WORKING PAPER NO. 135

IMPACT OF TARIFF REFORMS ON INDIAN INDUSTRY: ASSESSMENT BASED ON A MULTI-SECTOR ECONOMETRIC MODEL

Arvind Virmani, Bishwanath Goldar, Choorikkad Veeramani and Vipul Bhatt

June 2004

INDIAN COUNCIL FOR RESEARCH ON INTERNATIONAL ECONOMIC RELATIONS
Core-6A, 4th Floor, India Habitat Centre, Lodi Road, New Delhi-110 003
website1: www.icrier.org, website2: www.icrier.res.in

IMPACT OF TARIFF REFORMS ON INDIAN INDUSTRY: ASSESSMENT BASED ON A MULTI-SECTOR ECONOMETRIC MODEL

Arvind Virmani Bishwanath Goldar, Choorikkad Veeramani and Vipul Bhatt

June 2004

CONTENTS

Page No

TABLES

Foreword

In a period of about thirteen years since July 1991 (when India embarked on a major economic reforms program), the foreign trade regime in India has been considerably liberalised, especially in respect of imports of manufactures. The quantitative restrictions on imports of manufactured products, which was about 90 percent before the economic reforms (end-1990), have now been mostly done away with. This has been accompanied by drastic reductions in industrial tariff rates. The import weighted average tariff rate on manufactured products has come down from about 72 per cent in 1990 (prior to the reforms) to about 15 per cent at present. The peak rate of import duty, which was 150 per cent in 1991, has now come down to 20 per cent. Yet, the current rates of industrial tariff in India are among of the highest in the world.

Given the present high levels of industrial tariff, India is likely to come under severe pressure to make significant cuts in industrial tariff during the negotiations for market access in non-agricultural products under the Doha development round. Independent of the Doha-round market access negotiations, the Indian government is already committed to make reductions in industrial tariff from the present level so as to bring it in line with the rates in ASEAN countries in the near future. How the domestic industry in India would be impacted by such reductions in industrial tariff is a moot question. A study on this issue was undertaken last year at the ICRIER for the Ministry of Industry using a multi-sector dis-aggregated econometric model. The Report was completed in November 2003. Since then, further work has been done on the model. The model, which now has more than 800 equations, has been modified, to overcome a problem of convergence that was being faced in the previous version. Further, the issue of efficiency enhancing effects of tariff reform has been incorporated in the new model. Since improvement in efficiency and competitiveness of domestic industry is a prime object of trade reforms, the incorporation of this aspect into the model is a significant improvement. This paper reports the findings of the new model in regard to the likely impact of tariff reform on domestic industry.

Dr. Arvind Virmani
Director and CE
ICRIER

June 2004

Impact of Tariff Reforms on Indian Industry:
Assessment based on a Multi-Sector Econometric Model

Arvind Virmani[❀], Bishwanath Goldar[✯], Choorikkad Veeramani[‡] and Vipul Bhatt[§]

Abstract

India is expected to bring her tariff rates in line with the ASEAN levels in the near future. Since the level of tariff adjustment may be large and the impact on domestic industry due to such policy change could be significant, it is imperative to quantify the impact of tariff policy changes on India's industrial sector. The present study is an attempt to gauge the impact of reductions in tariff on the Indian manufacturing sector using a multiple-equations dis-aggregated econometric model. An 838 equations model is estimated and solved to carry out simulations (under alternative tariff reduction scenarios) encapsulating the impact of tariff reduction on key economic variables like output, employment, invested capital stock, exports and imports. The results of the study suggest that a substantial reduction in tariff rates, say bringing down the import-weighted average rate for industrial products from about 20 percent as prevailing in the beginning of 2003-04 to about 10 percent (along with associated currency depreciation and increased market access) would have only a marginal impact on net exports, value of production and employment in the organised manufacturing sector. It seems no significant adverse impact would be there on the domestic industrial sector from the tariff cuts. Rather, a small increase in aggregate industrial production and employment might occur emanating from the efficiency enhancing effects of tariff reform. However, a detailed sector-wise analysis indicates that the impact of tariff reforms would be differentiated across products i.e. opening up of new opportunities and potential threats, with firms in some industries gaining and firms in some other industries losing in terms of net exports, value of production and employment.

Acknowledgements: We are grateful to Prof. K.L. Krishna for his valuable intellectual inputs to the study and thank Mr. Prabhu Prasad Mishra and Mr. R. Ravishekhar for providing competent research assistance.

❀ Director and CE, ICRIER, New Delhi
✯ IFCI/IDBI Chair Professor, ICRIER, New Delhi
‡ Fellow, ICRIER, New Delhi
§ Consultant, ICRIER, New Delhi

1 INTRODUCTION

India's customs tariff rates have been declining since 1991. The "peak" rate has come down from 150% in 1991-2 to 40% in 1997-8. The downward momentum was reversed the next year with the imposition of a surcharge. This momentum has resumed with the reduction of the "peak" rate to 35% in 2001-2 and 30% in 2002-3. "Peak" rates (applicable to all manufactured and mineral products except alcoholic beverages and automobiles) were reduced to 20% at the end of 2003-4. The simple average tariff rate has therefore declined from 81.8% in 1990 to 32.4% in 1999 and to 29% in 2002. It is therefore an appropriate moment to take stock of the impact of such tariff reduction on Indian Industry during the nineties and chart out a course for the future.

Despite the substantial reductions since 1991, India's tariff rates remain among the highest in the World. India is therefore likely to come under pressure during market access negotiations for non-agricultural products in the Doha Development Round of the WTO. Independent of the Doha-round negotiations, the Indian government is already committed, through the statements of successive Finance Ministers before the Parliament, to bring down the tariff rates in India to the levels prevailing in ASEAN countries. This will require substantial tariff cut for non-agricultural products. The Virmani Committee [Revenue Department (2001)] recommended the reduction of peak rates to 10% and Virmani (2002) has outlined a schedule of tariff reductions to a uniform rate of 5% by the end of the decade. This would align India's import tariff rates with those of ASEAN, a move whose importance has increased with the signing of the framework agreement for an India-ASEAN FTA. Given that deep cuts in industrial tariff are likely to be made in the coming years, it is important to assess how further tariff reductions would impact domestic industry.

This paper presents the major findings of a study undertaken to quantify the impact of tariff policy changes on Indian industrial sector. The assessment of the impact of tariff reform is made in the background of the tariff proposals being considered by the Negotiating Group on Market Access (NGMA) at the WTO, and the commitments of tariff reform already made by Indian Finance Ministers. To this end, a multiple-equations

dis-aggregated econometric model is formulated for understanding the behaviour India's organised manufacturing during the last two decades (1980-2000) and for simulating the effects of alternative tariff policy scenarios. It is a model of industrial production, international trade (exports and imports), labour demand, capital formation, and price determination, with inter-sectoral linkages. For a given change in tariff rates, the counterfactual simulation of the model provides industry level estimates of resulting changes in: (i) imports and exports, (ii) investment, production and employment, and (iii) domestic prices. The model helps in identifying the industries that would need restructuring in the face of heightened import competition as well as the industries that would be able to take advantage of emerging export opportunities.

The model focuses largely on the endogenous interactions within the registered manufacturing sector. Two levels of interactions are involved: (a) interactions among production, domestic demand, imports and exports within each industry, and (b) interaction between sectors or industries emanating from inter-industry flows of goods and other channels such as prices and income generation. The simulation results reflect the inter-dependence among industries and the fact that there are dynamic effects of a change in tariff policy. Since a substantial reduction in tariff is likely to lead to depreciation in exchange rate, this is taken into account while making an assessment of the impact of tariff policy changes. The model simulation exercises also take into account the possible increase in India's market access in non-agricultural products in the current round of market access negotiations. For this purpose, separate studies have been carried out on possible increase in India's market access in non-agricultural products in the current round of market access negotiations in respect of seven countries, namely the US, the EU, Indonesia, Japan, Korea, Malaysia and Thailand. The results of these analyses are used in the model to assess how these increased export opportunities would impact Indian industry.

Apart form the objectives delineated above, the study, by examining the patterns of resource reallocation pursuant upon tariff reduction, is expected to throw light on certain other important issues regarding the performance of India's industrial sector. One issue is related to the viewpoint that trade liberalisation has been affecting India's

domestic industries adversely because of cheaper imports [e.g., Nambiar et al (1999), Chaudhuri (2002)]. This view is certainly contentious and, we hope, can be addressed appropriately by a comprehensive econometric model of the present type. Poor employment growth in the organised industrial sector is often cited as a case in point to support the adverse effects of trade liberalisation. However, any attempt to correlate trade liberalisation with employment growth, ignoring the rigidities in the labour market, is likely to yield spurious results. The results of the simulation exercise suggest that labour market rigidities stand in the way of re-allocating productive resources to the labour intensive industrial sectors and thus causes poor employment growth in the organised manufacturing sector.

The remainder of paper is organised as follows. Section 2 provides a brief overview of the policies and performances relating to Indian manufacturing sector, particularly during the 1980s and 1990s. Section 3 describes briefly the basic structure of the model. Section 4 outlines the data sources, elucidates the econometric methodology, and presents some key elasticity values that drive the model. Section 5 summarises the simulation results based on which an assessment is made of the effect of tariff policy changes on domestic industry. Finally, the conclusions of the study and implications for policy are given in Section 6. The Appendix contains a list of the industrial sectors covered in the study, a list of the equations and identities used for estimation, details about the construction of variables etc, and estimates of various demand and supply-side equation for 13 selected industrial sectors.

2 INDUSTRIAL POLICIES AND PERFORMANCE: OVERVIEW

2.1 Industrial and Trade Policy

India adopted a development strategy centred on import substitution in the beginning of the Second five-year Plan (1956-61). A major feature of this policy-stand was the significant role assigned to the public sector with emphasis on the development of heavy industries, which included capital goods as well as core intermediate-goods such as steel. Moreover, the government regulated various aspects related to investment, production and trade by the private sector through industrial licensing and various controls and fiscal measures. A number of studies showed that the import substitution policy, while helped broaden the industrial base of the country, led to resource misallocation and economic inefficiency. These policies also had a number of detrimental effects on exports.

A process of re-orientation of the policy framework began in the late 1970s, which gained momentum in the 1980s. The measures included industrial de-licensing, softening of restrictions on monopolies, liberalisation of capital goods imports with a view of technological up-gradation and modernisation of industry, some shifts from quantitative import controls to a protective system based on tariffs, greater subsidies for exports and a policy of active exchange rate depreciation.

The policy reforms during the 1980s, however, focussed on domestic industrial restrictions and import of inputs for export production. General import liberalisation initiatives during this period were rather selective. Imports of manufactured consumer goods remained completely banned while licenses were required to import most items of capital goods, raw materials and intermediates. Import without a license was allowed for only a selected list of inputs and components, where domestic substitutes were not being produced.

Serious and consistent attempts towards trade and industrial liberalisation were undertaken since July 1991, in response to a severe macro economic crisis. Trade

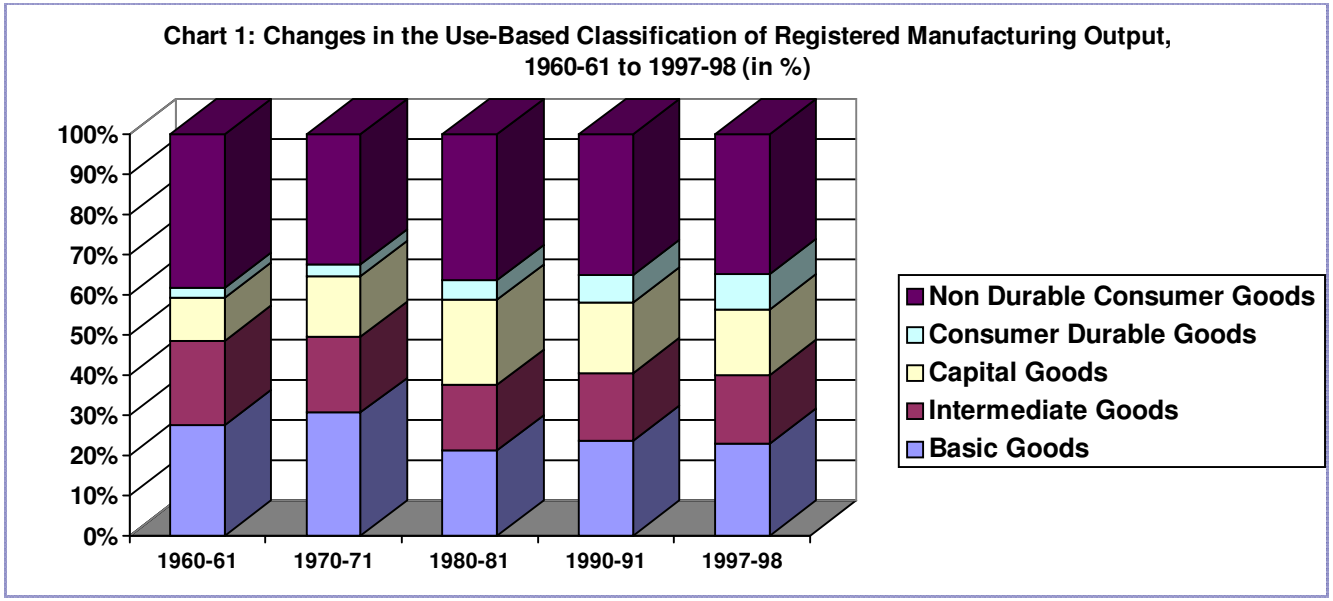
reforms during the 1990s have been largely guided by the need to improve the competitiveness of Indian Industry (Virmani, 2003). Licensing and quantitative restrictions have been abolished on most imports except those items included in the negative list. Significant attempts have been made towards bringing down the tariff rates and its rationalisation. Other important changes during the 1990s involve complete abolition of industrial licensing, abolition of phased manufacturing programs (PMPs), easy approval process for FDI, increased and flexible foreign equity participation and current account convertibility.

It is important to keep in mind the nature of the policy changes while formulating the econometric model and interpreting the results. Against the background of the policy changes, it is also important to understand the broad trends and patterns of production and trade in the manufacturing sector.

