggests that this could be the case in the industrial sectors of Pakistan.

Trade liberalization can also increase productivity if the reallocation of resources from the less efficient to more efficient plants/firms takes place. This can only occur if there are no barriers to turnover and if government policies facilitate turnover. Impeding exits of inefficient producers, or supporting producers who otherwise cannot survive, can contribute to the weak effect of trade liberalization reforms. This hinders the development of a competitive environment which is integral to realising the benefits of trade reforms. In Pakistan, manufacturing sectors were harbouring enormous number of sick industrial units in 1990 which would have exited the market naturally if not provided bail outs by Government. The competitive mechanism of firm survival and exits depending upon their productivity and efficiency thus was hindered.

Policies have largely favoured established large producers and ignored the small firms, which are at a clear disadvantage not just in getting import permits and licences but also in getting credit from banks. This fostered large size as an effective entry barrier and groups of large producers have created a concentrated production structure. Many of these groups ventured into various manufacturing branches and collusion can be feasible in such an environment, furthering the oligopolistic industrial structure.

Understandably, competitive effect of trade liberalization depends on complementary policies to encourage competition such as equal incentives for small, medium and large producers, and facilitate the liquidation of inefficient plants or firms. Trade protection and promotion policies in Pakistan have served to create and enhance the structural entry barriers. These barriers have made it easy for groups of large producers to persist with the same structure. Trade reforms have failed to weaken the entry barriers and therefore, there is a weak association between changing trade policies and improvement in total factor productivity. If competition is hindered by other policies, trade liberalization cannot work effectively to force the producers to trim their fat.

Policies should focus on enhancing the competitive forces in the industrial sectors. In this regard incentives should not be biased towards the large established producers. Small and medium size producers need equal support in terms of access to credit and trade facilities. Competitive policies should be implemented to curb the monopoly power of the groups of large producers and to curb any collusive behaviour among them. Turnover of firms, which can contribute to improving aggregate industrial productivity, should not be hampered by any policy. Inefficient or dying firms should not be kept in business by bail outs from the government. It also creates moral hazard problem because firm owners/managers do not share the full burden of their actions which are implicitly insured by government.

Focusing on trade liberalization with little regard for complementary reforms in education, infrastructure and development areas impedes the beneficial effects of trade reforms. Government should make a concerted effort to not only improve the educational level of populace but also improve the quality of education so as to bring it at par with international standards. In order to reduce the fiscal deficit while continuing with tariff reductions which can cause revenue loss, the desired and appropriate policy ought to be to curtail non development expenditure. The development and infrastructure related projects should not suffer because this can affect the successful implementation of trade reforms. These policies create the enabling environment for the manufacturing industry without which it is inconceivable to realise the benefits of trade reforms.

This thesis was constrained by the limited firm level data available. It would be interesting to investigate questions related with the effect of trade liberalization on the performance of the firms. Further research should be directed at gathering firm or plant data if and when it becomes available to study the effects of entry and exits on total factor productivity and the impact of trade reforms. It is important to conduct an incisive study on the market structure prevalent in the manufacturing sectors and find measures by which the collusive behaviour in an industry or among the firms could be documented. This thesis focused on trade reforms and its relationship with total factor productivity, technical efficiency and profitability. However, substantial reforms were being carried out in the financial sector as well. These might have had an effect on how trade reform influences industry. It would be interesting to investigate whether financial sector reforms have influenced the performance of the manufacturing industries or if both financial and trade reforms have a combined effect.

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Appendices:

Table 1.1
Tables on effective protection rates by sectors

Food manufacturing and beverages

Sector	1980	1990
Dairy products	156	161
hydrogenated & vegetable oil	-43	-505
Rice milling	-76	201
Wheat milling	-60	
Refined sugar	40	1571
Tea blending	93	1293
Beverages	-1	-7

Textile and wearing apparel

Sector	1980	1990
cotton ginning	-9	
spinning of cotton	-431	32
weaving of cotton	157	41
weaving and spinning of wool	68	95
silk & artsilk	-3	119
jute textile	161	-420
Narrow fabrics	478	136
Made up textile goods	510	20
Knitting mills	51	563
Carpets	3	46
Wearing apparel	33	185
Leather tanning	21355	-2337

Wood and products	**1980**	**1990**
wood, cork and articles	24	122
wood furniture	-369	
Paper, printing & publishing		
Paper board & products	492	21
Printing and publishing	-43	347
Non metallic mineral products		
earthenware, pottery and chinaware	262	77
Glass & glass products	67	63
Cement and cement products	-3	94
other non metallic materials	83	123
Iron & steel	318	78
Sports equipment	392	69
Chemical, Rubber & Plastic	**1980**	**1990**
Drugs & pharmaceuticals	18	235
Cosmetics	362	97
Paints & varnishes	23	157
Fertilizers	32	83
Acids, alkalies , compressed gases		
Soaps & detergents	-47	-467
Matches	-314	395
Petroleum products	-6	-468
Tyres and tubes	159	22
Other rubber products	99	-970
other plastic products	147	44

Metal products, machinery & equipment	**1980**	**1990**
structural metal products	39	33
Heating and cooking equipment	214	
Utensils and cutlery	3251	118
Wires, bolts & nuts	130	
tin cans and tin wares	608	
Plumbing equipment	35	
Agricultrual machinery	-20	
Textile machinery	15	
Metal working machinery	14	
Other non electrical machinery	-16	264
Industrial electrical machinery	-18	383
Eletrical apparatus and supplies	16	
Sewing machines	-766	
Electric bulbs and tubes	37	
Electrical transmission	-13	
Batteries	33	
Motor vehicles	49	-495
Cycles and parts	28	
Surgical instruments	13	
watches and clocks	301	652

Source : Structure of Protection (Kemal (994) , Naqvi (1990)

Table 1.2

Year	Consumer goods %	Incidence raw material %	Consumer goods raw material %	Capital goods raw material incidence %	Capital goods incidence %
1980	60	35	34	40	36
1981	64	45	48	40	45
1982	69	47	53	40	45
1983	63	52	51	50	49
1984	50	40	42	38	39
1985	61	45	46	45	42
1986	69	48	51	39	35
1987	56	41	41	45	38
1988	47	33	31	44	38
1989	40	40	40	43	39
1990	38	39	39	41	39
1991	37	31	30	39	34
1992	41	36	35	45	32
1993	38	36	35	44	30
1994	43	33	32	46	31
1995	46	33	31	48	36

Source : CBR year book, Government of Pakistan, several issues.

Table 1.3

Trade taxes as percentage of total imports

unit: Rs. Million

Year	Customs duty	Total imports	Customs duty as % of total imports
1980-81	14276	52544	27.17
1981-82	15074	59482	25.34
1982-83	18510	68151	27.16
1983-84	21532	76707	28.07
1984-85	23371	89778	26.03
1985-86	29343	90946	32.26
1986-87	33364	92431	36.10
1987-88	38001	112551	33.76
1988-89	42362	135841	31.18
1989-90	48584	148853	32.64
1990-91	50528	171114	29.53
1991-92	61821	229889	26.89
1992-93	61400	258250	23.78
1993-94	64240	258250	24.88
1994-95	77653	320892	24.20
1995-96	88916	397575	22.36
1996-97	86094	465001	18.51
1997-98	74496	436338	17.07
1998-99	78654	465964	16.88
1999-00	63916	533792	11.97

Table 1.4 : Composition of total tax revenue

Year	Direct tax as % of total tax rev	Indirect tax as% of total tax
1981-82	20.65	79.35
1982-83	18.89	81.11
1983-84	17.14	82.86
1984-85	17.39	82.61
1985-86	16.28	83.72
1986-87	13.39	86.61
1987-88	13.31	86.69
1988-89	13.16	86.84
1989-90	14.11	85.89
1990-91	16.02	83.98
1991-92	18.14	81.86
1992-93	21.19	78.81
1993-94	21.39	77.65
1994-95	23.12	76.88
1995-96	25.99	74.01
1996-97	26.82	73.18
1997-98	29.63	70.37
1998-99	27.02	72.98
1999-00	27.73	72.27

Table 1.5 : Composition of Indirect taxes

Year	% share of customs duty in indirect taxes	%share of sales taxes in indirect taxes	% share of central excise taxes in indirect taxes
1980-81	51.8	10.5	30
1981-82	50.1	10.8	30.5
1982-83	53.4	10.1	29.3
1983-84	51.8	11.1	30.6
1984-85	54.2	1.8	28.7
1985-86	59.4	10	25.6
1986-87	61	11.7	22.9
1987-88	59.8	13.8	22.3
1988-89	55.4	19.2	21.5
1989-90	54.8	21	20.6
1990-91	55.8	18.8	20.9
1991-92	54.9	18.6	26.5
1992-93	61.6	19.7	28.7
1993-94	49.2	23.8	26.9
1994-95	47	26.2	26.8
1995-96	46.8	26.3	26.8
1996-97	43.7	28.4	27.9
1997-98	40	28	32.6
1998-99	32.8	36.4	30.8
1999-2000	28.5	44.8	26.4

Source: Various issues of Central board of revenue year book and economic survey of Pakistan

Table 1.6

Trends in sales tax revenue

year	sales tax as% of total tax	sales tax as%of indirect tax	sales tax as % of GDP
1981-82	7.56	9.53	1.00
1982-83	7.12	8.77	0.96
1983-84	8.62	10.40	1.10
1984-85	8.35	10.11	0.99
1985-86	7.81	9.33	0.96
1986-87	7.73	8.92	1.12
1987-88	9.36	10.79	1.29
1988-89	13.37	15.40	1.91
1989-90	15.30	17.81	2.17
1990-91	13.12	15.62	1.67
1991-92	12.66	15.46	1.72
1992-93	13.19	16.73	1.75
1993-94	14.58	18.77	1.93
1994-95	16.97	22.07	2.32
1995-96	16.65	22.50	2.33
1996-97	17.15	23.43	2.27
1997-98	15.21	21.61	2.01
1998-99	18.45	25.29	2.47
1999-2000	28.76	39.80	3.68

Table 1.7

Trends in CED

year	CED as % of total tax	CED as % of indirect tax	CED as%of GDP
1981-82	27.30	34.41	3.62
1982-83	25.85	31.87	3.48
1983-84	28.68	34.62	3.67
1984-85	26.90	32.56	3.19
1985-86	24.01	28.68	2.94
1986-87	18.04	20.83	2.61
1987-88	18.02	20.79	2.49
1988-89	17.64	20.32	2.52
1989-90	17.66	20.55	2.50
1990-91	17.81	21.20	2.26
1991-92	17.23	21.04	2.34
1992-93	17.68	22.44	2.35
1993-94	16.56	21.33	2.19
1994-95	17.01	22.13	2.32
1995-96	17.61	23.79	2.46
1996-97	17.44	23.84	2.30
1997-98	17.51	24.88	2.32
1998-99	15.66	21.46	2.10
1999-2000	13.78	19.07	1.76

Table 1.8

Trends in customs duties

year	customs duty as % of total taxes	customs duty as % of GDP	customs duty as % of indirect tax
1981-82	35.05	4.65	44.18
1982-83	37.75	5.08	46.54
1983-84	40.14	5.13	48.44
1984-85	41.76	4.95	50.55
1985-86	46.51	5.70	55.56
1986-87	40.23	5.83	46.45
1987-88	40.66	5.63	46.91
1988-89	38.53	5.50	44.37
1989-90	40.02	5.68	46.59
1990-91	38.98	4.95	46.41
1991-92	37.63	5.10	45.96
1992-93	34.42	4.58	43.67
1993-94	30.82	4.08	39.70
1994-95	30.24	4.13	39.34
1995-96	29.71	4.15	40.14
1996-97	26.52	3.50	36.24
1997-98	21.00	2.78	29.84
1998-99	20.13	2.70	27.58
1999-2000	15.75	2.01	21.79

Table 1.9

Share of total, indirect and direct taxes in GDP

year	total tax as%of GDP	indirect tax as%of GPD	direct tax as % of GDP
1981-82	13.27	10.53	2.74
1982-83	13.46	10.91	2.54
1983-84	12.78	10.59	2.19
1984-85	11.85	9.79	2.06
1985-86	12.26	10.26	2.00
1986-87	14.49	12.55	1.94
1987-88	13.84	12.00	1.84
1988-89	14.28	12.40	1.88
1989-90	14.18	12.18	2.00
1990-91	12.70	10.67	2.03
1991-92	13.56	11.10	2.46
1992-93	13.30	10.48	2.82
1993-94	13.25	10.29	2.83
1994-95	13.64	10.49	3.15
1995-96	13.97	10.34	3.63
1996-97	13.21	9.67	3.54
1997-98	13.25	9.32	3.93
1998-99	13.41	9.79	3.62
1999-2000	12.79	9.24	3.55