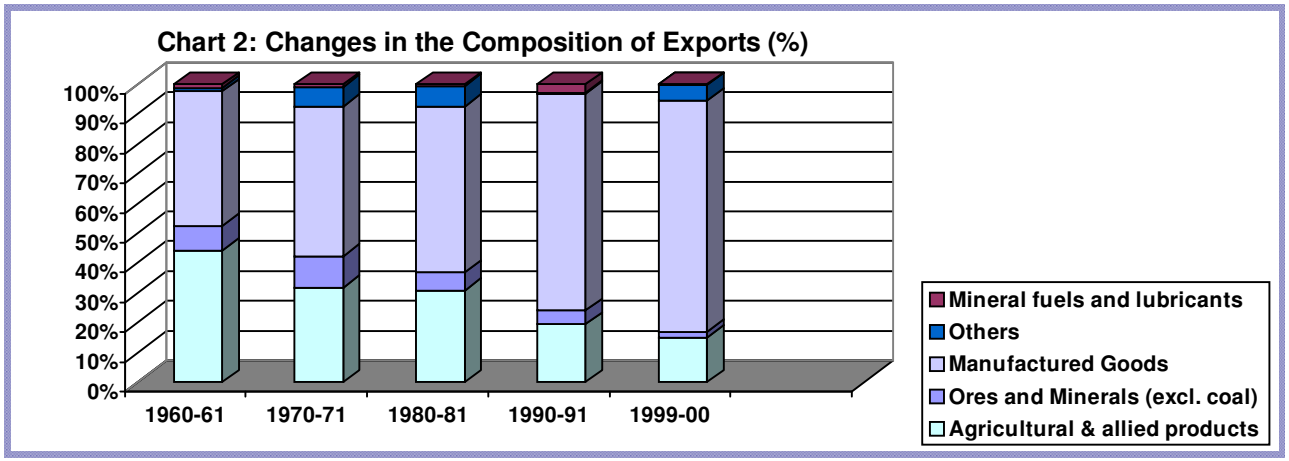
2.2 Production Trends and International Trade Patterns

At the time of independence, India inherited an industrial structure, dominated by textiles and sugar. However, the industrialisation strategy based on import substitution resulted in a wide diversification of its industrial base by the mid-1960s. The changes in the relative weights of use-based industrial groups in the registered manufacturing since 1960-61 are shown in Chart 1. It is clear that during nearly four decades since 1960-61, capital goods and consumer goods gained in importance at the cost of basic and intermediate goods. The increase in the share of consumer goods is mainly on account of consumer durable goods.

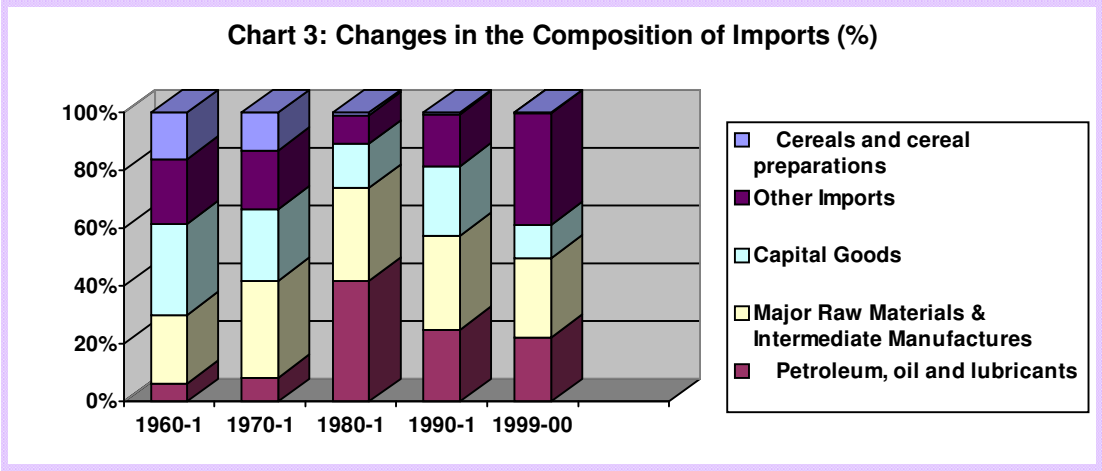
As to the composition of exports, there has been a significant structural change characterised by a consistent decline in the share of Agriculture and allied products and an improvement in the share of manufactured goods. A summary of the changes in the composition of exports is given in Chart 2. The composition of imports too has undergone changes with falling share of capital goods and food products. Chart 3 provides a summary of the changes in the composition of India's imports.



Data Source: Nagaraj (2003)



Source: Economic Survey: 2000-2001, Ministry of Finance, Government of India



Note: Prior to 1990 category **Other Imports** comprised mainly of other food and raw materials. Post 1990 however, it includes consumer goods also, which explains the rise in the share of Other Imports.

Having provided a synoptic account of the changes in the composition of production and trade, it may be useful to look at the changes in the trends in the specific industries (which are covered in the study) during the 1990s as compared to the 1980s. Such an analysis of actual performance, given the lowering of tariff rates during the 1990s, would give useful insights into the way that the manufacturing sector would respond to further tariff cuts. The trend growth rates of exports, imports and domestic production along with average tariff rates and non-tariff barriers are shown separately for the 1980s and 1990s for each of the 41 industrial sectors in Table 1.

Table 1: SECTOR GROWTH RATES, TARIFFS(average) & Non-TARIFF BARRIERS

		1980s					1990s				
No.	**Description**	**Avg Tariff**	**Avg NTBs**	**Trend Growth Rates**			**Avgerag Tariff**	**Avg NTBs**	**Trend Growth Rates**		
				Prod.	**Export**	**Import**			**Prod.**	**Export**	**Import**
1	Food products	118.6	100	6.9	5.4	-12.7	60.05	67.15	7.4	13.9	22.2
2	Beverages	172.7	100	9.4	31.4	14.8	132.95	72.5	9.1	7.2	7.8
3	Tobacco products	133.95	100	2.8	-8.9	7.2	75.9	100	3.4	-4.9	18.6
4	Textiles (except readymade garments and carpets)	121.1	100	6.2	10.6	14.8	68.4	60.75	6	12.9	7.78
5	Carpet weaving	104.45	100	-3.5	11.3	2.1	66.7	87.75	8.6	3.1	70.5
6	Readymade garments	135.5	100	13.1	19	20.8	79.45	88.9	12.2	8.3	6.3
7	Furniture and fixtures wooden	133.95	100	0.1	-9.3	1.2	75.4	75.8	-0.1	28.9	52.8
8	Wood and wood products	98.1	100	2.3	3.9	14.1	64.85	30.35	3.1	2.7	5.3
9	Paper and paper products	105	100	5.6	12.3	1.4	62.65	41.9	6.2	28.9	7.3
10	Printing and publishing	80.15	100	0.9	3.1	6.8	42.55	43.15	7.6	15.3	3.3
11	Leather footwear	135.5	100	9.9	14.6	36.2	78.2	100	9.8	2.6	-1.5
12	Leather and leather products	118.25	66.6	10.1	8.9	37.5	66.1	45.75	8.4	8.7	3.9
13	Rubber products	123.75	100	9.1	19.7	9.1	76.15	31.75	7	14.3	14.9
14	Plastic products	136.05	100	14.7	23.6	15.5	76	45.65	14.3	23.4	11.1
15	Petroleum and coal tar products	96.95	100	4.8	26.1	6.3	55.95	33.75	5.2	-20.4	14
16	Inorganic and organic heavy chemicals	101.45	100	9.2	25.3	10.3	69.05	10.155	5.9	16.6	7.4
17	Fertilizers and pesticides	71.35	100	11.2	37.3	-0.4	53.55	76.25	7	13.1	4.6
18	Paints, varnishes and lacquers	149.5	100	8	3.1	14.8	80.85	25.35	10.1	-17.4	6.3
19	Drugs and medicines	95.6	79.25	11.2	19.3	2.8	68.3	9.65	8.8	10.7	2.4
20	Soaps, cosmetics, glycerine	123.15	99.75	6.9	10.1	19.4	79.85	51.05	7.5	3.8	7.2
21	Synthetic fibres, resin	129.25	100	11.7	41.5	5.7	69.7	22.85	19.4	17.3	3.3
22	Other chemicals	106.15	98.55	10.2	19.7	11.4	66.9	58.25	11.6	14.1	5.4
23	Structural clay products	103.8	100	5.5	10.7	3	69.45	64.9	7.3	23	6.9
24	Cement	88.05	100	12.7	36.2	-60.3	73.35	85.5	6.3	23.9	24
25	Other non-metallic mineral products	107.65	96.2	8.3	15.6	8.4	69.985	54.55	3.5	18.5	3.8
26	Iron and steel basic metals	110.95	100	4.9	21.1	-1.2	62	10	4.6	22.7	1.3
27	Non-ferrous basic metals	97.65	100	11.3	28.1	1.4	59.2	18.3	8.6	2.2	12.7
28	Handtools, hardware	100.85	100	0.2	9.5	7.7	61.7	29	11.1	12.2	6.8
29	Miscellaneous metal products	121.1	100	5.7	5.4	5.1	72.35	48.55	9.6	17.2	2.1
30	Tractors, agricultural Implements	67.75	100	7.4	6.3	-0.02	44.75	24.85	8.5	20.2	15.8
31	Non-electrical machinery except agricultural and office machinery	76.8	81.2	5.8	10.5	1.5	49	17.45	5.5	10.8	6.9
32	Office, computing machinery	102.35	100	7.4	43.8	15.4	62.75	10.9	23.7	6.1	15.2
33	Electrical industrial machinery	87.9	86.95	7.2	12.7	4.7	48.85	11.7	5.2	17.5	6.2
34	Other electrical machinery	106.75	92.45	9.8	12.7	12.9	68.45	40	6.8	14.3	7.1
35	Ships and boats	62.6	100	-3	4.9	2.2	52.2	59	21	38.9	10.8
36	Rail equipment	70.95	100	2.8	-5.7	0.97	46.85	10	-5.3	6.1	2.5
37	Motor vehicles	99.75	100	6.9	5.4	-12.7	65.25	24.45	7.4	13.9	22.2
38	Manufacturing of motor cycles, scooters, bicycles	105.5	100	13.6	13.4	31.9	66.2	57.1	7.8	11.6	-24
39	Other transport equipment	96.3	100	11.1	7.5	-2.2	72.45	49.35	7.1	6.7	4.5
40	Watches and clocks	129.45	100	13.9	19.1	-2.8	65.45	64.5	3.4	41.2	1.4
41	Miscellaneous manufacturing industries	88.05	82.3	15	23.6	0.8	70.95	49.94	19.5	8.6	27.7

Note: Production data relates to registered manufacturing while imports and exports are total.

It may be observed from Table 1 that removals of QRs and reduction of tariff rates during the 1990s in general have not adversely affected production and exports of the manufacturing industries. Further, imports liberalisation has not always led to a surge in import growth and even when imports grew significantly, it has not generally led to any contraction of domestic industries. For example, while Carpet weaving and Furniture and fixtures have experienced substantial import growth during the 1990s, the impact on domestic production was far from adverse. Thus, it can be inferred from the analysis of historical data that a policy change leading to sharp tariff cut is a plausible instrument for improving efficiency and may in fact open up new opportunities in terms of higher exports, production and employment.

Given the backdrop of the above analysis of the performance of the industrial sector, we now move on to the structure and estimation of the multi-equations dis-aggregated econometric model, which has been used to carry out counterfactual simulations under alternative tariff reduction schemes. The next section briefly explains the model structure, and the following one elucidates the econometric methodology and data sources.

3 MODEL STRUCTURE

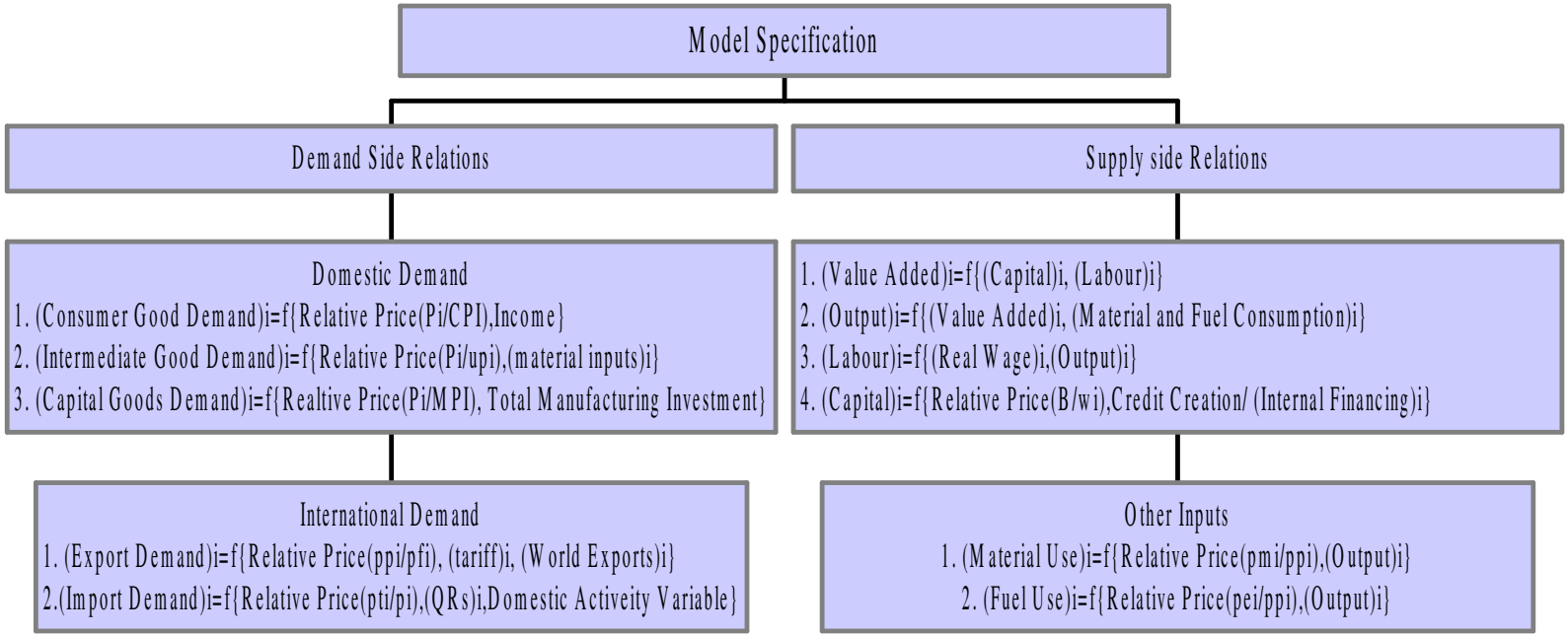
A multiple-equations econometric model is formulated for understanding the behaviour of India's organised manufacturing during the last two decades and for simulating the effects of alternative tariff policy scenarios. The basic structure of the model consist of various supply and demand equations in each sector as functions of relative prices and other relevant variables in a manner consistent with the optimising behaviour of firms and individuals. The specification of the model also incorporates various inter-sectoral linkages so as to render the model its general equilibrium features. Product price is assumed to be market clearing[1] in that it is determined at the level where supply equates demand in each sector. The sectoral classification used follows that in the official Input-Output tables for India. There are 66 sectors falling under the broad group of manufacturing in the Input-Output tables. However, data constraints necessitate aggregation of some of the individual sectors reducing total

[1] For fertilizers and petroleum products, because of price controls, we do not make the assumption that markets are cleared by price changes.

number of sectors to 41 {See Table A.1 in the Appendix for a list of sectors}. Diagram 1 briefly explains the basic behavioural equations that are estimated for 41 sectors using Ordinary Least Squares (OLS). Diagrams 2 and 3 depict some of the inter-linkages {see Table A2 in the Appendix for all the equations and identities used for estimation}.

The basic structure of the present model is similar to that formulated by Lucas (1989) for Indian industry using data for the period 1959-60 to 1979-80. The specification of demand functions for inputs and products, production function representing the supply-side and the equations inter-linking various industries have been done mostly following Lucas (1989). However, we make certain important modifications in Lucas' model. The specifications of various functions in the Lucas model reflect certain specifics of the import substitution policy and domestic industrial control regime (such as industrial licensing, price ceilings, import quotas, minimum wages, employment laws, excise and profit taxes, export incentives and duties). In the context of changes in the policy environment in India during the 1980s and 1990s, we modify some of these specifics to the extent that they have undergone changes. Most importantly, while Lucas considered imports as exogenously given (because of the existence of import quotas at that time), we treat imports as an endogenous variable in the light of removal of import quotas in most of the sectors, particularly during the 1990s. In other words, we estimate separate equations of import demand for each of the sectors. Also, unlike in Lucas (1989), we treat energy demand as endogenous to the model.

Diagram 1**: MODEL STRUCTURE**



Note:

pi- whole sale price index for ith product
ppi-producer price index for ith product
CPI- Consumer price index
Upi and umi are measure of prices and material inputs among sectors to which ith product is an input
MPI-index of manufactured product price
Wi-nominal wage rate
Pmi-material price index for ith sector
Pei-fuel price index for ith sector
See also Table A3 in the Appendix for more details regarding variable definition and construction

Diagram 2: STRUCTURE OF SUPPLY FUNCTIONS

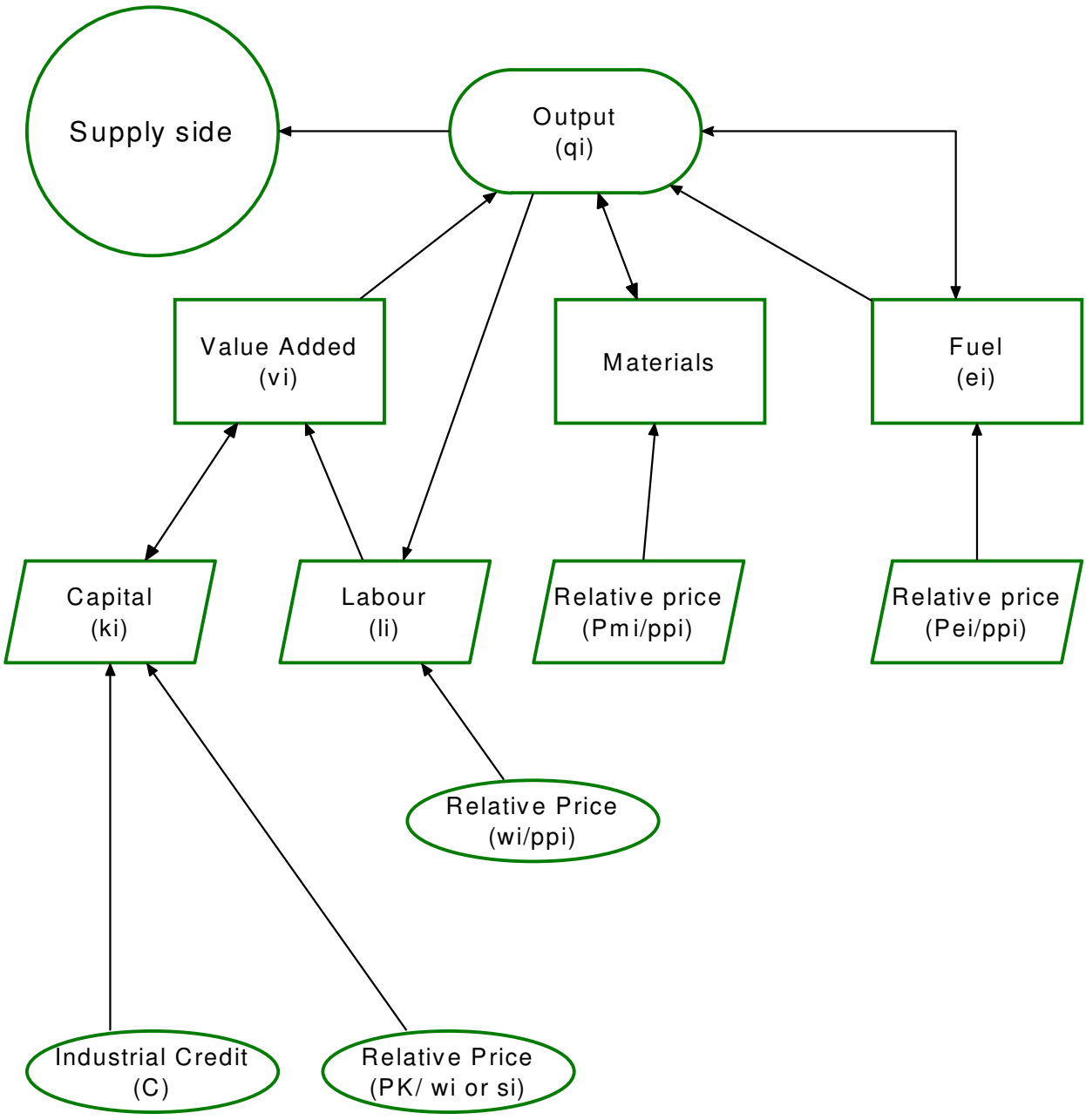
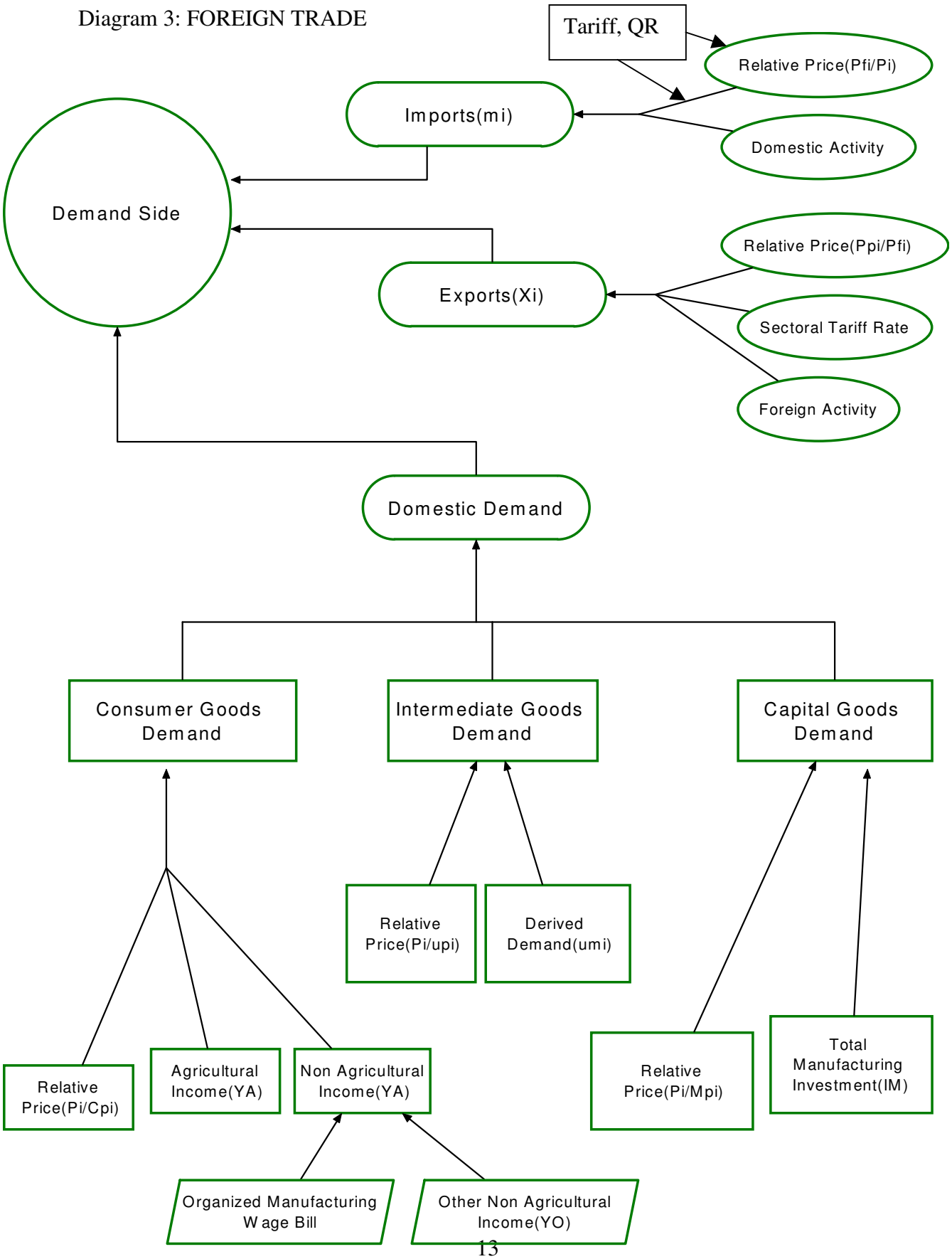


Diagram 3: FOREIGN TRADE



Another point of departure in the present study relates to the specific policy scenarios considered for counterfactual simulation. Variables relating to tariff and non-tariff barriers do not enter explicitly in Lucas's model, as import demand is considered exogenous. Thus, Lucas attempts the counterfactual simulation of the effects of trade liberalisation by replacing prices of all manufactured goods and raw materials by estimates of border prices for foreign substitute goods. The structure of our model, however, allows us to simulate the effects of trade liberalisation by adopting those tariff rates that are consistent with the contemplated tariff reforms. In so doing, we make certain plausible assumptions about the rate of currency depreciation associated with a given rate of tariff reduction. From the point of view of practical policy considerations, this procedure would yield more useful insights.

Though the model takes into account the likely changes in exchange rate caused by tariff reform, exchange rate determination is not incorporated into the model either as a part or a module. Rather, it is taken as exogenous to the system of detailed equations constituting the model. It may be pointed out in this context that at the core of the CGE models are various resource balances and accounting identities. In a fully neo classical model, the supply of various sectoral commodities has to match their total demand, labour and capital markets must clear. Apart from the commodity balances there are various financial balances in the models too, such as the balance of trade, the balance of foreign payments, etc. Typically, these conditions are incorporated as closure rules. Selection of macroeconomic closure rule (which is how adjustment takes place) and institutional characteristics (assumption about the working of markets) determine the outcome of the policy change.

In our case, we assume that a reduction in tariff would lead to depreciation in exchange rate so as to neutralise the adverse impact of the proposed tariff reduction on overall balance of merchandise trade. This is more like a closure rule needed to ensure that there is overall trade balance – a basic macro closure common to most CGE models. Ideally one would like to derive the expected depreciation due to proposed tariff reduction using an exchange rate model. However, most exchange rate models critically

depend on high frequency data. Since our study uses annual data for analysis, it is technically not feasible to integrate a high frequency exchange rate model with our model. Note, however, that even if an exchange rate model was appended to the current model another closure rule would have to be adopted to deal with the current account deficit (or surplus) that would emerge.

The Computable General Equilibrium (CGE) models, which have been commonly used for carrying out counter-factual simulations of alternative policy scenarios, usually underestimate the true gains from trade liberalisation. This is because that the CGE models are generally tailored to capture only the static allocative efficiency gains arising from trade liberalisation and ignores the dynamic gains. The dynamic gains are the results of certain efficiency enhancing effects of trade liberalisation which include greater exploitation of scale economies, learning by doing, and a host of spill-over effects associated with international trade and multinational activities.

Apart from capturing the allocative efficiency gains, the simulation in the present study attempts to capture, albeit not perfectly, the gains arising from the efficiency enhancing effects of tariff reduction. Two different procedures have been followed to capture the efficiency gains. First, the specification of the export function, for a number of industries, includes tariff rate on imports of such product into India as an additional explanatory variable. The rationale for this novel feature is that a lowering of tariff would generate pro-competitive efficiency enhancing effects and hence improve the competitiveness of Indian products. Greater competitive pressure from abroad would force the Indian firms to rationalise the choice of their product lines within each industry. The increased specialisation in (narrower) product lines is reflected in increased intra-industry trade leading to greater efficiency in the use of resources. Veeramani (2003) showed considerable growth of intra-industry trade (that is to say, the simultaneous occurrence of exports and imports within the same industry) in India's manufacturing sector during the 1990s. Another reason for including tariff rate in the export function is that reduction of tariff is likely to increase the relative profitability of export sales vis-à-vis domestic sales and thus increase exports.

Tariff rates are not however included in the export function as an explanatory variable in every sector. Since consumer goods continued to be subjected to extensive quantitative restrictions on imports in the post-reform period, the export function specifications for these industries do not include tariff rates as an explanatory variable. Even for other industries, for which the initial results indicated a favourable effect of tariff reduction on export performance, the estimated equation was checked for robustness by introducing a trend variable in the equation (in effect de-trending the series) and estimating the relationship in growth rate form. Only when the relationship between tariff and export performance was found to be robust, the tariff rate variable was retained in the estimated export function.

As exports account for only a small proportion of total production, it is not correct to assume that export increase alone can capture the entire efficiency gains accruing from tariff reduction. It may, therefore, be appropriate to estimate the extent of productivity gains because of tariff reduction and use such estimates as a proxy for the overall efficiency gain in industrial production. This is the second approach that we will follow to account for the efficiency gains on account of tariff reduction.

There are two other points to be noted about the specification of the export function. The first point relates to modelling of export behaviour. One would notice form Table A.2 in the Appendix that while, for imports, we are estimating an import demand function (the supply being assumed infinitely elastic), for export we are estimating an eclectic export function that combines demand-side and supply-side variables (see Srivivasan, 1998). Needless to say, a more satisfactory approach would be to specify the export demand and export supply as separate functions in the model, the market getting cleared by movements in the export price. This, however, could not be done due to lack of data on export incentives.2 The second point is about the interpretation of the coefficient of tariff in the export function. We are of the view that the coefficient reflects in the main the dynamic gains associated with lowering of tariffs, and the change in the relative profitability of export sales vis-à-vis domestic sales caused by tariff reform.

To discuss the issue of dynamic gains further, a number of studies have shown that trade liberalisation can give rise to greater intra-industry resource reallocation (as opposed to inter-industry reallocation) because of specialisation opportunities in narrow product lines. Growth of intra-industry trade (that is to say, the simultaneous occurrence of exports and imports within the same industry) under liberalisation is often viewed as a manifestation of such rationalisation in the choice of product lines within narrowly defined industries. Indeed, as shown by Veeramani (2003) the intensity of IIT has been growing significantly in a large number of industries since 1991 in India. Specialisation in narrow product lines and product differentiation is an added source of competitive advantage (that is, apart from the competitive advantage based on cost differences), which can not be captured by price differences. Each firm can enjoy some market power with respect to its own distinct variety of product and hence the price–cost margin can well increase even as the firm improves international competitiveness through the strategy of product differentiation. Evidently, all these effects of tariff reform get reflected in the coefficient of the tariff rate variable in the export function. It should be noted, however, that the function also has the export price (taken to be equal to producers' price) as an explanatory variable. Thus, the cost-saving effect of tariff reforms and the increases in exports due to cost reduction are captured by the price variable. The other beneficial effects of tariff reform on exports are captured by the coefficient of the tariff variable in the function.