Table 2.1
List of sectors and sub sectors

Sectors	ISIC Classification
Food manufacturing	**311 & 312**
1. Dairy products	31121
2. Canning of fruits and vegetables	31130
3. Canning of fish and sea food	31140
4. Vegetable ghee	31151
5. Other vegetable oils	31152
6. Cotton seed & inedible animal oil	31153&59
7. Rice milling	31161
8. Wheat & grain milling	31162 & 63
9. Bread & bakery products	31171
10. Biscuits & other bakery products	31172 & 79
11. Refined Sugar	31181
12. Blending of tea	31212
13. Feeds for animals& fowls	31221 & 22
14. Starch	31291
15. Edible salt	31292
16. Ice	31293
17. Other food products	31299
18. Beverage industries (spirits, fruit drinks &other soft drinks)	31310, 20, 41 & 49
Manufacture of Textiles	**320 & 321**
1. Cotton spinning	32011
2. Cotton weaving	32012
3. Woollen textiles	32020
4. Jute textiles	32030
5. Silk & artsilk textiles	32040
6. Narrow fabrics	32050
7. Finishing of textiles	32070
8. Made up textile goods	32120
9. Knitting mills	32130
10. Carpets & rugs (cotton & woollen)	32141, 42 & 49
11. Cordage , rope & twine	32150
12. Spooling & thread ball making	32160
13. Other textiles	32190
14. Wearing apparel	32210
15. Ginning & bailing of fibre	32500

Sectors	ISIC Classification
Wood, wood and cork products	**331**
1. Plywood and products	33120
2. Wood articles	33130
3. Hardboard & products	33140
4. **Furniture & fixture**	**332**
Paper & Paper products	**341**
1. Pulp & paper	34110
2. Paperboard	34120
3. Pulp, paper & board article	34130
4. Other paper products	34190
Printing & Publishing	**342**
1. Newspapers	34210
2. Books, periodicals & maps	34220
3. Job printing	34230
4. Printed cards & stationary	34240
5. Book binding	34250
6. Metal sheets & other printing	34260 & 90
Drugs & Pharmaceutical products	**350**
1. Medicines & basic drugs	35010
2. Unani & other medicines	35020, 40 & 90
3. Alkalies	35111
4. Acids, salts & intermediates	35112
5. Sulphuric acid	35113
6. Dyes, colors & pigments	35120
7. Compressed gases	35130
8. Fertilizers	35140
9. Pesticides & insecticides	35150
10. Synthetic resins	35160
11. Other industrial chemicals	35190

Sectors	ISIC Classification
Other Chemical products	**352**
1. Paints & varnishes	35210
2. Perfumes & cosmetic	35220
3. Soaps & detergents	35230
4. Polishes, waxes & candles	35240 & 70
5. Matches	35250
6. Other chemical products	35290

Products of petroleum & coal	**354**
1. Petroleum products	35410
Rubber Products	**355**
1. Tyres & tubes	35510
2. Retreading of tyres & tubes	35520
3. Rubber footwear	35591
4. Vulcanised rubber products	35592
5. Rubber belting	35593
6. Other rubber products	35599
Plastic products	**356**
1. Plastic footwear	35610
2. Other Plastic products	35690
Pottery , China & earthenware	**361**
1. Earthenware	36110
2. China & ceramics	36120
Other non-metallic mineral products	**369**
1. Bricks & tiles	36910
2. Cement	36920
3. Cement products	36930
4. Other non metallic mineral products	36990
Sectors	**ISIC Classification**
Iron & Steel industries	**371**
1. Iron & steel mills	37110
2. Iron & steel foundaries	37120
Non ferrous metal basic industries	**372**
1. Aluminium & aluminium alloys	37210
2. Other non ferrous metal alloys	37220 & 90
Metal products, machinery and Equipment	**38**
Fabricated metal products	**380 & 381**
1. Cutlery	38010
2. Hand & edge tools	38020
3. Metal furniture	38040
4. Structural metal products	38050
5. Metal stamping & coating	38060

6. Wire products	38080
7. Utensils	38090, 38110 & 20
8. Metal barrels & drums	38130
9. Tin cans & tin ware	38140
10. Metal trunks	38150
11. Bolts, nuts & rivets	38160
12. Plumbing equipment	38170
13. Safes , vaults & other metal products	38190
Non electrical Machinery	**382**
1. Engines & turbines	38210
2. Agricultural machinery	38220
3. Metal & woodworking machinery	38230
4. Textile machinery	38240
5. Other industrial machinery	38250
6. Sewing machines	38270
7. Other non electrical machinery	38290
Electrical machinery & supplies	**383**
1. Electrical industrial machinery	38310
2. Radio & television	38321
3. Electrical appliances	38330
4. Insulated wires & cables	38340
5. Electrical bulbs & tubes	38350
6. Batteries	38360
Transport equipment	**384**
1. Ships & boat building	38410 & 20
2. Rail road equipment	38430
3. Motor vehicles	38440
4. Cycles & pedicabs	38460
5. Other transport equipment	38490
Scientific & measuring instruments	**385**
Sports & athletic goods	**392**

TABLE 2.2

Percentage shares in manufacturing output, Employment and value added

	Industry(PISC)											
	food mfg. (311&312)				Beverage industries (313)				Tobacco mfg. (314)			
Year	units	output	empl.	value added	units	output	emp	value added	units	output	emp	value added
			%				%				%	
1980	494	20.80	12.90	20.12	35	1.18	.98	1.82	20	5.75	2.42	13.26
1982	675	21.38	14.77	20.62	42	1.27	1.02	2.38	20	5.03	2.09	13.19
1984	848	19.32	14.49	17.91	51	1.23	1.11	2.28	18	4.65	1.90	11.48
1985	730	19.37	14.32	17.65	51	1.34	1.16	2.21	18	4.16	1.52	10.15
1986	831	18.29	13.29	13.85	50	.96	.91	1.52	19	5.72	1.37	14.45
1987	822	18.97	13.32	15.95	52	1.03	1.04	1.79	15	3.93	1.46	10.08
1990	858	16.60	12.51	13.96	47	.82	.82	1.40	19	2.34	.85	6.35
1995	931	17.72	12.27	15.19	38	1.03	.89	1.59	15	2.32	1.02	6.18

	Industry(PISC)											
	Manufacture of Textile (320&321)				wearing apparel (322)				gin.&bailing of fibres(325)			
Year	units	output	emp.	value added	units	output	emp.	value added	units	output	emp.	value added
			%				%					%
1980	914	17.37	31.18	15.93	56	6.74	1.07	.89	261	6.74	1.87	2.66
1982	908	18.47	26.39	16.13	47	5.33	.91	.53	235	5.33	1.37	1.26
1984	895	16.21	23.86	15.90	55	6.03	1.30	.53	303	6.03	1.56	1.45
1985	980	16.56	23.43	15.54	76	5.91	1.63	1.13	283	5.91	1.42	2.07
1986	1013	17.72	23.50	16.09	94	4.70	1.87	.91	250	4.70	1.22	.93
1987	1045	17.48	22.26	17.35	105	5.24	1.96	1.57	302	5.24	1.83	1.47
1990	1135	24.47	38.22	26.35	153	5.29	2.73	1.36	343	5.29	1.40	1.16
1995	1068	28.79	28.06	22.31	130	5.05	2.23	1.36	299	5.05	.71	1.17

Industry(PISC)

	Leather products (323)				leather footwear (324)			
Year	units	output %	emp.	value added	units	output	emp. %	value added
1980	61	1.42	.73	1.06	19	.66	1.18	.79
1982	63	1.53	.79	1.60	22	.16	.19	.11
1984	73	1.84	.87	1.07	20	.15	.15	.09
1985	81	2.09	.86	1.71	21	.21	.19	.21
1986	81	1.78	.72	1.39	21	.18	.16	.17
1987	86	2.61	1.05	.60	35	.66	1.28	.73
1990	80	2.32	1.16	1.09	24	.56	1.15	.46
1995	77	1.40	.93	.78	15	.56	1.16	.50

Industry(PISC)

	drugs& pharmaceuticals(350)				industrial chemicals(351)				other chemical products(352)			
Year	units	output	emp %	value added	units	output %	emp.	value added	units	output	emp.	value added %
1980	103	3.15	4.07	4.31	80	3.90	5.43	5.54	148	2.37	2.52	2.46
1982	99	2.81	4.05	3.94	89	4.58	5.70	7.30	134	2.09	2.03	2.61
1984	119	3.06	4.91	3.98	93	5.51	6.42	8.67	162	2.43	2.12	3.12
1985	123	3.08	4.67	4.28	89	5.60	6.17	8.31	161	2.48	2.16	3.51
1986	133	2.95	4.47	3.46	97	5.65	5.92	7.96	168	3.01	2.84	3.11
1987	129	3.26	5.20	3.77	94	4.97	5.54	6.98	166	2.54	2.48	3.50
1990	146	3.76	5.82	4.63	120	5.39	5.59	7.85	134	2.25	1.76	2.56
1995	166	3.68	6.38	4.75	116	5.80	6.42	8.53	128	2.63	2.62	2.98

Industry(PISC)

	Rubber products(355)				Plastic products(356)				Petroleum Refining (353)			
Year	units	output	empl. %	value added	units	output	emp. %	value added	units	output	emp. %	value added
1980	52	.94	1.21	.97	31	.27	.52	.30	3	14.84	1.14	6.87
1982	52	1.28	2.09	1.62	39	.51	.85	.56	3	13.07	1.22	.87
1984	49	1.25	2.06	1.26	48	.62	.93	.63	3	11.88	.98	1.39
1985	44	1.27	2.39	1.56	52	.57	.86	.58	3	12.04	1.18	7.08
1986	50	.93	1.25	1.05	64	.65	.83	.59	3	8.75	1.05	8.19
1987	49	.88	1.29	.94	64	.58	.71	.46	3	8.60	1.12	5.89
1990	49	.81	1.18	.96	67	.53	.74	.55	3	8.10	.94	2.05
1995	41	.74	1.23	.88	83	.57	.77	.41				

Industry(PISC)

	Petroleum&coal Products(354)				fabricated metal products except machinery(380)				Non electrical machinery(382)			
Year	units	output	empl. %	value added	units	output	empl. %	value added	units	output	empl. %	value added
1980	12	.57	.22	.51	272	1.10	2.28	1.06	273	1.69	3.58	1.71
1982	13	.88	.24	.65	256	.90	1.56	1.18	300	1.92	3.52	2.38
1984	12	.71	.22	.52	252	.82	1.46	1.01	376	3.31	4.18	2.46
1985	14	.64	.12	.41	231	.71	1.40	.85	343	2.90	4.08	2.42
1986	16	.65	.16	.50	256	.86	1.53	.83	360	2.76	3.73	1.87
1987	15	.61	.17	.74	260	.91	1.49	1.04	367	2.41	3.53	1.77
1990	17	.65	.24	.93	211	.89	1.35	.86	259	2.34	4.58	2.52
1995					171	.68	1.11	.69	193	1.81	3.99	1.61

Industry (PISC)

Year	Elect. machinery (383) units	output	emp.	value added	Transport equipment (384) units	output	emp.	value added	scientific&measuring instruments(385&386) units	\output	emp.	value added
			%				%				%	
1980	185	3.15	4.53	3.47	122	2.87	7.34	2.47	52	.26	.54	.29
1982	183	2.77	3.70	3.15	94	3.00	5.50	2.52	40	.19	.43	.17
1984	198	2.89	4.04	3.02	120	3.41	5.18	2.57	57	.27	.57	.23
1985	179	3.04	3.81	3.36	127	3.71	4.54	2.50	52	.23	.45	.14
1986	178	3.52	4.39	2.51	136	3.80	4.96	2.36	55	.25	.42	.13
1987	191	3.75	4.67	3.27	140	4.42	5.55	3.64	55	.31	.56	.27
1990	220	3.31	3.52	4.09	130	3.88	4.14	2.59	59	.28	.41	.24
1995	183	4.46	4.77	7.67	121	4.30	3.35	3.50	63	.32	.43	.25

Industry(PISC)

Year	Iron &steel (371) units	output	empl.	value added	non ferrous metal basic industries(372) units	output	empl.	value added
			%				%	
1980	197	3.93	4.58	3.98	14	.07	.12	.05
1982	184	5.18	10.66	5.11	8	.02	.07	.03
1984	186	6.70	10.46	10.55	10	.02	.08	.02
1985	200	5.61	11.49	3.97	7	.02	.06	.02
1986	198	6.81	12.25	7.46	8	.03	.08	.03
1987	218	6.98	10.90	6.50	11	.03	.07	.03
1990	187	5.83	12.08	5.54	14	.04	.07	.03
1995	136	3.88	10.52	4.15	12	.04	.05	.02

Industry(PISC)

Year	Wood& cork Products(331) units	output	empl. %	value added	wood furniture& fixtures(332) units	output	emp.	value added	paper&paper products(341) units	output	emp.	value added
1980	22	.24	.33	.27	35	.10	.22	.15	38	1.32	2.29	1.48
1982	24	.19	.36	.23	40	.12	.25	.18	38	1.04	1.73	1.30
1984	29	.22	.36	.28	50	.15	.28	.17	47	1.03	1.64	1.02
1985	32	.26	.38	.28	46	.07	.17	.08	49	1.06	1.68	1.13
1986	33	.23	.46	.20	53	.13	.23	.12	47	.89	1.25	.88
1987	38	.29	.49	.34	54	.13	.21	.12	56	1.28	1.55	1.11
1990	39	.21	.32	.27	59	.15	.20	.16	74	1.49	1.36	1.57
1995	45	.21	.34	.23	36	.05	.09	.05	75	1.50	1.46	1.61

Industry(PISC)

Year	Printing& publishing (342) units	output	empl. %	value added	China& earthenware pottery (361) units	output	emp. %	value added	glass& glass products (362) units	output	empl. %	value added
1980	139	.66	1.52	.75	17	.12	.38	.19	28	.28	.60	.33
1982	131	.90	2.39	1.17	18	.17	.36	.24	30	.38	.75	.33
1984	137	.88	1.93	1.11	18	.17	.38	.23	29	.37	.72	.62
1985	143	.92	2.14	1.13	12	.18	.39	.24	22	.43	.80	.53
1986	148	.91	2.35	1.12	17	.16	.34	.26	28	.45	.94	.63
1987	151	.84	2.54	.95	25	.20	.54	.35	27	.48	.89	.57
1990	110	1.00	1.49	2.26	20	.16	.38	.26	31	.41	.68	.68
1995	96	1.00	1.61	2.01	32	.12	.26	.20	27	.23	.49	.70

Industry(PISC)

Year	Other non-metalic Mineral products(369) units	output	empl. %	Value added	Sports &athletic goods (392) units	output	emp. %	value added
1980	69	3.25	3.65	5.91	22	.11	.19	.10
1982	79	3.84	4.61	8.11	23	.13	.11	.06
1984	96	3.59	5.33	6.14	27	.16	.19	.11
1985	103	3.94	5.94	6.50	26	.18	.22	.12
1986	100	4.38	5.64	7.69	28	.19	.22	.15
1987	111	4.39	5.72	7.68	30	.22	.25	.19
1990	110	3.71	5.04	6.62	37	.40	.64	.38
1995	87	3.90	4.67	7.15	34	.54	.42	.36

TABLE 2.3

Shares of sub sectors in aggregated sectoral total output, employment& Value added

Chemical, Rubber and Plastics Industry(PISC)

Year	Medicines & basic drugs output	emp.	value added	unani& other medicines output	emp.	value added	Alkalies output	emp.	value added	Acids, salts& intermediates output	emp.	value added
1980	11.64	41.88	19.74	0.46	1.42	0.81	1.95	5.38	3.46	0.49	1.12	0.91
1982	11.16	25.05	53.89	0.50	1.20	2.48	1.72	4.64	9.15	0.63	1.49	2.29
1984	11.47	26.50	43.39	0.55	1.29	2.53	1.77	5.57	7.80	0.60	1.29	1.84
1985	11.45	25.19	49.28	0.54	1.44	2.27	1.45	4.25	6.29	0.67	1.46	2.72
1986	12.40	25.48	25.26	0.64	1.58	3.16	2.18	5.93	9.97	0.67	1.38	2.02
1987	14.18	29.98	48.25	1.02	1.50	5.80	2.24	6.06	10.61	1.02	1.97	3.26
1990	16.82	33.93	55.80	0.69	1.86	3.20	2.93	6.84	13.75	0.76	1.26	2.61
1995	19.04	31.57	51.96	1.13	2.33	3.78	2.79	3.75	7.21	1.34	1.57	2.71

Industry(PISC)

Year	Sulphuric acid output	emp.	value added	Dyes, colors & Pigments output	emp.	value added	Compressed gases output	emp.	value added	Fertilizers output	emp.	value added
1980	0.13	0.35	0.10	0.15	0.46	0.24	0.59	2.22	1.09	8.40	17.52	15.49
1982				0.25	0.80	1.74	0.92	1.73	5.34	10.49	18.79	61.44
1984	0.11	0.27	0.29	0.23	0.65	1.40	0.74	1.78	2.37	13.70	19.19	66.06
1985	0.29	0.58	0.88	0.22	0.69	1.33	0.74	1.93	5.13	13.82	18.32	64.54
1986	0.23	0.57	0.72	0.26	0.71	1.37	1.28	2.47	5.72	15.66	18.93	67.12
1987	0.20	0.76	0.81	0.28	0.76	1.51	0.50	1.35	1.72	13.99	17.76	63.22
1990	0.26	0.54	0.57	0.06	0.26	0.29	0.78	1.67	1.49	12.33	17.32	58.74
1995	0.51	0.52	1.22	0.47	0.91	1.44	0.90	1.18	2.32	16.84	18.52	62.24

Industry(PISC)

	Pesticides& insecticides			Synthetic resins			other industrial chemicals			Paints&varnishes		
Year	output	emp.	value added	output	emp.	value added	output	emp.	value added	output	emp.	value added
1980	0.29	0.98	0.38	1.26	5.54	2.22	1.73	2.38	2.53	2.25	3.35	3.98
1982	0.31	1.12	1.63				1.44	1.12	5.57	2.06	2.90	11.83
1984	1.01	1.25	4.56	2.20	5.22	10.04	1.24	1.14	5.50	2.06	3.11	8.23
1985	1.25	1.44	4.85	2.27	5.49	10.81	1.10	0.99	3.45	1.68	2.28	6.37
1986	1.63	3.24	2.94	1.85	1.49	7.12	1.26	1.13	3.01	2.28	3.02	7.55
1987	1.47	1.90	4.88	1.95	2.30	8.37	1.53	0.92	5.62	1.94	2.53	6.75
1990	3.78	2.58	***	2.75	2.54	9.23	1.22	0.98	1.92	1.30	1.90	4.19
1995	4.14	4.19	10.84	2.91	2.35	8.13	1.83	1.14	3.89	2.69	2.90	6.65

	Perfumes& cosmetics			Soaps & detergents			Polishes& waxes			Matches		
Year	output	emp.	value added	output	emp.	value added	output	emp.	value added	output	emp.	value added
1980	1.08	3.33	0.72	3.33	4.22	2.55	0.67	1.75	1.64	0.92	2.91	1.33
1982	1.09	2.55	5.97	2.78	3.28	8.36				0.87	1.88	3.93
1984	2.22	2.21	10.65	3.20	3.56	9.94	0.44	0.50	2.13	0.77	1.58	2.70
1985	3.11	2.90	17.78	2.80	3.61	10.40	0.46	0.60	2.15	0.85	1.89	3.28
1986	3.35	4.31	7.50	5.22	5.98	16.53	0.54	0.65	1.32	1.00	2.09	3.55
1987	3.11	3.08	18.67	4.44	5.12	15.80	0.89	1.58	3.58	0.89	1.58	3.58
1990	3.05	2.45	5.22	3.84	4.05	13.38	0.50	0.54	2.32	1.16	1.26	5.76
1995	2.54	2.65	5.00	7.16	5.01	18.76	0.64	1.16	2.31	0.57	1.24	0.57

	Other chemical products			petroleum products			tyres&tubes			rubber footwear		
Year	output	empl.	value added	output	empl.	value added	output	empl.	value added	output	empl.	value added
1980	0.83	1.09	1.54	2.19	1.48	2.43	1.62	2.35	2.26	1.32	0.38	1.52
1982	1.46	1.83	5.48	3.50	1.49	8.89	1.51	3.00	6.60	3.12	0.29	13.95
1984	0.82	0.97	2.28	2.77	1.22	5.98	1.67	2.74	4.07	2.66	0.36	8.92
1985	0.72	0.95	2.20	2.47	0.68	4.93	1.89	2.58	8.43	2.70	0.50	9.19
1986	0.88	1.02	2.51	2.88	0.99	6.27				1.09	0.48	2.89
1987	0.81	1.18	2.39	2.87	1.06	10.61				1.18	0.47	3.47
1990	0.58	0.57	1.62	1.76	0.64	6.31	2.21	3.35	8.05	1.05	0.50	2.78
1995	0.73	0.89	1.60				2.49	3.40	7.02	1.11	0.48	2.21

Industry(PISC)

Year	Vulcanised rubber products			Rubber belting			Plastic footwear			Other plastic products		
	output	empl.	value added	output	empl.	value added	output	empl.	value added	output	empl.	value added
1980	0.26	0.55	0.37	0.39	1.01	0.46	0.07	0.12	0.05	0.96	3.31	1.38
1982	0.14	0.46	0.61	0.15	0.39	0.63	0.06	0.09	0.12	1.99	5.16	7.48
1984	0.30	0.33	0.61	0.15	0.38	0.36	0.04	0.08	0.11	2.38	5.17	7.20
1985	0.08	0.24	0.27	0.15	0.40	0.42	0.05	0.14	0.15	2.18	4.77	6.78
1986	0.37	0.51	0.87	0.23	0.42	0.66	0.04	0.07	0.09	2.83	4.95	7.31
1987	0.30	0.49	0.94	0.19	0.47	0.59	0.03	0.06	0.09	2.67	4.23	6.54
1990	0.30	0.41	0.65	0.10	0.32	0.31	0.03	0.05	0.06	2.44	4.48	6.91
1995	0.30	0.33	0.75	0.03	0.06	0.05	0.09	0.19	0.04	3.01	3.92	4.74

Metal products, machinery & Equipment Industry (PISC)

Year	Cutlery			Hands&edge Tools			Metal furniture			Structural metal products		
	output	empl.	value added	output	empl.	value added	output	empl.	value added	output	empl.	value added
1980	0.12	0.32	0.09	0.12	0.30	0.11	0.23	0.19	0.23	0.43		0.59
1982	0.07	0.11	0.06				0.12	0.24	0.12	0.26	0.79	0.41
1984	0.10	0.16	0.06	0.06	0.19	0.07	0.15	0.27	0.17	0.18	0.45	0.24
1985	0.06	0.09	0.02	0.05	0.17	0.07	0.15	0.23	0.17			
1986	0.08	0.19	0.10	0.15	0.26	0.19	0.09	0.12	0.12	0.11	0.39	0.31
1987	0.17	0.28	0.17	0.13	0.22	0.11	0.14	0.21	0.13	0.12	0.36	0.23
1990	0.08	0.19	0.05	0.06	0.08	0.02	0.01	0.23	0.12	0.19	0.71	0.34
1995	0.08	0.24	0.06				0.04	0.12	0.03	0.07	0.19	0.04

Industry(PISC)

	Metal stamping & coating			Heating &cooking equipment			Wire products			Utensils aluminium		
Year	output	empl.	value added	output	empl.	value added	output	empl.	value added	output	empl.	value added
1980	0.76	0.86	1.08	0.35	0.94	0.44	2.48	0.68	1.50	0.58	1.45	0.32
1982	1.76	0.85	3.35	0.43	0.89	0.67	1.81	0.96	1.15	0.74	1.69	0.56
1984	0.99	0.83	1.89	0.44	1.06	0.55	1.23	0.73	1.04	0.45	1.32	0.49
1985	0.91	0.90	1.72	0.35	1.00	0.46	0.82	0.61	0.73	0.45	1.07	0.38
1986	1.06	1.09	1.06	0.56	0.95	0.94	1.26	0.77	1.29	0.72	1.06	0.63
1987	0.67	0.78	0.81	0.34	0.76	0.56	1.59	1.10	1.26	1.01	1.56	1.51
1990	1.47	0.71	0.81	0.46	0.67	0.49	1.17	0.87	0.76	0.80	1.70	0.74
1995	0.21	0.41	0.13	0.10	0.36	0.09	0.69	0.78	0.27	1.54	1.82	1.30

Industry(PISC)

	Metal barrels& drums			Tin cans & tin ware			Bolts,nuts& rivets			Plumbing equipment		
Year	output	empl.	value added	output	empl.	value added	output	empl.	value added	output	empl.	value added
1980	0.87	0.55	1.52	3.25	4.18	2.81	0.62	0.88	0.69	0.18	0.53	0.21
1982	0.54	0.48	0.56	1.41	3.53	1.79	0.96	1.14	1.20	0.14	0.53	0.18
1984	0.51	0.33	0.56	1.26	2.48	1.86	0.66	1.27	0.93	0.10	0.45	0.13
1985	0.46	0.37	0.61	1.11	3.37	1.65	0.63	1.47	0.77	0.15	0.59	0.20
1986	0.56	0.54	0.87	1.04	2.21	1.47	0.66	1.42	1.03	0.16	0.67	0.25
1987	0.54	0.50	0.96	1.09	2.13	1.34	0.66	1.44	0.88	0.15	0.52	0.19
1990	0.37	0.57	0.48	1.06	1.82	1.14	0.56	1.06	0.65	0.11	0.63	0.15
1995	0.10	0.39	0.06	1.70	2.06	0.16	0.38		0.41			

Industry(PISC)

Year	Other metal Products output	empl.	value added	Engines &turbines output	empl.	value added	Agricultural machinery output	empl.	value added	Metal&wood working machinery output	empl.	value added
1980	0.71	2.71	0.77	0.90	1.24	0.57	9.41	4.56	5.68	1.81	3.97	4.18
1982	0.71	1.51	0.87	1.53	1.31	0.69	5.77	4.90	4.27	2.47	4.62	5.62
1984				0.11	0.50	0.14	21.18*	8.13	11.14	1.29	3.93	3.64
1985				0.11	0.47	0.12	18.41	9.00	9.82	1.55	3.95	3.86
1986	0.61	2.04	1.12	0.07	0.33	0.10	14.63	6.95	8.73	1.17	4.08	3.03
1987	0.51	1.34	0.85	0.06	0.30	0.07	13.06	6.92	8.88	0.17	4.08	0.17
1990	0.46	1.49	0.56	0.06	0.31	0.05	9.97	5.79	6.77	0.08	3.76	0.05
1995	0.47	1.75	0.42	0.17	0.24	0.06	8.42	5.89	4.61	0.38	4.50	0.67

Industry(PISC)