[2] Such data are needed to estimate properly the export supply function, But, time-series data for twenty years on effective export incentive rates for the 41 sectors considered in the study could not be obtained.

4 METHODOLOGY, DATA AND ESTIMATES

4.1 Econometric methodology

The CGE models have been commonly used for carrying out counter-factual simulations of alternative policy scenarios. A number of such models do exist in the specific context of India.[3] Particularly noteworthy, from the point of view of our focus, is the CGE model constructed by Chadha et al. (1998). While the CGE models are attractive as they explicitly build the mutual interdependence between various sectors in the economy, a principal critique of these models is that, unlike the econometric models, CGE models generally do not estimate but numerically calibrate the model parameters. Various elasticity parameters are generally taken from other studies. This is problematic since the methodology, data, and time period involved in the estimation of elasticity differ from one study to another.

The methodology followed in the present study retains, to the extent possible, the attractiveness of the CGE model by incorporating inter-sectoral linkages. However, all the required parameters of the present model for each sector are estimated using time-series data for the period 1980-81 to 1999-2000. Post-estimation, we need to solve the system as a whole with estimated coefficients feeding into each stage generating a solution for all endogenous variables in the system. For this purpose, we used the Gauss-Siedel Simulation approach wherein each endogenous variable in the system is solved treating all other endogenous variables to be fixed. Consider the following system:

$$
\begin{aligned}
x1 &= f(x2, x3, \ldots . xn, z) \\
x2 &= f(x1, x3, \ldots xn, z) \\
&\cdot \\
&\cdot \\
xn &= f(x1, x2, \ldots ., z)
\end{aligned}
$$

[3] See Chadha *et al*. (1998) for a review.

where x's are endogenous variables and z represents exogenous variables, which may include lagged dependent variable. Then the problem is to find a fixed point such that $x = f(x, z)$. Gauss-Siedel uses an iterative rule for finding the solution:

$$x^{(i+1)} = f(x^{(i)}, z).$$

4.2 Sources of data

The source of data on variables concerning production, investment, and employment is the *Annual Survey of Industries* (ASI) brought out by the Central Statistical Organisation (CSO). We have taken these data for all the years till 1997-98 from a CD-ROM on ASI data prepared by the EPW Research Foundation. For the remaining years (that is for 1998-99 and 1999-2000) we obtained comparable data directly from the CSO. The basic data on India's export and import, at the 4-digit levels of International Standard Industrial Classification (ISIC), are obtained from the World Bank's 'Trade and Production Database CD-ROM" [4]. Estimates of tariff and non-tariff barriers are taken primarily from a study undertaken at the ICRIER [Das (2003)]. In addition, estimates are taken from the studies by Goldar and Saleem (1992), NCAER (2000) and Nouroz (2001). Apart from the ASI data, the CD-ROM from the EPW Research Foundation also provides data on the relevant wholesale price indices corresponding to most of the NIC 3-digit industries. In addition, we used price indices reported in Chandhok (1991). The measures of excise tax rates in each sector are compiled from data on revenue according to commodity classification for each year, as reported in *Budget Papers* of the Union Government, divided by the value of output in the ASI. World prices are proxied by U.S commodity-wise producer price indices obtained from the web-site of the Bureau of Labour Statistics, U.S. Department of Labour. Estimates of corporate tax rates are obtained from Rajakumar (2000).

[4] See Nicita and Olarreaga (2001) for details.

It may be noted that the various data we used are available according to different product classification systems. Thus, for the purpose of this study, we have made an elaborate mapping of these classification codes so as to build a harmonised database.

4.3 Key elasticity estimates

Due to limitations of space, it is not possible to present the estimates of various demand- and supply-side equations for each of the 41 industrial sectors.[5] Summary estimates of elasticity are presented here for three broad use-based product categories, namely consumer goods, capital goods and intermediate goods, and for aggregate manufacturing. Table 2 shows the price and income elasticity for India's imports and exports of manufactured goods.

Table 2**:** IMPORT AND EXPORT ELASTICITIES

Product category	**Import function**		**Export function**	
	Price elasticity	Elasticity with respect to Income/activity	Price elasticity	Elasticity with respect to Income/activity in the importing countries
Capital Goods	-0.56	1.49	-1.34	1.55
Intermediate Goods	-0.51	0.73	-2.25	1.62
Consumer Goods	-1.49	1.26	-1.14	1.21
Overall	-0.91	1.13	-1.36	1.30

The overall price elasticity for imports of manufactures is found to be -0.9 without taking into account fertilisers and petroleum products. Since price elasticity of import demand for fertilisers and petroleum products are likely to be low, the overall price elasticity would go down substantially if those two industries were included. Comparison across the three product categories reveals that import demand for consumer goods are more responsive to change in prices (hence tariff) than the import demand for capital goods and intermediate goods.

[5] Estimates for 13 selected sectors are presented in the Appendix (Tables A9 to A18). These are the sectors for which the simulation results indicate relatively greater impact of tariff reform. In some cases the effect is expected to be favourable. In other cases, it is expected to be unfavourable.

The overall (aggregated) elasticity of imports of manufactures with respect to income/activity is found to be 1.13. The import demand for intermediate goods appears to be relatively less responsive to changes in income/activity level than the import demand for capital goods and consumer goods.

At the aggregate level, the elasticity of demand for India's exports of manufactures with respect to price is found to be 1.36, while that with respect to income/activity in the importing countries is found to be 1.3. Thus, the demand for India's exports of manufactures seems to be fairly elastic with respect to price as well as income/activity. This is consistent with the estimate of Virmani (1991). This is true for all three major product categories: consumer goods, intermediate goods, and capital goods. The estimates suggest that, among the three product categories, the export demand is relatively more elastic for intermediate goods than for consumer goods and capital goods.

Turning to domestic demand (see Table 3), the elasticity of demand with respect to income/activity is unity at the aggregate level and nearly equal to one in all the three product categories. The weighted, average price elasticity of domestic demand for manufactured products is found to be –0.844. For consumer goods and capital goods, the price elasticity are –1.17 and –0.87 respectively. The average price elasticity of domestic demand for intermediate goods is relatively lower at –0.404. The results suggest that domestic demand for intermediate goods industries is relatively less sensitive to price changes than the domestic demand for capital and consumer goods industries.

Table 3**:** DOMESTIC DEMAND ELASTICITIES

Product category	Price elasticity	Elasticity with respect to Income/activity
Capital Goods	-0.874	1.08
Intermediate Goods	-0.404	1.06
Consumer Goods	-1.172	0.94
Overall	-0.844	1.01

5 SIMULATION RESULTS

Using time-series data for the period 1980-81 to 1999-00, the demand and supply relations specified in Section 3 have been estimated, applying OLS, for each of the 41-sectors, so as to obtain the relevant parameter estimates to carry out the simulation exercise. This procedure, as pointed out earlier, makes the present study considerably different from typical CGE modelling that utilises parameters from other studies instead of estimating them.

The supply and demand relations for the 41-sectors specified in Section III along with the following equilibrium relation constitute the model (see also Table A2 in the Appendix):

$q_i = d_i + x_i - m_i$

where q denotes production, d domestic demand, x exports and m imports. The identity implies that total production of output in a sector should be equal to domestic demand for the product plus export demand minus the quantity imported

The model is solved using Gauss-Siedel Procedure. The first step was to validate the model by checking the alignment of the baseline solutions with the actual. The baseline estimates of the model are fairly close to the actual values with the exception of employment, imports and exports (the deviations are -6.2%, -9.6% and 11.8% respectively). It should be noted, however, that the model follows closely the trends and is able to predict the turning points very well. The next step is to use the model for simulation under alternative tariff scenarios.

5.1 Aggregate Registered Industry

The simulations have been carried out for the years 1997-98 to 1999-00, the last three years in our data set. During these three year, the import weighted average tariff on industrial products was about 35 percent. The question we ask is the following. Assuming tariff rates to be hypothetically lower than the existing levels during 1997-98 to 1999-00, what would have been the deviation from baseline (model solutions with tariffs that

actually prevailed during that period) in respect of production, employment, capital stock, imports and exports of industrial sector? We consider the following two tariff reduction scenarios:[6]

- Scenario 1: General tariff rate for manufactures brought down to 10 percent and exchange rate depreciates by 2.82 percent.[7]

- Scenario 2: General tariff rate for manufactures brought down to 10 percent and India gets increased market access[8] in industrial products.

For the purpose of the analysis, to be done in a general equilibrium framework, counterfactual simulations of the model have been carried out for alternative tariff regimes (along with expected depreciation and market access increase) mentioned above. The analysis has been done at the level of the 41 sectors or industry groups considered in the model[9]. The baseline solutions of the model for the three years 1997-98 to 1999-00 (average) are compared with the simulation results, which incorporate the effects of tariff reduction, increased market access and depreciation in exchange rate.[10] Table 4 below summarises the impact on the Manufacturing Sector's aggregate production, exports, imports, employment and capital stock.

[6] For specifying the scenarios regarding reduction in tariff rates, we have considered the proposals that have been given on the formula to be adopted for tariff cuts in the current round of negotiations on market access for non-agricultural products. We have also considered the recommendations that some important official committees in India have made on tariff reform (Kelkar Committee, Virmani Committee) and the commitments made by the Indian government for tariff reduction in the coming years.

[7] According to our estimates, this extent of exchange rate depreciation would have neutralized the adverse effect of tariff reduction on the overall balance of merchandise trade.

[8] Our analysis indicates that increased market access will help India's exports of manufactures at the aggregate level to increase by about 6 percent.

[9] Table A6 in the Appendix shows the tariff rates prevailing in the 41sectors during 1997-98 to 1999-00, and the change considered in the simulation exercise.

[10] As a check on the results of model simulation, a simple simulation exercise has been carried out first, in a partial equilibrium framework, for which only the estimated import and export functions have been used. The results obtained from the partial equilibrium analysis are found to be consistent with the simulation incorporating the general equilibrium features of the model.

Table 4: EFFECT OF TARIFF REDUCTION ON AGGREGATE INDUSTRY

Change Considered	Simulation Results (average for 1997-8 to 1999-00)				
	Imports	**Exports**	**Production**	**Employment**	**Capital stock**
Tariff reduction & Exchange Rate Depreciation (2.82%)	10.6	12.0	-0.08	0.21	-0.08
Tariff reduction & increased market access	12.7	12.2	0.06	0.29	-0.09

It is clear from above table that at the aggregate level, tariff reforms would have only a marginal effect on output, invested capital and employment. Even if exchange rate does not depreciate following the tariff reduction but Indian exporters gain increased market access as in Scenario 2, a significant increase in exports will occur almost equal to the increase in imports (because of pro-competitive effects of tariff reform and gains from better market access).

While the result at the aggregate level is useful, it is instructive to determine and understand the response of each of the use-based product categories (namely consumer goods, capital goods and intermediate goods) and each of the 41 industrial sectors (covered in the study as shown in Table A1 in the Appendix).

5.2 Use-based Industry

The attempt is to bring out the impact of tariff reduction and exchange rate depreciation/change in market access across major product groups. For the purpose, we have categorised 41 sectors into three groups: consumer goods, intermediate goods and capital goods. The results of the simulation exercise are summarised in Table 5. It may be observed from the table that tariff reductions would favour intermediate and capital goods at the cost of consumer goods. The percentage increase in exports of intermediate and capital goods would be more than the percentage increase in imports. In the case of consumer goods, on the other hand, the percentage increase in imports would be more than the percentage increase in exports. While tariff reform causes production of capital and intermediate goods to go up, it leads to a decrease in the domestic production of

consumer goods. Moreover, the model indicates that tariff reforms (with accompanying changes in market access and exchange rate) will not have any major impact on the rate of investment in manufacturing but may increase employment marginally. Tariff reform accompanied by exchange rate depreciation causes capital stock to decline by –0.08 percent and employment to increase by 0.21 percent {in the aggregate). Tariff reform accompanied by increased market access, causes capital stock to decline by –0.09 percent and employment to increase by 0.29 percent.

Table 5: SIMULATION RESULTS FOR USE-BASED CATEGORIES
(Average change relative to baseline for 1997-98 to 1999-00)

Scenario/ Product Group	**Change relative to baseline estimate (%)**				
	Imports	Exports	Production	Capital	Labour
Tariff reduction coupled with exchange rate depreciation by 2.82 percent					
Capital goods	9.34	26.30	0.29	0.72	0.16
Intermediate goods	6.34	26.96	0.60	-0.12	0.46
Consumer goods	19.91	5.99	-0.70	-0.25	0.13
All industries	**10.58**	**12.04**	**-0.08**	**-0.08**	**0.21**
Tariff reduction along with increase in India's market access					
Capital goods	11.09	24.75	0.54	0.86	0.34
Intermediate goods	7.19	22.41	0.55	-0.21	0.45
Consumer goods	24.84	7.83	-0.44	-0.17	0.23
All industries	**12.71**	**12.21**	**0.06**	**-0.09**	**0.29**

It may be noted that while the impact of tariff reduction on imports and exports are quantitatively very significant, the impact on other variables (such as production, investment and employment) does not appear to be so. This result is not surprising as the quantitative importance of international trade in relation to the size of the domestic economy is still not very high in India.

5.3 Individual industrial sectors

As expected, the reductions in tariff rates (along with an increase in market access and depreciation in exchange rate) have differential effects on the production. Some industries gain while others lose in terms of production, exports, employment etc.[11] Table 6 presents a brief summary of potential gains in terms of increased production and exports and possible threats in terms of fall in production and increased imports for the sectors that are impacted significantly.

As shown in Table 6, the model predicts marked increase in production for the following products. Leather and leather products, Plastic products, Synthetic fibres and resins, Structural clay products, Non-metallic mineral products (except cement), Electrical machinery (other than electrical industrial machinery), Textiles and textile products (except readymade garments), and Carpet weaving. Interestingly, with increased market access there would be a rise in exports of readymade garments, but this is not translated into an increase in domestic production, which may be explained by the impact of increased exports of textiles and other industrial goods on production costs of readymade garments.

Among the industries for which the model results indicate a fall in the value of production, the prominent ones are: Beverages and liquor, Wood and wood products, Wooden furniture and fixtures (organised sector component), Office and computing machinery, Ships and boats, Watches and clocks, and Miscellaneous manufacturing. In most of these cases, the model insinuates a significant increase in imports also. In almost all cases, where a significant decline in production (say more than one percent) is indicated, the decline in value added is relatively lower than the decline in value of production. Similarly, the increase in value added is generally lower than the increase in production in the cases where a significant increase in production is indicated. This seems to reflect the stickiness in making adjustments in capital and labour.

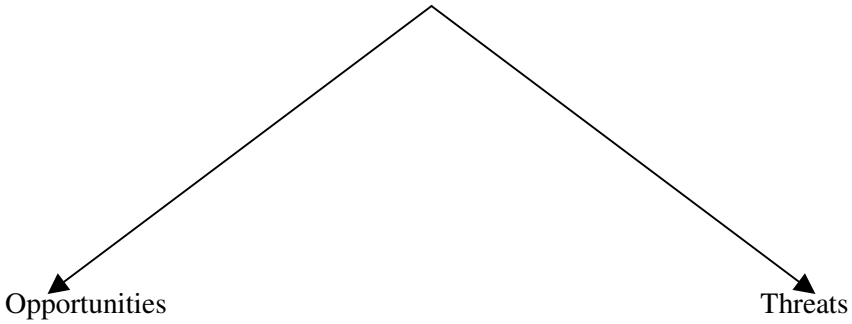
[11] For a detailed sector wise results of simulation exercise please refer to Tables A4 and A5 in the Appendix.