Year	Textile machinery output	empl.	value added	Other industrial Machinery output	empl.	value added	Sewing machines output	empl.	value added	Other non-electrical machinery output	empl.	value added
1980	0.59	1.20	0.65	3.02	5.52	4.36	0.40	0.99	0.44	2.50	3.24	3.15
1982	1.03	2.03	1.09	6.27	6.28	7.47	1.02	1.65	1.35	3.78	4.93	4.84
1984	0.81	2.07	0.95	3.78	6.12	4.31	0.88	1.32	1.39	2.82	5.32	4.84
1985	0.44	1.73	0.53	2.91	6.06	5.35	0.77	1.38	0.92	3.23	5.90	5.53
1986	0.51	1.66	0.84	4.28	5.48	5.23	0.96	1.35	1.31	3.07	6.20	4.98
1987	0.65	1.71	0.98	2.12	5.20	1.45	0.80	1.32	0.95	2.81	5.30	3.59
1990	0.55	1.80	0.72	3.83	7.64	4.32	0.94	1.18	1.01	5.30	11.11	8.67
1995	0.13	0.61	0.14	1.76	8.49	0.54	1.19	1.24	1.33	3.59	7.50	4.40

Industry(PISC)

	Electrical industrial machinery			Radio&television			Electrical appliances			Insulated wires&cables		
Year	output	emp.	value added	output	emp.	value added	output	emp.	value added	output	emp.	vad
1980	9.28	5.76	11.06	4.72	1.23	4.67	1.42	0.95	1.33	4.25	1.34	3.83
1982	8.03	6.40	9.20	4.24	1.21	4.57	3.01	3.92	2.50	2.89	1.43	4.08
1984	5.88	6.02	8.99	5.23	1.34	3.84	2.59	3.84	3.76	1.88	1.70	3.75
1985	5.34	5.62	7.46	6.23	2.27	8.46	3.21	4.28	3.58	1.94	1.53	3.32
1986	7.22	6.65	6.84	6.07	2.28	4.66	2.54	3.90	2.77	5.04	1.72	4.47
1987	6.12	6.63	6.42	5.19	2.22	3.15	4.06	4.53	4.44	2.15	2.16	5.29
1990	8.22	6.13	13.13	3.46	1.41	4.31	5.36	5.31	5.12	1.97	2.36	3.14
1995	7.82	7.82	10.52				12.58	9.59	18.86	0.10	1.78	0.09

	Electrical bulbs & tubes			Batteries			Other electrical supplies			Motor vehicle		
Year	output	emp.	value added	output	emp.	value added	output	emp.	value added	output	emp.	value added
1980	2.62	2.17	5.84	4.09	3.11	4.27	3.97	1.32	2.23	20.22	15.73	17.04
1982	2.89	2.47	4.08	3.35	3.15	4.70	2.48	2.15	2.35	27.95	12.24	18.39
1984	1.88	1.65	3.75	2.60	2.83	3.93	1.53	2.36	2.01	23.42	11.99	20.42
1985	1.94	1.25	3.32	2.66	2.88	3.90	0.94	1.68	1.32	26.50	12.72	17.90
1986	1.99	1.55	3.58	2.64	2.76	4.15	1.52	1.60	1.70	25.29	14.60	22.17
1987	2.15	0.80	5.29	2.42	2.72	3.23				3.17	10.52	0.94
1990	1.97	1.25	3.14	2.41	2.54	3.29				3.88	10.46	2.17
1995	0.10	0.38	0.09	2.14	2.42	2.30	2.20	2.95	2.19	0.61	9.06	0.57

Industry PISC

	Motor cycles& Auto rickshaw			pedicabs			Building&r railroad equipment			Surgical instruments		
Year	output	emp.	value added	output	emp.	value added	output	emp.	value added	output	emp.	value added
1980	3.87	0.48	2.13	2.26	0.65	2.34	3.72	9.46	4.28	2.12		2.59
1982	2.99	0.28	2.52	2.99	5.38	2.52	2.17	6.89	4.54	1.82	3.68	1.56
1984	3.40	0.85	1.66	3.02	5.87	2.70	1.30	6.56	1.90	2.56	4.02	2.53
1985	2.32	1.06	2.06	2.32	3.22	2.06	1.61	6.36	4.59	2.06	4.80	1.34
1986	3.45	0.75	3.63	3.45	5.27	3.63	1.34	5.89	2.81	2.05	4.38	1.42
1987	6.65	0.63	6.78	6.65	11.35	6.78	1.43	6.03	2.37	2.43	4.11	2.49
1990	1.20	1.59	1.11	1.20	3.22	1.11	1.98	6.10	2.76	2.49	5.09	2.02
1995	3.71	1.47	2.71	3.71	4.33	2.71				2.77	4.53	1.78

Textiles
Industry PISC

	Cotton spinning			Cotton weaving			Woollen textile			Jute textiles		
Year	output	emp.	value added	output	emp.	value added	output	emp.	value added	output	emp	value added
1980	42.88	41.10	41.23	21.38	27.90	22.89	4.20	3.80	3.61	3.33	6.77	4.27
1982	46.04	44.02	46.97	17.71	24.38	18.01	4.51	4.47	5.86	4.27	7.64	7.08
1984	41.55	41.31	41.66	18.14	23.11	17.19	3.81	3.96	3.45	4.76	8.04	5.50
1985	42.47	40.92	41.85	15.49	19.27	14.96	4.69	4.50	4.97	5.57	8.53	6.85
1986	45.98	25.41	25.06	9.21	9.30	10.26	4.12	4.04	3.47	4.06	8.20	6.10
1987	38.59	38.86	42.67	11.43	12.88	10.34	4.07	4.16	3.40	3.61	8.21	5.06
1990	49.24	47.97	54.33	11.65	10.75	11.36	2.02	2.42	1.62	2.86	5.86	4.34
1995	55.89	53.02	56.68	13.10	11.58	13.27	1.10	1.94	1.39	1.11	2.96	1.73

Industry (PISC)

	Silk & artsilk textile			Narrow fabrics			Finishing of textiles			Made up textile goods		
Year	output	empl.	value added	output	empl.	value added	output	empl.	value added	output	emp.	value added
1980	9.97	6.88	8.62	0.28	0.19	0.28	3.12	3.53	3.39	0.62	1.33	0.92
1982	9.06	5.78	6.45	0.33	0.19	0.17	3.46	3.84	4.22	1.08	0.78	0.65
1984	9.22	6.39	9.76	0.32	0.17	0.24	3.82	4.34	3.70	0.95	0.79	0.45
1985	10.16	6.84	10.57	0.13	0.13	0.11	4.42	4.78	4.24	0.75	1.00	0.63
1986	15.14	11.94	15.64	0.43	0.15	0.18	4.43	4.55	3.61	1.42	0.98	0.65
1987	15.61	12.78	16.06	0.50	0.11	1.22	5.33	5.33	3.54	1.51	1.18	0.76
1990	13.64	11.48	14.67	0.08	0.09	0.05	5.48	4.95	3.16	1.32	0.85	0.74
1995	8.18	7.64	7.97	0.30	0.28	0.15	5.82	5.64	4.82	0.60	0.69	0.46

Industry(PISC)

	Kntting mills			Carpets& rugs			Cordage,rope & twine			Spoolling& threadball making		
Year	output	emp.	value added	output	emp.	value added	output	empl.	value added	output	emp.	value added
1980	2.16	1.33	3.49	1.42	1.52	1.97	0.26	0.41	0.33	1.68	1.28	1.39
1982	2.60	2.18	2.44	1.68	1.26	1.69	0.17	0.34	0.24	1.11	1.07	1.07
1984	6.27	3.25	10.87	1.18	1.25	1.45	0.14	0.28	0.20	0.92	0.89	0.79
1985	4.57	3.72	3.73	1.00	1.01	1.27	0.13	0.24	0.17	0.84	0.76	0.73
1986	4.80	4.32	3.11	1.01	0.97	1.13	0.10	0.20	0.14	0.67	0.63	0.58
1987	5.67	5.08	5.21	1.21	1.03	1.11	0.09	0.19	0.09	0.57	0.60	0.48
1990	3.95	4.20	2.80	0.75	0.78	0.77	0.04	0.09	0.04	0.26	0.30	0.22
1995	3.52	4.73	3.34	0.72	0.67	0.67	0.02	0.06	0.01	0.12	0.19	0.13

Year	Manufacturing of Textiles			Ready made garments			Ginning &bailing of fibre		
	output	empl.	value added	output	empl.	value added	output	emp.	value added
1980	4.71	1.17	2.21	3.99	3.32	4.79	37.24	5.79	15.83
1982	4.77	1.31	2.68	3.74	3.34	3.20	27.79	5.02	7.55
1984	3.17	1.16	1.42	5.60	5.15	3.34	35.12	6.19	8.81
1985	2.95	1.94	3.09	6.85	6.50	6.77	33.22	5.67	12.44
1986	1.25	0.81	0.66	7.21	7.29	5.14	24.59	4.80	5.49
1987	2.38	1.49	1.76	9.12	8.01	8.20	27.17	7.57	7.76
1990	1.37	0.76	0.90	6.89	9.10	4.81	20.09	4.78	4.20
1995	4.34	2.88	3.30	4.71	7.19	5.67	16.71	2.36	4.92

Industry(PISC)
Food & Beverage

Year	Dairy products except ice cream			Ice cream			Canning of fruits & vegetables			Canning of fish & sea food		
	output	emp.	value added	output	emp.	value added	output	empl.	value added	output	emp.	value added
1980	0.08	0.20	0.03	0.20	0.61	0.23	0.37	0.69	0.29	1.41	1.28	0.45
1982	0.50	0.48	0.33	0.25	0.63	0.29	0.36	0.66	0.29	1.01	0.57	0.45
1984	0.54	0.75	0.32	0.49	1.47	0.57	0.32	0.58	0.43	0.51	0.36	0.12
1985	1.21	1.15	0.73	0.46	1.17	0.54	0.44	0.58	0.43	1.81	0.75	2.18
1986	1.47	1.63	0.74	0.65	1.37	0.97	0.36	0.58	0.32	1.72	0.53	0.32
1987	1.49	1.73	0.87	0.48	1.30	0.66	0.21	0.33	0.16	1.59	0.47	0.33
1990	1.97	1.94	1.55	0.58	1.32	0.69	0.80	1.30	0.85	1.19	0.41	0.48
1995	3.35	3.32	3.27	0.98	2.33	1.35	0.60	1.13	0.61	0.49	0.13	0.18

	Vegetable ghee			Other vegetable Oils			Cotton seed oils			Rice milling		
Year	output	empl.	value added	output	empl.	value added	output	empl.	value added	output	emp.	value added
1980	22.81	23.27	15.75	1.55	0.73	0.98	3.14	1.57	1.60	1.19	1.23	0.70
1982	21.29	20.75	14.77	2.06	0.61	1.01	1.40	1.53	0.62	1.40	1.53	0.62
1984	23.67	26.50	13.70	1.55	0.80	0.54	1.53	2.05	0.89	1..53	2.05	0.89
1985	*21.42*	*20.45*	*11.86*	*1.56*	*0.79*	*0.79*	*2.61*	*1.33*	*1.01*	*0.87*	*1.46*	*0.41*
1986	*18.57*	*18.69*	*6.47*	*1.68*	*0.55*	*0.91*	*4.32*	*4.28*	*3.72*	*1.12*	*1.56*	*0.55*
1987	*19.97*	*20.67*	*8.83*	*2.45*	*1.17*	*1.32*	*2.45*	*1.32*	*1.17*	*1.88*	*1.72*	*1.39*
1990	*17.24*	*19.18*	*6.64*	*1.84*	*0.73*	*0.84*	*1.56*	*0.95*	*0.54*	*1.75*	*1.11*	*1.56*
1995	*16.72*	*9.00*	*5.87*	*4.58*	*4.23*	*1.57*	*1.66*	*0.67*	*0.88*	*1.16*	*1.25*	*0.72*

Industry(PISC)

	Wheat &grain milling			Bread &bakery products			Biscuits&other bakery products			Refined sugar		
Year	output	emp.	value added	output	emp.	value added	output	empl.	value added	output	emp.	value added
1980	9.44	4.34	2.46	0.24	0.77	0.17	0.72	1.55	0.60	23.62	34.14	27.51
1982	10.71	3.87	1.78	0.26	0.70	0.14	0.72	1.26	0.56	24.40	38.72	29.97
1984	11.80	4.04	1.68	0.35	1.36	0.29	0.86	2.34	0.65	24.04	47.37	32.39
1985	12.30	3.52	2.64	0.28	1.08	0.24	0.92	1.88	1.07	22.37	40.98	31.15
1986	10.48	3.52	1.23	0.27	0.87	0.22	1.42	2.87	1.36	19.98	37.82	23.31
1987	12.05	3.71	1.70	0.26	0.83	0.27	1.46	3.00	1.29	24.47	39.53	32.94
1990	15.92	3.96	5.70	0.24	0.45	0.21	1.41	2.64	1.28	26.28	45.05	36.16
1995	13.13	4.34	2.95	0.30	0.79	0.29	1.34	2.80	1.81	26.22	47.68	34.83