Another significant implication that can be derived from this exercise is that there has been no shift in the industrial structure in favour of labour intensive industries as a result of tariff reform. In fact, the model predicts significant gains in terms of production for a number of capital-intensive industries, (Synthetic fibres and resins, Plastic products, and Organic and inorganic heavy chemicals). Some labour intensive industries, such as Food products, would lose in terms of production, as imports make greater inroads into the domestic markets. The reason for this is the well known rigidities in the labour market that raise the effective cost of labour and thus discourage new entrants from entering labour-intensive sectors and bias the system towards use of capital intensive techniques. Other policy distortions such as SSI reservation and excise tax exemptions augment the dis-incentive to produce global quality, labour-intensive products on a large enough scale to exploit economies of scale and scope. Under such circumstances, the inability of the organised manufacturing sector to generate adequate employment is not surprising.

5.4 Efficiency Gains From Tariff Reduction

The discussion until now has focused on the impact of tariff reduction with associated depreciation or increased market access on net exports, production, employment and invested capital in the manufacturing sector of the Indian economy. However, such a reform is most likely to generate efficiency gains in production due to reduction in tariffs. A study by Topalova (2003) on Indian manufacturing firms has suggested that there would be around 0.5% efficiency gains (in value addition) for every 10-percentage point decrease in tariff rates.

Table 6**:** IMPACT OF TARIFF REFORM BY SUB-SECTOR



Increase in Exports	Increase in Imports
Textiles and textile products except carpets and readymade garments Leather footwear Paper and paper products Rubber products Plastic products Synthetic fibres and resins Structural clay products Non-metallic mineral products Iron and steel basic metal industries Miscellaneous metal products Motor vehicles Electrical industrial machinery Other electrical machinery	Food products Beverages and liquor Textiles and textile products except carpets and readymade garments Carpet weaving Leather footwear Wooden furniture and fixtures Plastic products Paints, varnishes and lacquers Soaps, cosmetics and glycerin Cement Non-ferrous basic metals Ships and boats Rail equipment Motor vehicles Tractors and agricultural implements Office, computing machinery Miscellaneous manufacturing industries
Increase in Value of Production	**Fall in the Value of Production**
Textiles and textile products except carpets and readymade garments* Carpet weaving (organized)* Leather and leather products Plastic products Synthetic fibres and resins Structural clay products Non-metallic mineral products Electrical machinery (other than electrical industrial machinery) * in increased market access scenario	Beverages and liquor Wood and wood products Wooden furniture and fixtures (organized sector component) Office and computing machinery Ships and boats Motorcycles, scooters, bicycles Watches and clocks Miscellaneous manufacturing industries

Using data for 137 three-digit manufacturing industries for the period 1980-81 to 1997-98, we have analysed the effect of trade reform on productivity and have found that efficiency gains to be roughly 1% for every 10-percentage point decrease in tariff rates.[12] Since any such gain in efficiency is likely to have significant impact on domestic production, we have conducted two more simulation exercises incorporating the expected efficiency gains accruing from tariff reforms (see Table A6 in Appendix for sector wise efficiency gain estimates):

Scenario 3: General tariff rate for manufactures brought down to 10 percent, exchange rate depreciates by 2.82 percent and we expect 1% efficiency gains for every 10-perecentage point fall in tariff rate.

Scenario 4: General tariff rate for manufactures brought down to 10 percent, India gets increased market access in industrial products and we expect 1% efficiency gains for every 10-perecentage point fall in tariff rate.

At the aggregate level, the impact of tariff reform is more prominent after incorporating expected efficiency gains in the analysis. Table 7 summarises the impact of tariff reduction across major product groups. From the table we observe that the impact of tariff reduction on the domestic economy is much more significant with production increasing by about 3% in both scenarios at the aggregate manufacturing sector level compared to a near negligible impact in the scenario without any efficiency gains (see Table 4). The increased production would imply lower imports and higher exports for the manufacturing sector at the aggregate level. As a result we have lower imports (9.8 % for

[12] The estimated regression equation (fixed-effects model) is shown below (t-ratios in brackets):

$$\ln(V/L) = \text{constant} + \underset{(19.3)}{0.315}\ln(K/L) - \underset{(-3.0)}{0.00105}\,\text{tariff}(t-1) - \underset{(-6.3)}{0.0023}\,QR(t-1)$$

Overall R-squared = 0.26, Number of industries = 137, Period = 1980-81 to 1997-98

V denotes real value added, L employment and K fixed capital stock at constant prices. QR denotes quantitative restrictions. Tariff and QR have been introduced in the equation with one-year lag, as done by Topalova (2003). It may be pointed out that the estimates of the random-effects model are similar.

scenario 3 and 12.0 % for scenario 4) and higher exports (13.8% for scenario 3 and 13.9% for scenario 4) compared to those observed under Scenarios without efficiency gains. Similarly we observe higher growth in employment and capital at the aggregate.

Analysing the sector-wise results we see that, on the micro side the impact of tariff reduction coupled with depreciation or market access and expected efficiency gains is similar to the results of the simulation exercise conducted without accounting for efficiency gains. We get almost similar list of potential gainers with impact on production, net exports, capital and employment being even more significant quantitatively (The detailed sector-wise results of the exercise are summarised in Tables A7 and A8 in the Appendix).

Before concluding this section, it may be useful to take up the issue of effective rates of protection (ERP) and how the tariff reform induced reduction in the level of ERP and the extent of inter-industry variation would contribute to higher efficiency. Indeed, theoretical discussions on the impact of tariff reform are often in terms of its effect on the ERP. It would be noticed from the model structure described in Section 3 and the equations constituting the model shown in Table A2 in the appendix that ERP does not directly enter the model. But, looking at the demand and supply-side inter-linkages in the model it would be realised that the model does implicitly take into account the effect of tariff reform on ERP and the effect of that on resource allocation. The model links tariff to prices, and production and input use to output and input prices. Thus, a lowering of materials prices for an industry (say due to lowering of tariff on material supplying industries), other things remaining the same, leads to increased use of materials, which in turn causes an increase in production and hence increased use of labour and capital. We recognise at the same time that the changes in the industrial structure predicted by the model for Scenario II are quite small as compared to the expected changes in ERP resulting from the tariff reform.13 The explanation seems to lie in the rigidities in the use

---

[13] Rough estimates of ERP for 1999-00 for the 41 sectors considered in the study suggest that effective protection accorded by tariff was about 42 percent that year, ranging from 94 percent for beverages to 20 percent for printing and publishing. Using tariff rates of Scenario II, the mean rate of effective protection is found to be much lower at about 9 per cent. The range is found to be

of labour and capital in industry. The lagged labour and capital variable often turned out to be statistically significant in the labour demand and capital demand functions. This implies that entrepreneurs find it difficult to change the amount of capital used and the number of persons employed in the factories even if input price changes so warrant (see Tables A13 and A15 in the Appendix). These rigidities prevailing in the past probably get reflected in the estimated equations of the model, which tends to limit the inter-industry movements of primary inputs and restrict changes in production level. It follows therefore that if the rigidities in the use of capital and labour in industries could be removed/relaxed, allocative efficiency gains from tariff reform can be realised to a greater extent.

Another issue worth considering in this context is that the effect of lowering of ERP on industrial productivity. The equation in footnote 12 uses tariff as an explanatory variable. An alternative would be to use Effective Protection rates in place of tariff rates. But, we have not done so as available estimates of nominal protection (tariff) are more reliable than the estimates of ERP. The tariff rates for primary sectors (particularly agriculture) are far less precise than those for manufactured goods and may not correctly show the level of protection enjoyed those sectors. These tariff rates are in turn necessary for estimating ERPs for manufactured goods that have a significant proportion of agricultural input.

---

38 percent for beverages to about 2 percent for food products and −1 percent for other chemicals (leaving aside petroleum products for which the ERP is found to be −15 percent because the tariff on crude oil is taken at the historical value, exceeding that on petroleum products). Evidently, tariff reform would lower the inter-industry dispersion in ERP. Table A19 in the Appendix presents the industry-wise estimates.

Table 7: SIMULATION RESULTS FOR SUB-AGGREGATES
(Percent deviation from baseline estimates, average for 1997-98 to 1999-00)

Scenario/ Product Group	**Change relative to baseline estimate (%)**				
	Imports	Exports	Production	Capital	Labour
Tariff reduction plus 2.82% exchange rate depreciation and 1% efficiency gains					
Capital goods	9.01	27.85	3.99	2.52	1.13
Intermediate goods	5.71	30.48	2.99	1.07	2.21
Consumer goods	18.48	7.15	2.37	0.87	0.75
All industries	**9.81**	**13.77**	**2.82**	**1.14**	**1.14**
Tariff reduction + increase in India's market access and 1% efficiency gains					
Capital goods	10.77	26.23	4.11	2.67	1.31
Intermediate goods	6.63	25.77	2.94	0.98	2.18
Consumer goods	23.34	8.93	2.57	0.95	0.86
All industries	**11.95**	**13.85**	**2.91**	**1.14**	**1.23**

6 CONCLUSIONS AND IMPLICATIONS

The present study delineates the impact of a import tariff reduction in India with the help of a comprehensive multi-equations econometric model. The key findings of the simulation exercise (under alternative tariff reduction scenarios) at the aggregate and sub-aggregate level are the following. A significant reduction in tariff rates for industrial products would:

a) **Increase imports.** The increase in imports would, however, be relatively small.

b) **Increase Exports**: Tariff reforms and the associated exchange rate depreciation would increase exports[14]. As a result there might be only a marginal effect on net

[14] This result is consistent with the evidence that the intensity of intra-industry trade has been increasing significantly in Indian industry after liberalisation (Veeramani, 2003)

exports of the industrial sector. Even if tariff reduction does not lead to depreciation in exchange rate but it is accompanied by increased market access, the increase in exports of manufactures may be high enough to prevent any deterioration in the balance of trade in manufactures.

c) **Lead to a marginal change in the value of production and value added in organised industry**. The changes in employment and investment rate are also likely to be small.

d) There is a possibility of a favourable effect on industrial employment, especially if tariff reform is accompanied by increase in India's market access. But, no major shift in the industrial structure in favour of labour-intensive industries is indicated by the results of model simulation.

e) For capital goods and intermediate goods, growth of exports would far exceed the growth in imports with a resultant increase in net exports. Value of production and value added would increase slightly,

f) **Have a less favourable effect on consumer goods industries than on capital and intermediate goods industries**. In consumer goods, growth in imports will exceed growth in exports. Marginal declines in value of production and value added are likely in consumer goods.

At the individual industry level, the simulation results indicate that some industries would gain in terms of production and employment while some others will lose. Some prominent gainers identified are Leather and leather products, Plastic products, Synthetic fibres and resins, Structural clay products, Non-metallic mineral products (except cement) and Electrical machinery (other than electrical industrial machinery). Some prominent losers identified are Beverages, Wood and wood products, Furniture and fixtures wooden (organised sector component), Office and computing machinery, Ships and boats, and Miscellaneous manufacturing.

A reform involving lowering of tariff rates would bring about efficiency gains in production. Assuming such gains to be 1% for every 10-percentage point fall in tariff rates we have conducted two simulation exercises. The results indicate much stronger,

favourable impact of tariff reforms on the production, net exports, employment and capital not only at the aggregate level but also across individual sectors.

A few comments may be added here on the findings of the study. First, the results of the study do not show any extensive reallocation of resources across industries resulting from tariff reform. The explanation seems to lie in the supply-side rigidities. Since the model is estimated from past data, the rigidities prevailing in that period (labour laws/rules/procedures, SSI reservation) get reflected in the estimated parameters, which in turn, influences the results of simulation. It seems to us therefore that if these rigidities, particularly labour market rigidities, get removed, the effect of tariff reform on output and employment would be more favourable than what our model predicts.

Secondly, the model takes into account the pro-competitive effects of tariff reform on exports of capital and intermediate goods but not those in respect of consumer goods. This may have made the model results less favourable for consumer goods as compared to capital and intermediate goods. It should be noted that the counter-factual simulation is done in the study for 1997-98 to 1999-00 when many of the consumer goods had quantitative restrictions on imports. Given the quantitative restrictions, the pro-competitive effects of reduction in tariff on consumer goods would have been low. These effects have therefore not been considered in the model. However, it should be recognised that at present the quantitative restrictions on consumer good have been mostly removed and therefore the effect of tariff reform should be more favourable than what is indicated by the model results.

In sum, the findings of the study indicate that Indian industry would gain from further reduction of tariffs. The results of this research give us greater confidence that industry can and will cope very well with a reduction of the peak tariff rate to 10% in the next few years and to 5% during the next five years. The result of this study along with others on FDI, exports and productivity[15] suggests that the global competitiveness of Indian industry would increase substantially if tariffs are brought down to these levels.

[15] Either published or presented in ICRIER working papers.

Though certain industries could be adversely affected, these may be provided help in restructuring so that the costs of adjustment are kept low. A detailed analysis of resource cost, current technology and possibilities of improvement, and market structure is needed for better insight into the nature of restructuring required to overcome (if any) potential adverse effects stemming from the tariff reform process.

7 REFERENCES

Chadha, R., Pohit, S., Deardorff, A. V., and Stern, R.M., (1998), *The Impact of Trade and Domestic Policy Reforms in India: A CGE Modeling Approach*, The University of Michigan Press, Ann Arbor.

Chaudhuri, S., 2002, Economic Reforms and Industrial Structure in India, *Economic and Political Weekly*, January 12, 37, 155-168.

Chandok, H.L. (1991), *India Database: The Economy*, Living Media India Ltd., New Delhi.

Das, D.K. (2003), Quantifying Trade Barriers: Has Protection Declined Substantially in Indian Manufacturing? *Working Paper No. 105,* Indian Council for Research on International Economic Relations, New Delhi.

Goldar, B. N. and Saleem, H.N. (1992), India's Tariff Structure: Effective Rates of Protection of Indian Industries, *Studies in Industrial Development,* Paper No. 5, Ministry of Industry, Government of India, October 1992.

Lucas, R.E.B. (1989), Liberalizing of Indian Trade and Industrial Licensing: A Disaggregated Econometric Model with Simulations, *Journal of Development Economics.*

Nambiar, R.G., Mumgekar, B.L., Tadas, G.A., 1999, Is Import Liberalization Hurting Domestic Industry and Employment? *Economic and Political Weekly*, February 13, 34, 417-424.

NCAER (2000), *Protection in Indian Industry*, National Council of Applied Economic Research, New Delhi.

Nicita, A. and Olarreaga, M. (2001), Trade and Production, 1976-1999, *Working Paper No.: 2701,* Development Research Group, World Bank.

Nouroz, H. (2001), *Protection in Indian Manufacturing: An Empirical Study,* MacMillan India Ltd, New Delhi.