Year	Blending of tea output	empl.	value added	Animal&fowl Feed output	empl.	value added	Starch output	empl.	value added	Edible salt refining output	emp.	value added
1980	6.70	4.13	3.97	1.21	4.38	0.49				0.03	0.34	0.06
1982	7.48	6.57	3.17	1.92	0.88	0.70	1.12	2.21	1.08	0.03	0.19	0.04
1984	3.46	4.04	0.78	2.02	1.14	0.71	1.12	2.83	2.79	0.02	0.19	0.05
1985	6.66	3.88	2.42	2.09	0.82	1.00	1.18	1.92	3.02	0.03	0.29	0.08
1986	6.30	5.05	3.55	1.93	1.10	0.69	1.23	1.96	3.05	0.03	0.29	0.06
1987	5.52	2.48	3.03	2.01	1.15	0.70	1.19	2.36	3.18	0.02	0.22	0.04
1990	6.72	2.62	2.44	2.80	1.20	1.72	1.68	2.52	5.13	0.02	0.19	0.07
1995	7.15	4.43	4.03	3.42	1.44	1.60	1.76	3.13	5.27	0.02	0.28	0.05

Year	Manufacturing of Ice output	emp.	value added	Beverages output	emp.	value added
1980	0.09	0.38	0.09	4.25	6.04	5.18
1982	0.11	0.37	0.10	4.60	5.73	6.59
1984	0.14	0.50	0.12	4.88	7.65	7.19
1985	0.08	0.28	0.07	5.39	6.84	7.36
1986	0.08	0.26	0.07	3.85	5.84	5.08
1987	0.07	0.27	0.06	4.31	6.56	6.45
1990	0.06	0.21	0.07	4.17	5.79	6.44
1995	0.16	0.15	0.08	4.89	6.30	6.94

Other non-metallic mineral products

Industry (PISC)

	Pottery & earthenware			China&ceramics			Glass&glass products			Bricks&tiles		
Year	output	empl.	value added	output	empl.	value added	output	empl.	value added	output	emp.	value added
1980	0.06	0.15	0.04	3.31	8.03	2.95	6.48	12.87	5.18	2.89	5.80	2.09
1982	0.08	0.19	0.04	3.91	6.14	2.67	8.60	13.10	6.93	3.40	6.77	3.01
1984	0.03	0.06	0.02	4.05	5.87	3.35	8.84	11.23	7.64	4.02	5.57	4.58
1985	0.01	0.02	0.01	3.90	5.43	3.19	9.51	11.27	8.60	3.82	4.02	4.44
1986	0.01	0.01	0.00*..	3.25	4.96	3.02	9.02	13.53	6.65	4.47	5.80	4.59
1987	0.03	0.04	0.02	4.00	7.49	4.01	9.47	12.48	7.85	4.26	6.51	4.38
1990	0.02	0.03	0.01	3.71	6.24	3.45	9.61	11.17	9.17	2.86	4.41	2.81
1995	0.19	0.13	0.15	2.74	4.71	2.42	5.37	9.02	4.13	5.18	13.73	4.91

Industry(PISC)

	Cement			Cement products			Other non-metallic Mineral products		
Year	output	emp.	value added	output	emp.	value added	output	empl.	value added
1980	82.01	65.49	84.62	3.34	4.27	2.72	2.08	3.42	2.40
1982	78.01	67.73	82.86	5.59	5.41	4.18	0.41	0.66	0.31
1984	77.54	71.15	79.46	4.24	4.21	3.65	1.14	1.81	1.17
1985	77.52	71.76	79.83	4.60	6.45	3.37	0.64	1.06	0.56
1986	78.39	69.99	80.92	4.45	5.05	4.54	0.40	0.67	0.27
1987	77.98	67.61	79.94	3.82	5.19	3.47	0.43	0.67	0.32
1990	79.98	72.00	81.74	3.27	5.25	2.51	0.55	0.92	0.31
1995	75.68	67.34	77.18	10.49	3.88	11.01	0.35	1.17	0.19

Paper, printing & publishing
Industry(PISC)

Year	Pulp&paper output	Pulp&paper emp.	Pulp&paper value added	Paper board output	Paper board emp.	Paper board value added	Pulp, paper& Board products output	Pulp, paper& Board products empl.	Pulp, paper& Board products value added
1980	17.19	11.57	16.67	35.38	37.66	38.74	10.49	9.29	8.24
1982	14.50	6.87	11.62	10.51	9.97	9.25	23.60	22.37	27.97
1984	15.04	8.63	8.92	26.30	30.86	31.30	4.29	2.48*	2.09
1985	12.01	6.60	8.11	1.04	9.77	8.55	5.22	3.37	2.67
1986	4.41*	1.88*	2.32	8.49	8.98	7.17	28.57	20.58	29.41
1987	14.29	6.47	9.80	8.81	7.87	7.15	27.20	19.25	30.40
1990	1.60	8.36	7.77	10.40	10.17	8.12	27.83	22.92	20.55
1995	17.34	11.74	13.54	8.79	10.23	5.76	21.95	17.18	17.87

Year	Other paper products output	Other paper products empl.	Other paper products value added	Newspapers output	Newspapers empl.	Newspapers value added	Books, periodicals & maps output	Books, periodicals & maps emp.	Books, periodicals & maps value added
1980	3.59	1.68	2.67	4.99	11.99	5.88	6.68	6.77	8.04
1982	4.87	2.83	3.73	8.39	22.20	12.63	7.30	4.92	8.50
1984	8.24	3.82	5.48	2.81	5.99	4.66	8.74	8.98	10.58
1985	27.46*	24.20*	30.65*	3.69	7.74	5.82	9.75	8.37	10.16
1986	7.75	3.29	4.96	6.03	16.79	10.09	9.86	7.40	9.85
1987	9.95	4.37	6.58	4.80	15.19	8.80	7.71	6.17	5.57
1990	8.14	6.13	4.53	2.44	8.99	3.17	2.76	5.16	1.93
1995	11.98	8.40	7.35	2.21	8.72	2.77	3.94	6.39	2.99

Year	Job Printing output	Job Printing empl.	Job Printing value added	Printed cards& stationary output	Printed cards& stationary empl.	Printed cards& stationary value added	Paper binding & metal sheets output	Paper binding & metal sheets emp.	Paper binding & metal sheets value added
1980	17.69	15.35	16.28	1.51	1.96	1.19	2.42	3.73	2.29
1982	26.20	24.06	21.91	1.28	1.75	1.01	3.35	4.95	3.38
1984	30.23	31.48	32.57	1.03	1.48	0.78	3.18	6.19	3.50
1985	28.35	32.71	29.36	1.08	1.46	1.00	3.38	5.77	3.69
1986	30.29	34.13	31.37	1.27	1.91	1.04	3.34	5.06	3.80
1987	23.46	33.62	26.58	0.89	1.52	0.88	2.89	5.54	4.24
1990	33.17	34.95	52.69	0.68	1.20	0.33	1.17	2.09	0.91
1995	31.62	33.40	48.10	0.55	1.14	0.36	1.62	2.76	1.27

Basic Metal Industries

Industry(PISC)

Year	Iron&steel mills output	Iron&steel mills emp.	Iron&steel mills value added	iron&steel foundaries output	iron&steel foundaries emp.	iron&steel foundaries value added	Aluminium& aluminium alloys output	Aluminium& aluminium alloys empl.	Aluminium& aluminium alloys value added	other non-ferrous metal alloys output	other non-ferrous metal alloys emp.	other non-ferrous metal alloys value added
1980				90.06	92.82	95.20	1.65	2.61	1.18			
1982	36.78	65.76	45.26	62.84	33.60	54.10	0.39	0.65	0.65			
1984	62.86	65.74	79.24	36.74	33.40	20.41	0.19	0.63	0.18	0.07	0.09	0.03
1985	42.67	70.13	47.14	57.02	29.33	52.31	0.24	0.47	0.47	0.07	0.06	0.08
1986	56.38	75.35	58.23	43.19	24.00	41.32	0.26	0.56	0.35	0.17	0.10	0.11
1987	58.10	82.27	75.22	41.44	17.06	24.36	0.24	0.54	0.30	0.23	0.14	0.12
1990	58.91	86.90	79.88	40.43	12.52	19.67	0.31	0.44	0.26	0.35	0.14	0.19
1995	62.71	91.28	75.69	36.32	8.27	23.73	0.53	0.34	0.37	0.44	0.11	0.22

TABLE 2.4
Average Labour Productivity
1980-95

ISIC industrial Sectors	1980-85	1985-90	1995
1. Food manufacturing	1.12	0.99	1.22
2. Beverage Industries	1.59	1.43	2.14
3. Tobacco manufacturing	4.07	6.24	6.81
4. Manufacture of textile	0.32	0.49	0.62
5. Wearing apparel	0.48	0.46	0.62
6. Leather&leather product	1.01	0.69	0.70
7. Footwear except rubber	0.47	0.44	0.51
8. Ginning&bailing of fibre	0.53	0.56	0.83
9. Wood, wood&cork prod.	0.46	0.43	0.37
10. wood furntiture&fixture	0.38	0.38	0.33
11. Paper &paper products	0.42	0.72	1.04
12. Printing&publishing	0.41	0.79	1.56
13. Drugs&pharmaceutical	1.12	1.23	1.42
14. Industrial chemicals	1.69	2.17	2.67
15. Other chemical products	1.27	1.40	2.07
16. Petroleum refining	5.16	5.16	
17. Petroleum&coal prod.	1.99	1.99	
18. Rubber products	0.53	0.62	0.62
19. Plastic products	0.54	0.55	0.51
20. Pottery,china& Earthenware	0.33	0.48	0.43
21. Glass&glass products	0.49	0.63	0.61
22. other non metallic mineral products	0.49	1.69	2.83
23. Iron & steel	0.65	0.77	0.79
24. Non-ferrous metal Basic industries	0.26	0.33	0.37
25. Fabricated metal Products	0.40	0.45	0.68
26. Non-electrical machinery	0.48	0.49	0.59
27. Electrical machinery& Supplies	0.68	0.85	2.36
28. Transport equipment	0.48	0.67	1.59
29. Surgical instruments	0.26	0.31	0.56
30. Sports&athletic goods	0.37	0.48	0.54

TABLE 2.5

Distribution of establishments by employment size

	Food manufacturing			Beverage industries		
year	1-19	20-99	100+	1-19	20-99	100+
1980	242	165	87			14
1982	393	83	90	5	12	17
1984	530	210	108	7	20	24
1985	395	219	116	8	21	22
1986	489	214	128	9	21	20
1987	474	222		7	23	
1990	449	287	136	7	23	17

	Cotton Spinning			Wearing Apparel Products			Leather&leather		
Year	1-19	20-99	100+	1-19	20-99	100+	1-19	20-99	100+
1980	436	284	194	14	32	10	30	18	13
1982	394	157	196	16		10	30	13	12
1984	378	299	218	14	25	16	39	11	13
1985	429	324	227	23	32	21	44	22	15
1986	414	354	245	26	38	30	41	22	20
1987	461	348		28	44		43	22	
1990	402	406	327	19	81	53	21	35	24

	Leather Footwear			Ginning &bailing of Cotton fibres		
year	1-19	20-99	100+	1-19	20-99	100+
1980	8			68	170	23
1982	10			49	74	29
1984	10			62	217	24
1985	10		5	58	212	13
1986	18		6	51	184	15
1987	20			98	196	
1990	8			146	189	8

	Wood products			Wood furniture &fixtures		
Year	1-19	20-99	100+	1-19	20-99	100+
1980	8	8	6	21	14	
1982	5		7	22	18	7
1984	8	15	6	28		6
1985	8	18	6	27		5
1986		20	9	27	23	
1987	5	25		36	15	
1990	6	24	9	32	22	

	Paper &paper products			Printing & Publishing		
Year	Upto 19	20-99	100+	Upto 19	20-99	100+
1980	9	21	8	92	34	13
1982	12	9	6	81		19
1984	16	15	12	83	35	18
1985	12	25		92	33	
1986	13	26	8	92	33	23
1987	15	26		89	41	
1990	19	50	15	57	37	16

	Drugs&pharmaceuticals			Industrial chemicals Products			other chemical		
Year	Upto 19	20-99	100+	Upto 19	20-99	100+	Upto 19	20-99	100+
1980	40	32	31	28	28	24	68	55	25
1982	37	12	33	32	29	28	62	22	21
1984	42	41	36	29	36	28	82	58	22
1985	43	39	41	28	25	36	76	58	27
1986	50	42	41	28	35	34	74	67	27
1987	43	44		27	35		73	66	
1990	49	48	49	32	53	35	52	54	28

	Rubber products			Plastic products		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	25	19	8	16	9	4
1982	25	15	12	7	14	7
1984	25	13	11	20	16	12
1985	23	7	14	22	20	10
1986	24	14	12	31	20	13
1987	25	10		26	28	
1990	18	17	14	22	34	11

	Non metallic Mineral products			Basic metal industries		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	25	28	16	81	98	18
1982	33	23	23	74	94	16
1984	44	30	22	88	82	16
1985	54	24	25	80	99	22
1986	43	27	30	84	91	23
1987	56	24		103	95	
1990	47	30	33	58	109	20

	Fabricated metal Products except machinery			Manufacture of non electrical machinery			Electrical		
Year	upto 19	20-99	100+	upto 19	20-99	100+	upto 19	20-99	100+
1980	168	82	22	198	59	16	114	40	31
1982	113	80	14	202	82	16	102	49	32
1984		78	17	254	93	26	112	48	38
1985	131	80	15	228	88	27	89	50	40
1986	147	90	19	239	95	26	88	49	41
1987	162	81		244	98		97	51	
1990	105	78	28	137	91	31	105	67	48