Rajakumar, J.D (2000), 'Financing Patterns and Investment: A Study of the Private Corporate Sector in India' Unpublished Ph.D Thesis submitted to the Jawaharlal Nehru University, New Delhi, Centre for Development Studies, Trivandrum.

Revenue Department, Ministry of Finance, "Custom Tariff Committee Report, Department of Revenue," Ministry of Finance, November 2001 (Virmani committee). Annotated version available on Revenue department and ICRIER web sites.

Srinivasan, T.N. (1998), "India' s Export Performance: A Comparative Analysis", in I.J. Ahluwalia and I.M.D. Little (eds.), *India's Economic Reforms and Development: Essays for Manmohan Singh***,** Delhi: Oxford University Press.

Topalova, Petia (2003), "Trade Liberalisation and Firm Productivity: the Case of India", Yale university, available on line at: www.econ.yale.edu/seminars/NEUDC03/topalova1.pdf.

Veeramani, Choorikhad (2003), "Liberalisation, Industry-specific Factors and Intra-Industry Trade in India," ICRIER Working Paper No. 97, March 2003.

Virmani, Arvind (1991) "Demand and Supply Factors in India's Trade," Economic and Political Weekly, Vol. XXVI, No. 6, February 9, 1991.

Virmani, Arvind (2002) "Towards a Competitive Economy: VAT and Customs Duty Reform, Planning Commission Working Paper No. 4/2002-PC, april 2002).

(http://planningcommission.nic.in/reports/wrkpapers/rpwpf.htm).

Virmani, Arvind (2003) "India's External Reforms: Modest Globalization Significant Gains, Economic and Political Weekly, Vol. XXXVII No. 32, August 9-15, 2003, pp. 3373-3390.

8 APPENDIX

Table A1: List Of Sectors

Sector	Description
1	Food products
2	Beverages
3	Tobacco products
4	Textiles (except readymade garments and carpets)
5	Carpet weaving
6	Readymade garments
7	Furniture and fixtures wooden
8	Wood and wood products
9	Paper and paper products
10	Printing and publishing
11	Leather footwear
12	Leather and leather products
13	Rubber products
14	Plastic products
15	Petroleum and coal tar products
16	Inorganic and organic heavy chemicals
17	Fertilizers and pesticides
18	Paints, varnishes and lacquers
19	Drugs and medicines
20	Soaps, cosmetics, glycerine
21	Synthetic fibres, resin
22	Other chemicals
23	Structural clay products
24	Cement
25	Other non-metallic mineral products
26	Iron and steel basic metals
27	Non-ferrous basic metals
28	Hand tools, hardware
29	Miscellaneous metal products
30	Tractors, agricultural Implements
31	Non-electrical machinery except agricultural and office machinery
32	Office, computing machinery
33	Electrical industrial machinery
34	Other electrical machinery
35	Ships and boats
36	Rail equipment
37	Motor vehicles
38	Manufacturing of motor cycles, scooters, bicycles
39	Other transport equipment
40	Watches and clocks
41	Miscellaneous manufacturing industries

Table A2: Equations and identities of the model

No.	Description	Equation
1	Value added	$\ln v_i = \phi_0 + \phi_1 \ln k_i + \phi_2 \ln l_i.$
2	Output	$\ln q_i = \gamma_0 + \gamma_1 \ln v_i + \gamma_2 \ln me_i$
3	Labour Input	$\ln l_i = \lambda_0 + \lambda_1 \ln (w_i / pp_i) + \lambda_2 \ln q_i + \lambda_3 \ln l_{i-1}$
4A	Fixed Capital	$\ln k_i = \psi_0 + \psi_1 \ln (B / w_i) + \psi_2 \ln v_I + \psi_3 C/PK + \psi_4 \ln k_{i-1}$
4B	Fixed Capital	$k_i = \psi_0 + \psi_1 s_i / PK + \psi_3 C / PK + \psi_4 k_{i-1}$
5	Cost of capital services	$B = (\Sigma \psi_i p_i) (R + 0.05)$
6	Internal financing from sectoral profits	$s_i = (v_i - w_i.l_i) . (1 - T)$
7	Material Input	$\ln m_i = \mu_0 + \mu_1 \ln (pm_i / pp_i) + \mu_2 \ln q_i$
8	Fuel Input	$\ln e_i = \varpi_0 + \varpi_1 \ln (pe_i / pp_i) + \varpi_2 \ln q_i$
9	Domestic demand for Consumer goods	$\ln d_i = \delta_0 + \delta_1 \ln (p_i / CPI) + \delta_2 \ln (YN / CPI) + \delta_3 \ln (YA / CPA)$
10	Domestic demand for Intermediate goods	$\ln d_i = \delta_0 + \delta_1 \ln (p_i / up_i) + \delta_2 \ln um_i$
11	Domestic demand for Capital goods	$\ln d_i = \delta_0 + \delta_1 \ln (p_i / MPI) + \delta_2 \ln IM$
12A	Export	$\ln x_i = \eta_0 + \eta_1 \ln (pp_i / pf_i) + \eta_2 \ln f_i + \eta_3 t_i + \eta_4 \ln x_i\text{-}1$
12B	Export	$\ln x_i = \eta_0 + \eta_1 \ln (pp_i / pf_i) + \eta_2 \ln YF + \eta_3 t_i + \eta_4 \ln x_i\text{-}1$
13	Import	$\ln n_i = \wp_0 + \wp_1 \ln(pt_i / p_i) + \wp_2 \ln(A) + \wp_3 qr_i$
14	Demand-Supply Balance	$q_i = d_i + x_i - n_I$
15	Material Price index	$pm_i = \Sigma \alpha_{hi} pa_h + \Sigma \mu_{ji} p_j$
16	Wholesale price index	$p_i = pp_i (1+ z_i)$
17	Net national products in non-agricultural activities	$YN = YO + \Sigma w_i l_I$
18	Consumer price index for industrial workers	$CPI = \tau_0 p_0 + \Sigma \tau_i p_I$
19	Consumer price index for agriculatural workers	$CPA = \alpha_o p_o + \Sigma \alpha_i p_I$
20	Index of manufactured product prices	$MPI = \Sigma \gamma_i p_I$
21	World price adjusted for exchange rate and nominal tariff rates	$pt_i = pf_i (1+ t)$
22	Price index of the sectors where products of sector i is used as an input	$up_i = \Sigma \rho_{ij} pp_j$
23	Derived demand of the intermediate goods	$um_i = \Sigma \beta_{ij} m_j$

Note: For the model results presented in the paper, the domestic demand functions were estimated in inverse form.

Table A3: Variable Definition and Construction

Notation	Description
i , j	Subscript for industry i , j
Q	Value of gross output deflated by producer price index pp_i.
v	Gross value added deflated by producer price index pp_I
M	Material consumed deflated by material price index $pm_{i.}$
K	Capital stock constructed following the perpetual inventory method.
L	Labour input measured by total persons engaged
E	Fuel consumed deflated by fuel price index $pe_{i.}$
W	Wage rate = total emoluments divided by total persons engaged
X	Exports deflated by producer price index pp_I
N	Import values in US dollar deflated by the U.S producer price index
Me	Sum of materials and fuels consumed
D	Domestic demand = $q_i + n_i r - \alpha_i x_i$, where $n_i r$ represents ni converted into rupees. A factor α_i is introduced because the export data include exports from unorganized enterprises, but the model is only for the organised sector
T	Nominal tariff rate = applicable average tariff rate (basic plus auxiliary) for the sector taking into account general exceptions. Special customs duty or surcharge (applicable since 1996-97) is taken into account. CVD is not included.
Qr	Quantitative restrictions on imports
T	Corporate profit tax rate derived from realized revenues
Z	Excise tax rate derived from realized revenues
C	Industrial credit = total new credit creation for medium and large industries
YF	Average GDP of India's major export market countries weighted by their share in India's total export for each year
B	Cost of capital services
PK	Price index of new capital goods
R	Prime lending rate
P	Wholesale price index
CPI	Consumer price index for industrial workers
CPA	Consumer price index for agricultural workers
YN	Nominal net national products in non-agricultural activities
YA	Nominal net national products in agricultural activities
YO	Net national product other than in agriculture and other than in the registered manufacturing sector
IM	Aggregate investment in organised manufacturing
Pf	Price of foreign substitute good adjusted for exchange rate
F	Volume of world export in the particular commodity group
A	Activity variable

Table A4: **Tariff Reduction with Exchange Rate Depreciation (2.82%), %Deviation from Baseline (1997-99 average)**

Sector	Description	Imports	Exports	Prod	Capital	Labour
1	Food Products	25.56	3.17	-0.72	-0.28	-0.52
2	Beverages	72.13	6.59	-1.22	-0.52	-0.49
3	Tobacco Products	12.38	7.24	-0.33	-0.47	-0.09
4	Textile Products	21.15	2.40	-0.92	-0.16	-0.13
5	Carpet Weaving	58.16	3.82	-0.83	-0.08	-0.68
6	Readymade Garments	9.70	3.40	-0.98	-1.26	-0.89
7	Furniture and Wooden Fixtures	74.55	14.13	-7.14	-1.59	-6.93
8	Wood and Wood Products	14.02	0.72	-4.58	-13.29	-3.48
9	Paper and Paper Products	10.30	64.08	-0.18	-0.16	0.05
10	Printing and Publishing	1.20	5.53	-0.11	-0.14	-0.01
11	Leather Products	21.16	1.18	-0.97	-0.42	-0.50
12	Leather and Leather Products	6.07	6.02	1.54	0.29	1.53
13	Rubber Products	14.22	19.67	0.91	0.50	0.64
14	Plastic Products	51.46	31.04	1.95	2.48	1.61
15	Petroleum and Coal Tar Products	0.86	0.82	0.00	-0.23	0.40
16	Inorganic and Organic Heavy Chemicals	7.73	11.75	0.87	0.41	0.82
17	Fertilizers and Pesticides	7.00	4.50	-0.22	-0.08	-0.04
18	Paints, Varnishes and Lacquers	22.59	0.77	-0.48	-0.26	-0.04
19	Drugs and Medicines	2.01	3.48	-0.14	-0.13	0.05
20	Soaps, Cosmetics and Glycerine	35.66	1.72	-0.44	0.10	-0.16
21	Synthetic Fibers, Resin	14.27	76.14	4.37	-0.84	4.42
22	Other Chemicals	0.77	3.57	-0.90	-0.37	-0.30
23	Structural Clay Products	6.98	38.38	1.03	0.31	0.64
24	Cement	186.06	10.34	-0.66	-0.44	-0.22
25	Other Non- Metallic Mineral Products	6.69	71.03	8.12	0.75	11.81
26	Iron and Steel Basic Metals	11.17	39.36	0.58	0.13	0.95
27	Non-Ferrous Basic Metals	24.38	14.05	-0.17	0.90	0.02
28	Handtools, Hardware	7.91	5.95	-0.26	0.20	0.02
29	Miscellaneous Metal Products	2.60	14.59	0.90	0.89	0.72
30	Tractors, Agr. Implements	28.85	4.90	-0.49	-0.15	-0.08
31	Non-electrical Machinery except agriculture	8.75	3.55	-0.22	0.00	-0.01
32	Office, Computing Machinery	18.58	10.96	-9.22	-0.67	-9.92
33	Electrical Industrial Machinery	11.45	15.92	-0.68	-0.46	-0.18
34	Other Electrical Machinery	4.54	77.62	1.53	2.04	0.98
35	Ships and Boats	29.36	6.80	-1.68	-0.12	-0.37
36	Rail Equipment	19.32	0.00	-1.10	-0.08	-0.93
37	Motor Vehicles	33.70	43.85	-0.80	-0.48	-0.21
38	Manufacturing of Motor Cycles, Scooters and Bicycle	9.87	1.98	-2.05	-0.24	-1.60
39	Other Transport Equipment	-0.48	1.51	0.02	-0.21	0.55
40	Watches and Clocks	7.73	10.69	-1.78	-0.09	-0.67
41	Miscellaneous Manufacturing	20.94	4.21	-1.81	-0.32	-0.95
	ALL INDUSTRIES	**10.58**	**12.04**	**-0.08**	**-0.08**	**0.21**

Table A5: **Tariff Reduction with increased market access, %Deviation from Baseline**

(1997-99 average)

Sector	Description	Imports	Exports	Prod	Capital	Labour
1	Food Products	35.14	0.30	-0.99	-0.42	-0.81
2	Beverages	81.85	-0.34	-1.23	-0.60	-0.49
3	Tobacco Products	14.56	0.03	-0.41	-0.63	-0.13
4	Textile Products	24.87	11.70	1.08	0.45	0.57
5	Carpet Weaving	71.15	9.47	1.43	-0.11	2.78
6	Readymade Garments	11.09	8.40	-1.42	-1.70	-1.27
7	Furniture and Wooden Fixtures	85.77	9.77	-8.19	-1.85	-7.98
8	Wood and Wood Products	16.92	2.14	-4.55	-13.29	-3.44
9	Paper and Paper Products	12.19	51.57	-0.55	-0.27	-0.15
10	Printing and Publishing	1.52	0.42	-0.14	-0.21	-0.02
11	Leather Products	25.30	11.89	2.47	1.86	1.97
12	Leather and Leather Products	7.84	5.53	3.76	1.24	3.54
13	Rubber Products	16.20	14.81	0.82	0.69	0.61
14	Plastic Products	59.49	32.13	1.50	2.03	1.32
15	Petroleum and Coal Tar Products	0.85	0.84	0.00	-0.30	0.44
16	Inorganic and Organic Heavy Chemicals	8.97	9.43	0.74	0.33	0.74
17	Fertilizers and Pesticides	6.20	3.00	-0.22	-0.10	-0.05
18	Paints, Varnishes and Lacquers	26.59	5.89	0.75	0.32	0.76
19	Drugs and Medicines	2.28	0.19	-0.35	-0.37	-0.14
20	Soaps, Cosmetics and Glycerine	40.70	4.29	-0.44	0.10	-0.16
21	Synthetic Fibers, Resin	16.20	72.20	4.44	-1.18	4.58
22	Other Chemicals	0.88	11.15	-0.99	-0.53	-0.33
23	Structural Clay Products	8.06	50.15	1.14	0.28	0.72
24	Cement	233.43	-0.53	-1.09	-0.60	-0.36
25	Other Non- Metallic Mineral Products	7.30	70.28	8.01	0.72	11.67
26	Iron and Steel Basic Metals	12.89	28.05	0.19	0.08	0.71
27	Non-Ferrous Basic Metals	28.67	1.95	-0.36	0.87	-0.26
28	Handtools, Hardware	9.07	4.70	-0.06	0.27	0.06
29	Miscellaneous Metal Products	3.04	14.24	0.85	0.74	0.65
30	Tractors, Agr. Implements	35.31	0.01	-0.32	-0.10	-0.02
31	Non-Elec. Machinery except agriculture	10.54	0.74	-0.03	0.06	0.17
32	Office, Computing Machinery	21.48	6.29	-20.34	-4.82	-21.69
33	Electrical Industrial Machinery	14.41	18.24	-0.50	-0.56	-0.11
34	Other Electrical Machinery	5.15	78.56	2.04	2.40	1.27
35	Ships and Boats	33.79	1.13	-1.74	-0.13	-0.35
36	Rail Equipment	23.19	3.84	-0.58	0.10	-0.06
37	Motor Vehicles	41.25	55.19	-0.80	-0.65	-0.14
38	Manufacturing of Motor Cycles, Scooters and Bicycle	11.60	12.92	-1.40	-0.28	-0.97
39	Other Transport Equipment	0.53	1.54	-0.18	-0.37	0.31
40	Watches and Clocks	9.16	2.91	-1.61	-0.11	-0.61
41	Miscellaneous Manufacturing	24.87	2.34	-1.82	-0.36	-0.97
	ALL INDUSTRIES	**12.71**	**12.21**	**0.06**	**-0.09**	**0.29**