	Transport equipment			Scientific instruments			Sports &athletic goods		
Year	upto 19	20-99	100+	upto 19	20-99	100+	upto 19	20-99	100+
1980	41	51	21	27			6		3
1982	41	37	16	18	12	5	19		
1984	54	43	23	29	18	7	14	6	7
1985	61	44	22	23	21	8	13	7	
1986	61	50	25	24	23	8	12	12	4
1987	68	47		24	23		10		
1990	47	53	30	20	30	9	9	15	13

TABLE 2.6
Shares of various size establishments in manufacturing output, value added, capital and employment

Year	share in manufacturing output: upto 19	20-99	100+	share in manufacturing value added: upto 19	20-99	100+
1980	4.08	17.92	78.00	2.53	12.65	84.81
1982	4.04	17.21	78.75	2.25	10.70	87.05
1984	4.13	17.15	78.72	2.29	11.31	86.40
1985	4.21	17.30	78.48	2.73	10.48	86.79
1986	4.14	16.92	78.94	2.14	10.75	87.10
1987	4.58	17.65	78.94	2.65	10.74	86.61
1990	4.08	17.10	78.94	1.84	11.29	86.88

Year	Share in manufacturing employment: upto 19	20-99	100+	share in manufacturing capital: upto 19	20-99	100+
1980	4.62	12.55	82.83	2.68	9.66	87.66
1982	4.50	12.59	82.92	1.87	8.67	89.46
1984	4.66	12.59	82.75	2.32	8.86	88.82
1985	4.49	12.82	82.69	1.80	7.21	91.00
1986	4.42	12.82	82.76	1.73	6.64	91.63
1987	4.87	13.56	81.89	2.04	8.71	89.25
1990	3.45	12.68	83.87	1.96	9.48	88.56

TABLE 2.7
Output and value added per worker

Food manufacturing

	Output per worker			value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	3.81	4.45	3.13	0.57	0.82	1.18
1982	4.64	6.21	3.36	0.42	0.80	1.26
1984	4.54	5.75	3.41	0.53	0.72	1.24
1985	4.82	5.67	3.42	0.65	0.73	1.22
1986	5.00	6.26	3.26	0.57	1.04	0.98
1987	5.32	6.54		0.69	0.78	
1990	5.54	6.33	2.80	0.75	1.01	0.84

Beverage industries

	Output per worker			value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980			2.22			1.18
1982		4.65	2.80		2.52	1.71
1984	1.74	3.87	2.57	0.77	2.38	1.51
1985	1.68	4.30	2.43	0.89	2.09	1.36
1986	3.15	2.67	2.80	1.27	1.29	1.54
1987	3.41	3.40		1.54	1.84	
1990	1.95	3.86	2.12	1.24	1.95	1.06

Manufacture of Textiles

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	0.91	1.38	1.06	0.22	0.44	0.23
1982	0.49	1.06	1.07	0.88	0.28	0.30
1984	1.07	2.40	1.08	0.33	0.98	0.32
1985	1.56	1.92	1.14	0.38	0.51	0.36
1986	1.42	2.21	1.26	0.30	0.55	0.40
1987	1.77	2.67		0.41	0.71	
1990	1.23	2.14	1.76	0.25	0.53	0.58

Wearing Apparel

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	1.50	2.01	1.15	0.56	0.78	0.51
1982	3.56		2.01	1.12		0.39
1984	2.29	1.78	1.74	0.28	0.36	0.32
1985	1.91	2.27	1.68	0.78	0.71	0.48
1986	2.23	2.10	1.63	0.95	0.56	0.32
1987	1.94	2.55		0.52	0.79	
1990	5.61	2.36	1.40	0.69	0.54	0.30

Leather & leather products

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	4.87	3.64	2.11	1.18	1.13	0.49
1982	3.69	3.47	3.62	0.79	0.85	1.32
1984	3.13	7.70	4.80	0.53	1.76	0.97
1985	5.24	7.98	3.85	0.92	1.10	1.31
1986	3.70	3.45	5.67	0.30	0.72	0.38
1987	3.10	6.75		0.71	0.70	
1990	1.56	4.25	4.35	0.31	0.69	0.58

Ginning and bailing of fibres

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	7.18	5.29	2.12	0.88	0.77	0.20
1982	8.84	6.82	2.14	0.44	0.37	0.18
1984	10.15	6.64	2.24	1.00	0.48	0.17
1985	9.74	6.94	4.72	1.12	0.79	0.52
1986	11.48	6.52	4.77	0.71	0.46	0.24
1987	9.65	7.78		0.75	0.73	
1990	12.36	8.41	4.46	0.70	0.57	0.31

Wood, wood & cork products

Year	Output per worker: upto 19	20-99	100+	Value added per worker: upto 19	20-99	100+
1980	0.80	0.91	1.28	0.26	0.27	0.55
1982	0.48		0.97	0.14		0.42
1984	0.77	1.26	1.39	0.20	0.37	0.68
1985	0.41	1.56	1.18	0.14	0.50	0.44
1986		1.23	0.90		0.34	0.27
1987	1.02	1.56		0.26	0.42	
1990	0.48	1.29	1.28	0.17	0.34	0.56

Wood Furniture & fixtures

Year	Output per worker: upto 19	20-99	100+	Value added per worker: upto 19	20-99	100+
1980	0.53	1.05		0.16	0.58	
1982	0.73	0.91	0.93	0.32	0.41	0.46
1984	1.21		1.11	0.56		0.41
1985	0.86		0.69	0.26		0.26
1986	1.67	0.70		0.62	0.23	
1987	1.86	0.66		0.68	0.24	
1990	2.69	1.16		0.83	0.34	

Paper & paper products

Year	Output per worker: upto 19	20-99	100+	Value added per worker: upto 19	20-99	100+
1980	1.55	1.92	1.25	0.35	0.60	0.50
1982	2.04	0.98	1.44	0.71	0.31	0.58
1984	1.74	2.06	1.57	0.38	0.52	0.54
1985	2.17	2.25		0.46	0.76	
1986	2.24	2.34	1.74	0.59	0.61	0.61
1987	2.94	2.63		0.43	0.75	
1990	2.73	3.53	2.99	0.46	0.87	1.02

Printing & Publishing

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	0.79	1.00	0.57	0.26	0.35	0.24
1982	1.19		0.92	0.43		0.39
1984	1.35	1.33	1.25	0.40	0.46	0.51
1985	2.04	1.36		0.74	0.51	
1986	1.35	1.30	1.13	0.48	0.51	0.48
1987	1.26	1.20		0.41	0.38	
1990	1.81	1.55	2.43	0.45	0.45	1.85

Drugs & pharmaceutical products

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	1.22	1.47	2.57	0.36	0.50	1.24
1982	2.00	1.37	2.67	0.62	0.43	1.21
1984	2.04	2.28	2.74	0.60	0.62	1.21
1985	1.79	2.52	2.66	0.46	0.87	1.25
1986	2.55	2.83	2.98	0.73	0.77	1.26
1987	3.24	2.66		1.01	0.70	
1990	1.69	2.51	3.86	0.47	0.68	1.45

Industrial chemicals

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	1.59	1.74	2.71	0.48	0.48	1.19
1982	1.79	2.59	3.58	0.65	0.65	1.82
1984	1.99	3.30	2.22	0.54	0.54	2.15
1985	1.91	2.33	1.87	0.59	0.59	1.87
1986	1.92	2.49	10.88	0.53	0.53	2.26
1987	1.99	2.53		0.56	0.56	
1990	1.89	4.08	5.50	0.47	0.47	2.48

Other chemical products

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	2.05	2.36	2.15	0.80	0.79	0.77
1982	2.33	2.15	3.59	0.52	0.43	1.55
1984	1.90	2.79	4.97	0.47	0.84	2.26
1985	1.67	2.99	3.42	0.63	0.86	1.77
1986	1.88	2.90	3.45	0.50	0.91	1.24
1987	2.20	2.89		0.62	0.95	
1990	1.51	3.83	4.83	0.34	1.63	1.52

Rubber products

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	0.73	1.37	1.44	0.22	0.40	0.52
1982	0.74	1.02	1.49	1.19	0.34	0.60
1984	0.79	0.89	0.35	0.22	0.28	0.50
1985	0.85	0.72	0.02	0.19	0.26	0.01
1986	0.76	2.22	1.89	0.19	0.59	0.74
1987	1.03	1.69		0.25	0.49	
1990	1.14	1.17	1.74	0.29	0.39	0.62

Plastic products

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	1.08	1.71	0.88	0.45	0.63	0.34
1982	0.82	1.58	1.50	0.76	0.40	0.55
1984	1.76	2.66	1.78	0.35	0.75	0.62
1985	2.12	2.43	1.71	0.40	0.66	0.62
1986	2.24	3.14	1.77	0.39	1.13	0.53
1987	2.05	2.81		0.35	0.73	
1990	1.10	2.99	1.38	0.29	1.00	0.39

Other non metallic mineral products

Year	Output per worker: upto 19	20-99	100+	Value added per worker: upto 19	20-99	100+
1980	0.60	0.85	2.56	0.26	0.35	1.61
1982	0.79	0.87	3.67	0.41	0.36	2.45
1984	1.51	1.35	3.02	0.91	0.68	1.66
1985	1.18	0.83	3.08	0.74	0.35	1.64
1986	2.42	0.81	3.41	1.77	0.28	2.02
1987	1.34	1.35		0.79	0.57	
1990	0.57	0.93	3.38	0.21	0.36	1.80

Iron & Steel

Year	Output per worker: upto 19	20-99	100+	Value added per worker: upto 19	20-99	100+
1980	1.85	3.59	1.48	0.30	0.81	0.53
1982	2.36	4.08	2.28	0.36	0.82	1.31
1984	3.19	3.65	1.50	0.36	0.58	0.37
1985	3.71	3.56	2.06	0.48	0.63	0.75
1986	3.70	5.89		0.52	2.53	
1987	5.27	4.74	2.76	1.10	0.48	0.92
1990	4.98	5.15		0.13	0.69	

Fabricated Metal products

Year	Output per worker: upto 19	20-99	100+	Value added per worker: upto 19	20-99	100+
1980	0.58	1.23	0.24	0.16	0.16	0.09
1982	0.67	1.34	1.13	0.16	0.16	0.66
1984	0.71	1.40	1.43	0.18	0.18	0.77
1985	0.77	1.28	0.95	0.21	0.21	0.51
1986	1.06	1.67	1.14	0.25	0.25	0.48
1987	1.05	0.61		0.28	0.28	
1990	1.15	2.12	1.36	0.24	0.24	0.51

Non electrical machinery

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	0.74	0.68	0.35	0.22	0.22	0.13
1982	0.77	1.02	1.70	0.23	0.36	0.69
1984	0.82	0.94	3.31	0.24	0.38	0.73
1985	1.00	0.89	2.56	0.49	0.36	0.61
1986	0.84	1.32	2.72	0.22	0.37	0.59
1987	0.77	0.62		0.29	0.38	
1990	0.63	1.34	2.53	0.20	0.40	0.82

Electrical machinery & supplies

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	0.92	3.57	0.42	0.25	0.78	0.18
1982	1.64	2.87	1.82	0.52	0.83	0.69
1984	0.69	3.38	2.28	0.21	0.89	0.81
1985	0.84	2.93	2.36	0.24	0.79	0.89
1986	0.92	3.34	2.78	0.21	0.65	0.70
1987	1.02	2.84		0.26	0.59	
1990	0.82	2.08	4.90	0.20	0.62	1.85

Transport Equipment

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	0.57	1.11		0.25	0.33	
1982	0.83	1.55		0.34	0.52	
1984	0.79	2.02		0.35	0.69	
1985	0.88	2.28		0.39	0.40	
1986	0.69	2.67		0.23	0.39	
1987	0.75	2.75		0.31	1.41	
1990	1.31	2.13		0.27	0.49	

Scientific & measuring instruments

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	0.67			0.22		
1982	0.79	1.12		0.26	0.30	
1984	1.16	1.24		0.16	0.10	
1985	1.02	1.21		0.18	0.25	
1986	1.50	1.47		0.24	0.24	
1987	1.39	1.91		0.29	0.36	
1990	1.42	2.27		0.31	0.48	

Sports & athletic goods

	Output per worker			Value added per worker		
Year	upto 19	20-99	100+	upto 19	20-99	100+
1980	1.47			0.32		
1982	0.75			0.24		
1984	1.90	4.25		0.47	0.64	
1985	2.14	3.28		0.25	0.70	
1986	2.90	2.95		0.51	0.80	
1987	2.51			0.61		
1990	6.04	4.03		1.18	0.70	

TABLE 2.8
PRODUCTIVITY ESTIMATES
Metal products, machinery and equipment

year	Cutlery	Hand&edge tools	Metal furniture	Structural metal products	Metal stamping&coating
1980	.65	.38	1.96	2.14	2.13
1982	2.31	2.45	1.17	2.05	4.10
1984	.72	1.14	1.36	1.74	2.95
1985	.28	1.81	1.45		3.92
1986	.78	1.60	1.83	2.60	1.04
1987	.37	1.66	1.00	2.83	1.61
1990	.77	1.06	1.00	0.83	1.02
1995	.89		1.34	0.42	2.50

year	Heating&cooking equipment	Wire products	Utensils	Metal barrels&drums
1980	1.93	1.55	0.57	4.35
1982	2.26	1.21	0.89	1.95
1984	1.25	1.12	1.16	2.42
1985	1.25	1.23	1.00	2.34
1986	1.62	0.93	1.40	1.78
1987	1.55	1.41	2.31	3.20
1990	2.12	0.64	1.15	2.26
1995	1.67	0.73	2.26	0.44