Table A6: Sector-wise Estimated Efficiency Gains

Sector	Description	Actual Rate	Simulated rate	Fall in percentage points	Efficiency gain
1	Food products	39.2	20	19.2	1.92
2	Beverages	76.1	30	46.1	4.61
3	Tobacco products	46.9	20	26.9	2.69
4	Textiles (except readymade garments and carpets)	43.3	10	33.3	3.33
5	Carpet weaving	41.8	10	31.8	3.18
6	Readymade garments	46.2	10	36.2	3.62
7	Furniture and fixtures wooden	43.3	10	33.3	3.33
8	Wood and wood products	35.7	10	25.7	2.57
9	Paper and paper products	31.6	10	21.6	2.16
10	Printing and publishing	24.9	10	14.9	1.49
11	Leather footwear	46.7	10	36.7	3.67
12	Leather and leather products	35.4	10	25.4	2.54
13	Rubber products	46.6	10	36.6	3.66
14	Plastic products	40.3	10	30.3	3.03
15	Petroleum and coal tar products	27.9	10	17.9	*
16	Inorganic and organic heavy chemicals	37.5	10	27.5	2.75
17	Fertilizers and pesticides	30.2	10	20.2	*
18	Paints, varnishes and lacquers	38	10	28	2.8
19	Drugs and medicines	38	10	28	2.8
20	Soaps, cosmetics, glycerine	46.9	10	36.9	3.69
21	Synthetic fibres, resin	40	10	30	3
22	Other chemicals	36.5	10	26.5	2.65
23	Structural clay products	39	10	29	2.9
24	Cement	42.6	10	32.6	3.26
25	Other non-metallic mineral products	41.9	10	31.9	3.19
26	Iron and steel basic metals	35.1	10	25.1	2.51
27	Non-ferrous basic metals	35.6	10	25.6	2.56
28	Handtools, hardware	36.9	10	26.9	2.69
29	Miscellaneous metal products	39.6	10	29.6	2.96
30	Tractors, agricultural Implements	31	10	21	2.1
31	Non-electrical machinery except agricultural and office machinery	30.9	10	20.9	2.09
32	Office, computing machinery	37.9	10	27.9	2.79
33	Electrical industrial machinery	29.9	10	19.9	1.99
34	Other electrical machinery	40.6	10	30.6	3.06
35	Ships and boats	39.4	10	29.4	2.94
36	Rail equipment	31.5	10	21.5	2.15
37	Motor vehicles	43.6	20	23.6	2.36
38	Manufacturing of motor cycles, scooters, bicycles	46.7	20	26.7	2.67
39	Other transport equipment	46.6	10	36.6	*
40	Watches and clocks	36	10	26	2.6
41	Miscellaneous manufacturing industries	33.4	10	23.4	2.34
	Import weighted average	34.9	10.9	24	2.4

* For these industries, it is assumed in the model that imports are derived as the gap between demand and supply. Therefore for these industries, efficiency gains from greater import competition are not taken into account.

Table A7: Tariff reduction, 2.82 % depreciation and 1% efficiency gains, % Deviation from Baseline (1997-99 average)

Sector	Description	Imports	Exports	Production	Capital	Labour
1	Food Products	22.72	4.06	0.27	0.35	-0.52
2	Beverages	63.66	13.56	5.35	3.89	1.37
3	Tobacco Products	12.05	8.37	-0.26	0.38	-0.29
4	Textile Products	20.18	3.23	3.07	0.58	-0.15
5	Carpet Weaving	53.40	5.72	2.04	0.01	-0.01
6	Readymade Garments	9.32	4.74	7.90	6.10	4.53
7	Furniture and Wooden Fixtures	66.53	17.64	-2.77	-0.78	-4.72
8	Wood and Wood Products	16.64	0.96	-0.44	-13.29	-0.08
9	Paper and Paper Products	9.75	68.54	1.16	0.32	0.04
10	Printing and Publishing	1.03	8.44	1.44	0.11	0.13
11	Leather Products	20.55	1.46	2.92	1.26	0.83
12	Leather and Leather Products	13.70	7.39	4.40	1.77	2.59
13	Rubber Products	18.60	24.41	3.88	2.75	1.53
14	Plastic Products	48.85	37.21	8.43	6.30	4.27
15	Petroleum and Coal Tar Products	4.77	1.09	0.00	0.09	-0.08
16	Inorganic and Organic Heavy	9.77	14.02	6.15	2.30	2.87
17	Fertilizers and Pesticides	-58.00	11.76	0.22	0.02	0.02
18	Paints, Varnishes and Lacquers	24.40	1.13	4.17	1.74	1.56
19	Drugs and Medicines	1.84	5.69	2.52	1.16	0.53
20	Soaps, Cosmetics and Glycerine	33.79	2.58	1.94	-0.78	0.38
21	Synthetic Fibers, Resin	14.80	82.04	7.64	0.16	5.30
22	Other Chemicals	0.73	4.78	3.83	0.05	1.10
23	Structural Clay Products	8.17	41.71	3.58	0.70	0.61
24	Cement	177.84	13.28	2.27	0.34	0.62
25	Other Non- Metallic Mineral	6.33	76.31	10.94	0.93	11.85
26	Iron and Steel Basic Metals	11.66	44.76	1.16	0.45	0.47
27	Non-Ferrous Basic Metals	30.18	7.89	9.05	7.75	8.81
28	Handtools, Hardware	7.53	7.01	1.95	1.39	0.25
29	Miscellaneous Metal Products	4.36	15.51	3.71	3.40	1.84
30	Tractors, Agr. Implements	26.59	6.96	2.63	1.03	0.48
31	Non-electrical Machinery except	8.11	4.97	2.92	0.47	1.08
32	Office, Computing Machinery	17.09	14.40	7.08	4.05	2.05
33	Electrical Industrial Machinery	10.51	17.41	0.90	1.07	0.18
34	Other Electrical Machinery	4.43	78.35	6.62	5.31	2.41
35	Ships and Boats	27.66	9.62	4.15	0.48	0.68
36	Rail Equipment	18.00	0.00	0.56	0.41	-0.30
37	Motor Vehicles	30.55	45.72	2.61	1.13	0.45
38	Manufacturing of Motor Cycles,	9.37	2.62	0.87	0.15	-0.09
39	Other Transport Equipment	9.13	1.86	0.63	0.55	0.54
40	Watches and Clocks	7.46	13.10	2.82	0.20	0.98
41	Miscellaneous Manufacturing	19.97	5.14	3.20	0.93	0.97
AGGREGATE	**ALL INDUSTRIES**	**9.80**	**13.77**	**2.82**	**1.14**	**1.14**

Table A8: Tariff reduction, increased market access and 1% efficiency gains, % Deviation from Baseline (1997-99 average)

Sector	Description	Imports	Exports	Production	Capital	Labour
1	Food Products	32.09	1.15	-0.18	0.22	-0.81
2	Beverages	72.91	6.16	5.33	3.81	1.37
3	Tobacco Products	14.23	1.08	-0.34	0.22	-0.32
4	Textile Products	23.86	12.61	5.07	1.20	0.55
5	Carpet Weaving	66.00	11.48	4.38	-0.02	3.48
6	Readymade Garments	10.70	9.81	7.42	5.64	4.13
7	Furniture and Wooden Fixtures	77.41	13.08	-3.82	-1.04	-5.75
8	Wood and Wood Products	19.59	2.39	-0.41	-13.29	-0.06
9	Paper and Paper Products	11.63	55.68	0.79	0.22	-0.16
10	Printing and Publishing	1.36	3.19	1.41	0.04	0.12
11	Leather Products	24.67	12.19	6.50	3.62	3.34
12	Leather and Leather Products	15.58	6.89	6.73	2.75	4.66
13	Rubber Products	20.65	19.35	3.79	2.95	1.50
14	Plastic Products	56.75	38.33	7.96	5.84	3.98
15	Petroleum and Coal Tar Products	4.99	1.12	-0.22	0.02	-0.22
16	Inorganic and Organic Heavy Chemicals	11.03	11.64	6.03	2.22	2.79
17	Fertilizers and Pesticides	-59.93	9.13	0.22	-0.01	0.01
18	Paints, Varnishes and Lacquers	28.45	6.27	5.44	2.33	2.37
19	Drugs and Medicines	2.11	2.33	2.30	0.92	0.34
20	Soaps, Cosmetics and Glycerine	38.76	5.17	1.94	-0.78	0.38
21	Synthetic Fibers, Resin	16.75	77.97	7.72	-0.17	5.46
22	Other Chemicals	0.84	12.44	3.75	-0.11	1.08
23	Structural Clay Products	9.26	53.77	3.69	0.67	0.69
24	Cement	223.78	2.12	1.83	0.17	0.47
25	Other Non- Metallic Mineral Products	6.93	75.53	10.83	0.90	11.72
26	Iron and Steel Basic Metals	13.38	33.06	0.97	0.39	0.23
27	Non-Ferrous Basic Metals	34.68	-3.59	8.86	7.71	8.53
28	Handtools, Hardware	8.68	5.74	2.16	1.45	0.30
29	Miscellaneous Metal Products	4.79	15.16	3.63	3.21	1.76
30	Tractors, Agr. Implements	32.94	1.97	2.81	1.07	0.53
31	Non-electrical Machinery except agriculture	9.90	2.13	3.04	0.54	1.26
32	Office, Computing Machinery	20.04	9.35	-5.91	-0.36	-11.04
33	Electrical Industrial Machinery	13.44	19.76	1.08	0.97	0.26
34	Other Electrical Machinery	5.04	79.28	6.87	5.69	2.72
35	Ships and Boats	32.04	3.80	4.11	0.47	0.71
36	Rail Equipment	21.84	3.84	1.09	0.59	0.60
37	Motor Vehicles	37.92	57.20	2.61	0.96	0.52
38	Manufacturing of Motor Cycles, Scooters and Bicycle	11.09	13.63	1.54	0.11	0.54
39	Other Transport Equipment	10.18	1.89	0.43	0.39	0.30
40	Watches and Clocks	8.90	5.14	3.01	0.18	1.05
41	Miscellaneous Manufacturing	23.88	3.04	3.20	0.90	0.95
AGGREGATE	**ALL INDUSTRIES**	**11.95**	**13.85**	**2.91**	**1.14**	**1.23**

Table A9: Output Function Results

Sector	Description	Total materials plus energy (*me*)	Gross value added (*v*)	Dummy**	Constant	R^2
2*@	**Beverages**	0.354(3.76)			1.08	0.469
4	**Textiles (except readymade garments and carpets)**	0.865(9.52)	0.203(1.81)		-0.255	0.991
7*@	**Furniture and fixtures wooden**	0.373(3.68)			1.12	0.459
8*	**Wood and wood products**	0.640(5.50)		-0.297(-5.63)	0.963	0.668
12	**Leather and leather products**	0.717(5.90)	0.343(4.22)		0.252	0.986
14*@	**Plastic products**	0.226(2.11)		0.041(1.22)	1.42	0.233
21	**Synthetic fibres, resin**	0.852(15.45)	0.236(6.43)		-0.321	0.996
23*@	**Structural clay products**	0.323(6.20)			0.902	0.706
25@	**Other non-metallic mineral products**	0.585(1.74)	0.522(1.79)	-0.086(-2.00)	-0.179	0.985
32	**Office, computing machinery**	0.742(8.26)	0.531(5.00)		-1.15	0.982
34	**Other electrical machinery**	0.603(8.23)	0.393(5.38)		0.971	0.995
35	**Ships and boats.**	0.655(23.86)	0.318(7.00)		1.08	0.990
41	**Miscellaneous manufacturing industries**	0.713(10.87)	0.412(6.41)		-0.305	0.996

Notes: * estimated in ratio form [(ln(*q*/*v*)=f[ln(*me*/*v*)], assuming the function to be homogeneous of degree one.
** Dummy for the 1990s period
@ Estimated using data up to 1997-98

t-ratios in parentheses

Table A10: Value Added Function Results

Sector	Description	Capital (k)	Labour (l)	Year (trend)	Constant	Returns to Scale	R^2
2*	**Beverages**	0.598(11.69)			-0.790	1	0.883
4*	**Textiles (except readymade garments and carpets)**	0.469(12.84)			-1.16	1	0.901
7*	**Furniture and fixtures wooden**	0.239(1.98)			-1.86	1	0.180
8@@	**Wood and wood products**	0.211(2.44)	0.498(2.44)		1.36	0.709	0.641
12*	**Leather and leather products**	0.532(1.53)		0.040(2.57)	-1.38	1	0.914
14*	**Plastic products**	0.663(16.90)			-0.900	1	0.940
21*	**Synthetic fibres, resin**	0.826(6.69)			-.887	1	0.713
23*	**Structural clay products**	0.459(7.49)			-1.73	1	0.757
25*	**Other non-metallic mineral products**	0.665(6.56)			-1.04	1	0.705
32	**Office, computing machinery**	0.862(8.28)	0.401(2.52)		-2.22	1.263	0.801
34*	**Other electrical machinery**	0.614(19.99)			-0.590	1	0.956
35*$	**Ships and boats.**	0.435(1.16)		0.064 (2.3)	-2.26	1	0.633
41*$	**Miscellaneous manufacturing industries**	0.537(.629)		.039(.725)	-79.39	1	0.602

Notes: * estimated in ratio form [(ln(v/l)=f[ln(k/l)], assuming Constant Returns to Scale

$ Estimated using data for the 1990s

@@ an intercept dummy for 1990-91 is included to take care of a sharp fluctuation in the output-input series for that year.