Year	Tin cans& tin ware	Bolts ,nuts& rivets	Plumbing equipment	Other metal products	Engines & turbines
1980	0.93	0.92	1.11	0.29	0.71
1982	0.79	1.77	1.02	1.48	1.20
1984	1.09	1.01	0.78		0.74
1985	1.52	0.93	0.95		0.81
1986	1.51	0.72	0.99	0.70	0.34
1987	1.74	0.87	1.11	0.86	0.72
1990	2.14	1.13	0.69	0.51	0.45
1995	0.30			0.55	0.84

year	Agricultural machinery	Metal &wood working machinery	Textile machinery	Other industrial machinery	Sewing machines
1980	1.87	0.51	0.83	0.65	1.13
1982	1.21	0.91	0.44	1.47	1.35
1984	1.77	0.82	0.46	1.06	1.83
1985	1.21	0.74	0.30	0.94	1.27
1986	1.10	0.57	0.46	0.96	1.69
1987	1.29	0.16	0.59	0.36	1.80
1990	1.25	0.31	0.63	1.04	1.65
1995	1.32	0.55	0.48	0.19	2.91

year	Other non electrical machinery	Electrical industrial machinery	Radio & television	Electrical appliances	Insulated wires & cables
1980	1.09	2.65	3.24	1.1	2.6
1982	1.22	2.31	2.91	1.02	1.1
1984	1.36	2.48	3.14	1.3	1.5
1985	1.60	2.08	5.5	1.2	1.5
1986	1.08	1.40	2.1	1.00	1.6
1987	1.01	1.72	1.9	1.9	2.5
1990	1.89	3.80	1.6	1.2	1.4
1995	1.23	3.51		4.9	0.36

year	Electrical bulbs & tubes	Batteries	Electrical supplies	Shipping & building equipment	Motor vehicles
1980	1.4	2.09	1.7	0.36	1.6
1982	0.9	3.09	2.2	0.67	3.2
1984	1.5	2.43	0.9	0.37	1.9
1985	1.6	1.91	1.8	0.72	1.5
1986	1.00	1.4	1.6	0.62	1.4
1987	3.4	1.4		0.73	0.36
1990	1.7	1.9		0.72	0.64
1995	0.5	3.1	1.3		0.28

Year	Motor cycles	Cycles & pedicab	Surgical instruments
1980	1.81	2.9	
1982	2.5	1.04	0.91
1984	0.95	1.09	1.1
1985	1.4	1.01	0.56
1986	1.8	1.00	0.55
1987	3.2	1.35	1.05
1990	1.1	0.94	1.1
1995	3.0	2.2	1.1

Textile manufacturing

Year	Cotton spinning	Cotton weaving	Woollen textiles	Jute textile	Silk&artsilk textiles
1980	1.43	1.39	1.02	1.04	1.5
1982	1.59	1.24	1.60	1.80	0.93
1984	1.56	1.50	1.22	1.04	1.6
1985	1.51	1.47	1.53	1.13	1.8
1986	1.38	2.05	1.47	1.26	2.1
1987	1.87	1.48	1.59	1.06	2.1
1990	2.2	1.64	1.41	1.8	2.3
1995	1.8	1.76	1.64	1.2	1.4

Year	Narrow fabrics	Finishing of textile	Made up textile goods	Knitting mills	Carpets & rugs
1980	0.91	1.20	1.30	1.8	3.2
1982	1.09	1.35	1.5	1.5	2.2
1984	1.9	1.17	1.3	1.01	
1985	1.3	1.33	1.5	1.3	2.9
1986	1.6	1.31	1.5	1.8	3.0
1987		1.12	1.4	1.7	3.4
1990	0.81	1.01	1.4	2.2	1.8
1995	0.41	1.12	1.6	2.0	1.7

Year	Cordage, rope& twine	Spooling &threadball making	Manufacturing of textiles	Ready made garments	Ginning & bailing of fibres
1980	1.4	2.2	1.4	2.9	2.4
1982	1.1	3.1	1.9		2.2
1984	1.20	3.1	1.8	2.4	1.8
1985	1.00	3.6	1.7	2.9	3.3
1986	1.1	3.5	1.7	2.3	2.1
1987	1.3	3.5	1.8	2.9	3.5
1990	1.5	1.8	1.5	1.9	2.3
1995	1.1	0.63	1.2	1.3	2.8

Chemical, Rubber & Plastics

Year	Medicines& Basic drugs	Unani&other medicnes	Alkalies	Acids,salts &intermediates	Sulphuric acid	Dyes,colors & pigments
1980	11.11		4.7	4.2	0.75	3.4
1982	11.01	6.5	4.8	4.1		4.8
1984	7.6	6.4	*4.4*	*2.5*	*2.01*	*5.8*
1985	10.6	5.6	4.5	2.8	2.8	5.3
1986	5.4	6.6	5.8	3.2	4.1	3.3
1987	8.8	10.9	6.8	3.6	3.6	6.1
1990	10.3	7.5	6.6	3.7	2.4	1.8
1995	12.0	6.7	5.1	4.5	3.7	3.9

Year	Compressed gased	Fertilizers	Pesticides &insecticides	Synthetic Resins	Other industrial chemicals	Paints &varnishes
1980			3.2	4.3		
1982	3.17	6.35	.34			13.02
1984	2.16	9.45	9.4	7.7	6.3	11.17
1985	4.05	7.96	10.3	8.4	3.1	9.35
1986	4.04	9.1	3.8	5.8	5.6	11.2
1987	1.7	8.3	6.1	8.03	12.0	5.8
1990	1.5	10.2		8.5	3.70	7.08
1995	3.4	11.1	15.5	9.9	11.2	13.8

Year	Perfumes& Cosmetics	Soaps & detergents	Polishes, waxes & candles	Matches	Other chemical products	Petroleum products
1980			8.3		7.7	10.1
1982	7.6	6.15		4.3	7.1	10.0
1984	19.2	7.1	10.5	4.2	4.5	12.1
1985		7.20	4.5	4.5	4.9	11.6
1986	8.7	9.00	2.6	4.07	5.1	14.6
1987		7.9	5.3	4.6	3.8	
1990	8.6	9.1	9.2	8.3	4.0	12.3
1995	10.12		7.00	0.84	4.9	

Year	Tyres &tubes	Rubber footwear	Vulcanised rubber products	Rubber belting	Plastic footwear	Other plastic products
1980		6.70		2.09	1.71	
1982	5.6		2.00	1.35	1.40	4.27
1984	1.45	14.7	2.02	1.1	1.4	3.71
1985	2.7	16.1	1.60	1.2	1.1	3.24
1986		7.8	2.6	1.7	1.0	3.7
1987		8.2	2.4	0.9	0.95	3.2
1990	4.4	9.6	3.01		0.84	4.2
1995	6.7	10.0	8.7		0.27	2.6

Food and Beverage

Year	Dairy products	Ice cream	Canning of fruits&vegetables	Canning of fish&seafood	Vegetable ghee	Other vegetable oils
1980		2.6	4.0	2.6	16.9	8.04
1982	2.9	3.0	3.4	5.9	17.2	10.4
1984	2.5	4.8	5.9	2.3	15.3	3.9
1985	4.0	3.8	2.1		12.3	5.4
1986	3.0	6.9	3.8	5.2	7.6	3.7
1987	3.6	3.7	3.1	5.8	10.3	6.6
1990	4.4	3.7	4.3	7.0	6.4	4.5
1995	9.6	6.2	5.2	6.2	10.3	

year	Cotton seed oils	Rice milling	Wheat &grain milling	Bread &bakery products	Biscuits&other bakery products	Refined sugar
1980	6.7	2.9	4.5	1.2	3.0	9.4
1982	2.3	2.4	3.7	1.2	3.2	11.3
1984	3.1	3.4	3.6	2.1	2.5	12.3
1985	4.2	1.6	4.7	1.9	4.2	11.3
1986		2.4	2.6	2.1	3.5	9.7
1987	4.6	5.03	3.3	2.2		12.1
1990	2.4	4.7	6.2	2.3	3.01	10.1
1995	5.0	2.70	4.4	2.3	3.9	10.9

Year	Feeds for poultry	Edible salt	Ice manufacturing	Beverages
1980	4.6	1.1	0.84	9.9
1982	7.0	0.97	0.82	13.2
1984	5.7	2.1	0.83	12.3
1985	8.7	1.9	0.74	10.4
1986	4.5	1.3	0.86	14.9
1987	2.6	1.4	0.67	10.3
1990	6.2	2.7	0.23	8.4
1995	9.3	2.9	1.5	13.2

Non metallic mineral products

Year	Pottery& Earthenware	China & ceramics	Glass & glass products	Bricks & tiles	Cement	Cement products	Other non metallic mineral products
1980	0.29	1.39	1.7	1.1	9.0	2.01	1.8
1982	0.41	1.61	2.4	2.0	13.0	2.9	1.14
1984	0.30	1.71	2.4	2.6	9.6	2.6	1.5
1985	0.28	1.6	2.9	2.9	9.10	1.8	0.89
1986	0.30	2.4	2.3	3.0	11.3	1.7	0.98
1987	0.41	2.2	3.3	2.9	11.3	2.7	1.1
1990	0.25	1.9	3.5	2.2	10.20	1.8	0.65
1995	1.6	1.80	3.02	4.1	14.0	10.8	0.57

Paper, printing and publishing

Year	Pulp &Paper	Paperboard	Pulp, paper &board articles	Other paper products	Newspapers
1980	1.29	1.43	1.01	1.2	0.6
1982	1.38	1.10	1.67	1.7	1.3
1984	0.94	1.22	0.77	1.2	1.3
1985	0.89	0.94	0.80	1.4	1.1
1986	0.83	1.06	1.5	1.4	1.10
1987	0.91	0.73	1.6	1.05	1.08
1990	1.35	1.5	2.5	1.5	1.1
1995	2.21	1.14	2.4	1.7	1.6

Year	Books, periodicals&maps	Job printing	Printed cards & stationary	Book binding & metal sheets
1980	0.59	0.81	0.53	0.45
1982	0.99	0.96	0.60	0.77
1984	1.04	1.3	0.53	0.68
1985	1.09	1.4	1.2	0.79
1986	0.82	1.4	0.6	1.2
1987	0.71	1.1	0.6	0.89
1990	0.84	5.3	0.5	1.0
1995	1.1	5.8	0.8	1.1

Wood, wood products & furniture

Year	Plywood & products	Hardboard & products	Wood articles and other products	Furniture and fixtures
1980	1.5	4.9	1.7	3.1
1982	1.6	3.9	1.7	4.0
1984	1.8	6.3	1.9	4.2
1985	4.1	5.08	1.3	2.02
1986	3.1	3.4	1.5	2.9
1987	3.1	6.8	1.9	3.40
1990	1.5	6.1	0.6	2.8
1995	2.8	3.6	2.3	2.2

TABLE 2.9
Average total factor productivity, 1980-95

Textile Manufacturing	Average TFP	Std. Dev
	2.09	**1.69**
1. Cotton spinning	1.68	.30
2. Cotton Weaving	1.56	.24
3. Woollen textiles	1.43	.21
4. Jute textiles	1.30	.33
5. Silk & artsilk textiles	1.74	.45
6. Narrow fabrics	2.91	5.04
7. Finishing of textiles	1.43	.10
8. Made up textiles	1.67	.38
9. Knitting mills	3.34	2.16
10. Carpets & rugs	1.20	.15
11. Cordage , rope & twine	2.55	.99
12. Spoolling &threadball making	1.62	.21
13. Other textiles	3.23	2.5
14. Wearing Apparel	2.54	.61
15. Ginning & bailing of fibres	3.16	.82

Food manufacturing	Average TFP	Std. Dev
	6.7	**5.7**
1. Dairy products	3.8	2.6
2. Ice cream	4.3	1.5
3. Canning of fruits & vegetables	4.01	1.19
4. Canning of fish & seafood	6.2	3.6
5. Vegetable ghee	12.08	4.1
6. Other vegetable oils	7.7	5.1
7. Cotton seed & inedible animal oil	5.2	3.6
8. Rice milling	3.1	1.1
9. Wheat & grain milling	4.1	1.09
10. Bread & bakery products	1.9	.43
11. Biscuits & other bakery products	4.4	3.2
12. Refined sugar	10.9	1.08
13. Blending of tea	14.7	7.9
14. Foods for animals & fowls	6.1	2.2
15. Starch	19.3	6.2
16. Edible salt	1.8	.72
17. Manufacturing of ice	.82	.34
18. Beverage industries	11.6	2.15

Metal products, machinery & equipment	Average TFP	Std. Dev
	1.44	**.87**
1. Cutlery	.84	.62
2. Hand & edge tools	1.44	.65
3. Metal furniture	1.38	.35
4. Structural metal products	1.79	.88
5. Metal stamping & coating	2.4	1.19
6. Heating & cooking equipment	1.7	.37
7. Wire products	1.1	.31
8. Utensils	1.34	.62
9. Metal barrels & drums	2.3	1.12
10. Tin cans & tin wares	1.25	.58
11. Bolts , nuts & rivets	1.05	.33
12. Other metal products	.73	..41
13. Plumbing equipment	.95	.16
14. Engines & turbines	.72	.26
15. Agricultural machinery	1.37	.28
16. Metal & wood working	.57	.25
machinery	.52	.16
17. Textile machinery	.83	.41
18. Other industrial machinery	1.7	.55
19. Sewing machines	1.3	.29
20. Other non electrical machinery	2.4	.82
21. Electrical industrial machinery	2.9	1.3
22. Radio & television	1.7	1.3
23. Electrical appliances	1.6	.74
24. Insulated wires & cables	1.5	.86
25. Electrical bulbs & tubes	2.1	.66
26. Batteries	1.6	.45
27. Other electricl supplies	.59	.16
28. Ships, boat , railroad equipment	1.3	.97
29. Motor vehicles	2.01	.86
30. Motor cycles , auto rickshaw	1.45	.73
31. Cycles & pedicabs	.92	.26
32. Scientific & measuring instruments		

Chemical, Rubber & Plastics	**Average TFP**	**Std. Dev**
	6.5	**4.6**
33. Medicines & basic drugs	9.6	2.1
34. Other medicines	7.2	1.74
35. Alkalies	5.4	.94
36. Acids, salts & intermediates	3.6	.70
37. Sulphuric acids	2.7	1.18
38. Dyes ,colors & pigments	4.3	1.46
39. Compressed gases	2.8	1.04
40. Fertilizers	8.9	1.5
41. Pesticides & insecticides	7.4	4.5
42. Synthetic resins	7.5	1.8
43. Other industrial chemicals	7.04	3.7
44. Paints & varnishes	10.2	2.9
45. Perfumes & cosmetics	15.5	9.02
46. Soaps & detergents	9.4	4.6
47. Polishes & waxes	6.8	2.7
48. Matches	4.4	2.1
49. Other chemical products	5.3	1.4
50. Petroleum & coal products	13.2	4.1
51. Tyres & tubes	4.2	2.1
52. Rubber footwear	11.8	5.0
53. Vulcanised rubber products	3.2	2.4
54. Rubber belting	1.4	.42
55. Plastic footwear	1.1	.43
56. Other plastic products	3.5	.58

Basic metal industries	**Average TFP**	**Std. Dev**
	13.8	**20.3**
1. Iron & steel mills	42.0	21.3
2. Iron & steel foundaries	10.2	7.7
3. Aluminium alloys	.78	.65
4. Other non ferrous metal alloys	.50	.31

Non metallic mineral Products	Average TFP	Std. Dev
	3.2	**3.5**
1. Earthenware	.47	.45
2. China & ceramics	1.8	.33
3. Glass	2.7	.58
4. Bricks & tiles	2.6	.87
5. Cement	10.9	1.8
6. Cement products	3.3	3.0
7. Other non metallic mineral products	1.09	.57
Paper , printing & publishing	**Average TFP**	**Std. Dev**
	1.25	**.85**
5. Pulp & paper	1.2	.45
6. Paperboard	1.14	.26
7. Paper & board articles	1.56	.69
8. Other paper products	1.44	.24
9. Newspaper	1.18	.28
10. Books, periodicals	.90	.20
11. Job printing	2.2	2.06
12. Printed cards & stationary	.67	.26
13. Books binding	.87	.25

Wood , wood products & furniture	Average TFP	Std. Dev
	3.07	**1.5**
14. Plywood & products	2.4	.96
15. Hardboard products	5.06	1.2
16. Other wood & cork products	1.6	.49
17. furniture and fixture	3.11	.78

Table 3.10 Textile exports & imports:
Unit : Rs. million

year	cotton yarn	cotton thread	cotton cloth	Readymade garments	Carpets & rugs	Synthetic textiles	total exports	total imports: art silk yarn
1980	2050	101	2390	745	2243	1272	8801	1301
1982	3146	162	3579	2025	1913	2798	13623	1607
1984	3974	72	4638	2662	2031	636	14013	1589
1985	4511	61	5083	4214	2693	802	17364	1321
1986	8709	57	5931	7759	3439	2698	28593	1626
1987	9530	67	8540	8521	4445	3478	34581	2170
1990	26675	76	15199	18666	5003	7807	73426	1980
1995	52164	50	43279	45663	7131	15436	163723	1962

TABLE 3.10.1 : Sectoral Trade measures (textile)

Year	Ratio of sectoral trade shares to sectoral output	sectoral import penetration rates	Ratio of sectoral imports to sectoral output
1980	0.48	0.097	0.062
1982	0.52	0.055	0.055
1984	0.42	0.042	0.042
1985	0.46	0.054	0.033
1986	0.63	0.078	0.034
1987	0.65	0.09	0.038
1990	0.64	0.042	0.017
1995	0.68	0.024	0.008

Chemicals, Rubber and Plastic
TABLE 3.11.1 : Exports
Unit Rs. million

Year	petroleum& Products	Paints & varnishes	drugs&chemicals	Total exports
1980	1675	14	149	1838
1982	985	9	128	1122
1984	525	15	127	667
1985	507	7	84	598
1986	444	11	105	560
1987	479	15	216	710
1990	2228	16	350	2594
1995	2242	10	1544	3796

Table 3.11.2 : Imports
Unit : Rs. Million

YEAR	CHEMICALS	DRUGS & MEDICINES	DYES & COLORS	CHEMICAL FERTILIZERS	IMPORTS TOTAL
1980	2413	936	462	3537	5791
1982	3423	1390	578	2117	7373
1984	5604	1974	682	1790	10244
1985	6602	2253	729	2079	11569
1986	8846	2638	1042	3247	14512
1987	10394	2852	1204	3162	16437
1990	15448	4408	2136	5911	23982
1995	45897	11007	4982	11767	63881

Table 3.11.3 : Sectoral trade measures

Year	Ratio of sectoral trade shares to sectoral output	Sectoral import penetration rates	Ratio of sectoral imports to sectoral output
1980	0.42	0.27	0.33
1982	0.29	0.21	0.25
1984	0.26	0.2	0.24
1985	0.28	0.21	0.27
1986	0.36	0.26	0.35
1987	0.37	0.27	0.36
1990	0.38	0.26	0.35
1995	0.61	0.37	0.58

Food & Beverages
Table 3.12.1 : Exports
Unit : Rs. Million

Year	fish preparations	rice	total exp
1980	559	5602	6161
1982	897	3683	4580
1984	1231	3340	4571
1985	1335	5527	6862
1986	1930	5139	7069
1987	2186	6404	8590
1990	2576	7848	10424
1995	4702	17141	21843

Table 3.12.2 : Imports

Unit : Rs. million

Year	Tea	sugar refined	edible oils	Grains , pulses &flours	total imp
1980	1184	473	2625	637	15572
1982	1676	14	3670	880	13609
1984	3507	0	6954	2910	18372
1985	2175	930	6129	5067	20693
1986	2648	2763	4062	1754	18918
1987	2246	958	7769	2357	25009
1990	3729	3596	9020	3855	31021
1995	5707	54	28675	18604	73366

Table 3.12.3 : Sectoral trade measures

Year	Ratio of sectoral trade shares to sectoral output	Sectoral import penetration rates	Ratio of sectoral imports to sectoral output
1980	0.6	0.93	0.27
1982	0.4	1.06	0.23
1984	0.54	1.27	0.4
1985	0.6	1.21	0.41
1986	0.47	1.11	0.29
1987	0.47	1.1	0.29
1990	0.47	1.15	0.31
1995	0.58	1.24	0.41

Metal products, machinery & Equipment

Table 3.13.1 : Exports & imports

Unit : Rs. Million

YEAR	TOTAL EXPORTS: SURGICAL INSTRUMENTS	IMPORTS: ELECTRICAL GOODS	NON ELECTRICAL MACHINERY	TRANSPORT EQUIPMENT	TOTAL IMPORTS
1980	264	1915	5684	4686	12285
1982	287	2079	9312	5424	16815
1984	774	2477	13437	7816	23730
1985	842	3114	14956	9178	27248
1986	956	3118	15635	8791	27544
1987	998	3688	19617	9564	32869
1990	1901	4929	30195	11443	46567
1995	4293	14815	71125	18749	104689

Table 3.13.2: Sectoral trade measures

YEAR	RATIO OF SECTORAL TRADE SHARES TO SECTORAL OUTPUT	SECTORAL IMPORT PENETRATION RATES	RATIO OF SECTORAL IMPORTS TO SECTORAL OUTPUT
1980	1.64	0.62	1.61
1982	1.63	0.62	1.6
1984	1.42	0.59	1.37
1985	1.55	0.61	1.5
1986	1.27	0.56	1.23
1987	1.24	0.56	1.21
1990	1.21	0.55	1.16
1995	1.36	0.58	1.31

Basic metal industries

Table 3.14.1 : Imports

Year	Iron & steel manufacturing	non ferrous metal	total imports
1980	2779	582	3361
1982	4475	647	5122
1984	3938	934	4872
1985	4355	862	5217
1986	4666	1143	5809
1987	5053	1711	6764
1990	7100	2110	9210
1995	20555	6131	26686

Table 3.14.2 sectoral trade shares

YEAR	RATIO OF SECTORAL IMPORTS TO SECTORAL OUTPUT	SECTORAL IMPORT PENETRATION RATES
1980	1	0.5
1982	0.82	0.45
1984	0.45	0.31
1985	0.54	0.35
1986	0.42	0.3
1987	0.42	0.29
1990	0.42	0.29
1995	0.98	0.5

Paper , board and articles

Table 3.15 Sectoral trade measures

Year	Imports of paper & board in mln rs.	Ratio of sectoral imports to sectoral output	Ratio of sectoral import penetration rates
1980	741	0.22	0.18
1982	1054	0.17	0.14
1984	1559	0.14	0.13
1985	1626	0.17	0.14
1986	1963	0.14	0.13
1987	2388	0.15	0.13
1990	3216	0.15	0.13
1995	5412	0.2	0.17

Table 3.16.1 Sectoral trade shares- all sectors (sectoral imports+ exports/sectoral output)

Year	textiles	chemicals	food mfg	metal products
1980	0.48	0.42	0.6	1.64
1982	0.52	0.29	0.4	1.63
1984	0.42	0.26	0.54	1.42
1985	0.46	0.28	0.6	1.55
1986	0.63	0.36	0.47	1.27
1987	0.65	0.37	0.47	1.24
1990	0.64	0.38	0.47	1.21
1995	0.68	0.61	0.58	1.36

Table 3.16.2 Sectoral import penetration rates

Year	textiles	chemicals	food mfg	metal products	basic metal	paper
1980	0.097	0.27	0.93	0.62	0.5	0.18
1982	0.055	0.21	1.06	0.62	0.45	0.14
1984	0.042	0.2	1.27	0.59	0.31	0.13
1985	0.054	0.21	1.21	0.61	0.35	0.14
1986	0.078	0.26	1.11	0.56	0.3	0.13
1987	0.09	0.27	1.1	0.56	0.29	0.13
1990	0.042	0.26	1.15	0.55	0.29	0.13
1995	0.024	0.37	1.24	0.58	0.5	0.17

Table 3.16.3 Sectoral imports/sectroal output

Year	textiles	chemicals	food mfg.	metal products	bsic metal	Paper,board& articles
1980	0.062	0.33	0.27	1.61	1	0.22
1982	0.055	0.25	0.23	1.6	0.82	0.17
1984	0.042	0.24	0.4	1.37	0.45	0.14
1985	0.033	0.27	0.41	1.5	0.54	0.17
1986	0.034	0.35	0.29	1.23	0.42	0.14
1987	0.038	0.36	0.29	1.21	0.42	0.15
1990	0.017	0.35	0.31	1.16	0.42	0.15
1995	0.008	0.58	0.41	1.31	0.98	0.2

Aggregate trade measures

Table 3.17 Aggregate trade shares and aggregate GDP

Year	trade GDP ratio	Ratio of imports to GDP	Agg. Import penetration rates
1980	0.31	0.19	0.18
1982	0.32	0.22	0.19
1984	0.36	0.25	0.22
1985	0.37	0.24	0.22
1986	0.39	0.23	0.21
1987	0.44	0.26	0.24
1990	0.61	0.34	0.32
1995	1.12	0.64	0.55

Table 3.18 Ratio of effective exchange rate for imports to exports

Year	Effective excange rate for imports	Effective exchange rate for exports	Anti export bias
1980-81	12.47	9.9	1.26
1981-82	16.06	13.17	1.22
1982-83	17.47	14.18	1.23
1983-84	19.64	15.78	1.24
1984-85	20.47	16.73	1.22
1985-86	22.91	17.72	1.29
1986-87	25.37	18.55	1.38
1987-88	25.88	19.57	1.32
1988-89	28.08	21.46	1.31
1989-90	29.72	22.52	1.32
1990-91	32.52	25.5	1.27
1991-92	32.97	26.42	1.25
1992-93	38.19	31.77	1.2
1993-94	39.28	32.31	1.21
1994-95	42.33	34.63	1.22
1995-96	42.95	36.11	1.19