t-ratios in parentheses

Table A11: Materials Demand Function Results

Sector	Description	Constants	Relative Price (*pm/pp*)	Output (*q*)	R^2
2	**Beverages**	0.455 (0.937)	-1.171 (-4.291)	0.909 (21.932)	0.98
4	**Textiles (except readymade garments and carpets)**	-0.802 (-2.232)	-0.419 (-2.118)	1.019 (39.473)	0.99
7	**Furniture and fixtures wooden**	0.166 (0.298)	-0.859 (-11.365)	0.911 13.283)	0.92
8	**Wood and wood products**	-0.637 (-1.133)	-0.843 (-14.709)	1.015 (19.246)	0.97
12	**Leather and leather products**	-0.115 (-0.321)`	-1.21 (-6.466)	0.985 (30.009)	0.99
14	**Plastic products**	-0.106 (-0.595)	-1.051 (-10.029)	0.976 (60.724)	0.99
21	**Synthetic fibres, resin**	0.775 (2.100)	-0.583 (-1.592)	0.886 (28.254)	0.99
23	**Structural clay products**	-2.606 (-3.689)	-1.123 (-6.808)	1.145 (17.15)	0.98
25	**Other non-metallic mineral products**	0.028 (0.147)	-0.791 (-23.483)	0.935 (60.66)	0.99
32	**Office, computing machinery**	-0.680 (-0.949)	-0.571 (-1.707)	0.976 (11.230)	0.96
34	**Other electrical machinery**	-0.312 (-0.871)	-0.758 (-2.487)	0.987 (38.303)	0.99
35	**Ships and boats**	-3.024 (-4.92)	-0.842 (-0.787)	1.239 (20.881)	0.96
41	**Miscellaneous manufacturing industries**	-0.711 (-1.982)	-0.701 (-3.901)	1.004 (28.901)	0.99

t-ratios in parentheses

Table A12: Energy Demand Function Results

Sector	Description	Relative price (*pe/pp*)	Output (*q*)	Year (trend)	Constant	R^2
2	**Beverages**	-0.533(-1.84)	0.669(13.85)		0.879	0.921
4	**Textiles (except readymade garments and carpets)**	-0.113(-0.6)	0.644(2.26)	0.009 (0.5)	-17.46	0.971
7	**Furniture and fixtures wooden**	-1.50(-6.54)	1.07(6.21)		-4.60	0.753
8	**Wood and wood products**	-1.44(-10.57)	1.05(12.90)		-3.84	0.937
12	**Leather and leather products**	-0.419(-2.36)	0.825(9.65)		-2.20	0.929
14	**Plastic products**	-0.775(-3.87)	1.13(23.30)		-4.92	0.990
21	**Synthetic fibres, resin**	-0.999(-3.54)	0.823(13.91)		-0.151	0.948
23	**Structural clay products**	-0.509(-3.97)	0.685(14.03)		1.80	0.912
25	**Other non-metallic mineral products**	-0.956(-4.90)	1.06(18.50)		-2.83	0.958
32	**Office, computing machinery**	-0.868(-2.64)	0.682(5.24)		-1.15	0.755
34**	**Other electrical machinery**	-0.437(-1.10)	0.080(.251)	0.065(2.11)	-121.70	0.930
35	**Ships and boats.**	-0.506(-1.29)	0.452(4.52)		-1.38	0.594
41*	**Miscellaneous manufacturing industries**	-0.211(-.330)	0.775(4.40)		-1.60	0.940

Notes: *estimated for period up to 1997-98.
**estimated using data for the 1990s.

t-ratios in parentheses

Table A13: Labour Demand Function Results

Sector	Description	Real wage rate (*w/pp*)	Output (*q*)	Lagged labour (l_{-1})	Constant	R^2
2	**Beverages**	-.299(-1.90)	.391(3.38)	.119(.458)	3.05	.924
4*	**Textiles (except readymade garments and carpets)**	-.378(-2.90)	.091(2.04)	.238(1.12)	6.93	.686
7	**Furniture and fixtures wooden**	-.384(-1.91)	.529(2.98)	.473(2.43)	-2.40	.451
8	**Wood and wood products**	-.836(-1.88)	.933(2.80)		-5.06	.338
12	**Leather and leather products**	-.618(-5.90)	.614(5.89)	.220(1.47)	-2.91	.962
14	**Plastic products**	-.383(-1.55)	.493(4.48)	.219(.227)	.265	.965
21	**Synthetic fibres, resin**	-.609(-4.46)	.509(6.14)	.050(.335)	.375	.918
23	**Structural clay products**	-.339(-2.65)	.195(2.78)		7.24	.340
25	**Other non-metallic mineral products**	-.816(-15.67)	.522(13.05)		.188	.938
32	**Office, computing machinery**	-1.47(-2.63)	.728(3.03)	.290(1.15)	-9.48	.670
34	**Other electrical machinery**	-.545(-3.54)	.304(4.05)	.287(1.46)	1.37	.837
35	**Ships and boats**	-.271(-1.06)	.175(2.41)	.579(3.97)	.752	.639
41	**Miscellaneous manufacturing industries**	-.388(-2.55)	.462(8.44)		3.28	.961

Notes: * Estimated for period up to 1997-98

t-ratios in parentheses

Table A14: Elasticity of employment with respect to output and real wage rate

Sector	Description	Elasticity with respect to Real wage rate (*w/pp*)		Elasticity with respect to Output (*q*)	
		Short-run	Long-run	Short-run	Long-run
2	**Beverages**	-0.299	-0.339	0.391	0.444
4	**Textiles (except readymade garments and carpets)**	-0.378	-0.496	0.091	0.119
7	**Furniture and fixtures wooden**	-0.384	-0.729	.529	1.004
8	**Wood and wood products**	-0.836		0.933	
12	**Leather and leather products**	-0.618	-0.792	0.614	0.787
14	**Plastic products**	-0.383	-0.490	0.493	0.631
21	**Synthetic fibres, resin**	-0.609	-0.641	0.509	0.536
23	**Structural clay products**	-0.339		0.195	
25	**Other non-metallic mineral products**	-0.816		0.522	
32	**Office, computing machinery**	-1.47	-2.070	0.728	1.025
34	**Other electrical machinery**	-0.545	-0.764	0.304	0.426
35	**Ships and boats**	-0.271	-0.643	0.175	0.416
41	**Miscellaneous manufacturing industries**	-0.388		0.462	

Note: Long-run elasticity estimates are presented for only those industries for which lagged labour variable was used in the estimated employment function. For other industries, the estimated coefficients could be interpreted as short-run elasticity, as the equations are estimated from time-series data.

Table A15: Capital Demand Function Results

Sector	Description	ln (*B/w*)	S/PK	C/PK	ln (*v*)	ln k_{-1}	k_{-1}	Const.	R^2
2**	**Beverages**		172.60(3.26)	181.50(1.87)			0.647(4.42)	-1513.55	.992
4**$$ **[DR]**	**Textiles (except readymade garments and carpets)**		75.64(2.35)	937.28(1.75)			0.928(23.94)	17485.8	.997
7**	**Furniture and fixtures wooden**		22.79(1.89)	1.86(1.28)			0.942(14.56)	59.72	.971
8*$	**Wood and wood products**	-0.527(-2.577)				0.908(13.49)		6.299	.979
12**	**Leather and leather products**		76.09(4.72)	72.84(3.49)			0.718(12.06)	1452.15	.991
14**	**Plastic products**		292.92(3.66)				0.688(6.02)	-3759.37	.991
21* $	**Synthetic fibres, resin**	-0.497(1.82)		0.0029(1.54)		0.920(16.19)		5.55	.989
23**	**Structural clay products**		69.98(1.31)				0.983(10.14)	1591.22	.988
25** **[DR]**	**Other non-metallic mineral products**		17.31(1.76)				0.957(11.99)	11622.12	.987
32**	**Office, computing machinery**		99.13(4.09)				0.908(9.25)	-329.27	.922
34**	**Other electrical machinery**		129.90(3.86)				0.797(9.83)	-911.00	.982
35*	**Ships and boats**	-0.204(-3.90)		0.0005(1.32)	0.071(4.20)	0.327(2.28)		8.26	.916
41*	**Miscellaneous manufacturing**			0.0013(.905)	0.172(1.68)	0.781(6.39)		.510	.989

Notes: * Estimated using specification 1,i.e lnk = f [ln (B/w), ln v, C/PK, ln (lag k)]

** Estimated using specification 2,i.e k= f [s/PK, C/PK, lag k]; s is non-wage income

[DR] : Estimated using a post reform period Dummy

B = price of capital input (cost of capital); PK= price of capital goods; S= internal finance (value added minus labour payment); C= credit flow to industries; v= gross value added; lag k = capital stock with one year lag.

$ estimated using data up to 1997-98; $$ estimated using data up to 1998-99.

t-ratios in parentheses

Table A16: Import Function Results

Sector No.	Description	Constant	GDP/Mfg. Output/GFCF	Relative Price	Lagged Imports	QR below 50% (dummy) or reforms dummy	Relative Price*QR dummy	R^2
2*	**Beverages**	13.299 (0.7)	0.17 (0.1) [g]	-1.97 (-2.5)				0.86
4	**Textiles (except readymade garments and carpets)**	7.081 (0.7)	0.67 (1.0) [g]	-0.81 (-1.3)				0.62
7	**Furniture and Wooden Fixtures**	-16.801 (-1.1)	2.57 (2.1) [g]	-2.76 (-3.6)		0.52 (0.6) [rf]		0.75
8	**Wood and Wood Products**	1.096 (0.4)	0.65 (1.5) [m]	-0.45 (-0.7)	0.53 (2.3)			0.59
12	**Leather and Leather Products**	-8.428 (-1.7)	1.88 (2.0) [m]		0.50 (2.2)		-0.21 (-1.5)	0.89
14*	**Plastic Products**	11.570 (1.2)	0.73 (0.9) [m]	-1.81 (-1.5)				0.68
21*	**Synthetic Fibers, Resin**	12.204 (6.8)	0.41 (2.5) [m]	-0.54 (-2.0)				0.74
23	**Structural Clay Products**	6.874 (6.4)	0.56 (4.0) [m]	-0.31 (-1.0)		0.21 (1.0) [qr]		0.63
25*	**Other Non- Metallic Mineral Products**	-0.323 (-0.03)	0.98 (1.1) [g]	-0.21 (-0.3)				0.79
32	**Office, Computing Machinery**	-9.266 (-2.5)	1.34 (2.8) [c]	-0.60 (-2.0)	0.61 (3.4)			0.94
34	**Other Electrical Machinery**	-15.34 (-4.8)	2.41 (8.8) [c]				-0.20 (-3.3)	0.88
35*	**Ships and Boats**	-16.97 (-2.1)	2.62 (3.4) [c]	-1.22 (-0.9)				0.69
41	**Miscellaneous Manufacturing**	-7.406 (-0.7)	2.01 (2.3) [g]	-1.17 (2.4)		1.12 (2.0) [rf]		0.66

Notes: * estimated for the post-reform period (1991-92 to 1999-00)
[g],[m], and [c] denote activity variable used, GDP, manufacturing real output or GFCF (Gross Fixed Capital Formation)
[qr] and [rf] indicate the dummy used. The former represents reduction in QR to less than 50%, the latter is for the post-reform period (takes value one for 1991 onwards).
t-ratios in parentheses

Table A17: Export Function Results

Sector No.	Description	Constant	World Export	World GDP	Relative Price	Tariff	lag of export	R^2
2	**Beverages**	-35.34 (-6.9)	2.43 (6.53)		-2.41 (3.47)			0.9
4	**Textiles (except readymade garments and carpets)**	-12.53 (-3.84)	1.48 (6.99)		-0.82 (2.62)			0.94
7	**Furniture and Wooden Fixtures @ [*wrx]**	-31.91 (-10.4)		1.0	-1.10 (1.93)		0.63 (4.1)	0.91
8	**Wood and Wood Products**	-1.21 (-0.16)	0.71 (1.50)		-0.41 (0.88)			0.40
12	**Leather and Leather Products**	3.91 (1.36)	0.54 (1.72)		-0.92 (10.71)	-0.18 (-1.18)		0.98
14	**Plastic Products**	-15.22 (-2.41)	1.31 (3.35)		-2.23 (4.49)	-0.95 (-1.62)		0.95
21	**Synthetic Fibers, Resin**	-96.07 (-2.43)		3.14 (2.50)	-2.58 (2.83)	-2.40 (2.67)		0.92
23	**Structural Clay Products**	-17.23 (-3.59)	1.63 (5.11)		-1.54 (4.14)	-1.29 (-2.43)		0.93
25	**Other Non- Metallic Mineral Products**	-8.0 (-3.57)	1.05 (7.60)		-1.89 (12.2)	-2.52 (-12.7)		0.99
32	**Office, Computing Machinery**	-104.72 (-2.87)		3.34 (2.95)	-2.58 (4.87)			0.88
34	**Other Electrical Machinery**	-47.84 (-2.80)		1.87 (3.41)	-0.77 (1.39)	-2.22 (5.44)		0.88
35	**Ships and Boats**	-29.15 (-0.83)	2.02 (0.91)		-2.43 (2.13)			0.52
41	**Miscellaneous Manufacturing**	-6.85 (-1.44)	1.10 (3.81)		-1.27 (5.33)			0.97

*wrx = dependent variable is ratio of Indian export to Importing country GDP
@ estimated for the 1990s t-ratios in parentheses

Table A18: Domestic Demand Function Results

Sector	Description	Constant	Relative Price	Non-agricultural Income	Agricultural income	Non-agr +Agr income(*y*)	Aggregate investment in Manufacturing	Dummy **	Material Inputs purchase by other industries(*um)*	R^2
2	**Beverages**	-13.468 (-11.17)	-0.685 (-2.22)			1.745 (24.49)				0.98
4	**Textiles (except readymade garments and carpets)**	4.287 (5.10)	**-0.9@**			0.849 (17.05)				
7	**Furniture and fixtures wooden**	4.071 (1.31)	-0.744 (-2.51)			0.516 (2.79)				0.34
25	**Other non-metallic mineral products**	2.544 (1.16)	-1.456 (-7.60)	0.537 (2.30)	0.325 (0.87)					0.97
41*	**Miscellaneous manufacturing industries**	-1.097 (-3.26)	-1.490 (-2.09)			1.0				0.19
32	**Office, computing machinery**	-4.442 (-0.21)	-1.102 (-0.34)				1.023 (0.88)	-1.44 (-1.43)		0.82
34	**Other electrical machinery**	-9.742 (-7.04)	-0.121 (-0.34)			1.632 (19.62)				0.98
35	**Ships and boats**	11.44 (5.18)	-6.018 (-5.08)				0.232 (1.99)			0.76
8	**Wood and wood products**	6.465 (3.32)	-0.744 (-2.44)						0.764 (4.44)	0.55
12***	**Leather and leather products**	2.588 (1.51)	-0.194 (-0.63)						1.168 (8.45)	0.96
14	**Plastic products**	-3.542 (4.50)	-0.212 (-0.89)						1.674 (26.84)	0.99
21	**Synthetic fibres, resin**	-0.051 (-0.05)	-0.374 (-1.56)						1.343 (19.14)	0.97
23	**Structural clay products**	9.103 (33.81)	-0.449 (-3.24)						0.760 (22.48)	0.97

Notes: t-ratios in parentheses; * Coefficient of non-agr income+Agr income (y)=1 restriction imposed. **dummy for the 1990s period.
*** Observations for 1998 and 1999 excluded from the data set. @ Coefficient of price (p)=-0.9 restriction imposed; same value as readymade garments taken.

Table A19: Effective Rate of Protection

Sector	Description	1999-00(Actual)	Simulated: Scenario II
1	Food products	28.84	2.13
2	Beverages	94.12	37.97
3	Tobacco products	43.71	16.26
4	Textiles (except readymade garments and carpets)	54.55	8.87
5	Carpet weaving	41.75	9.92
6	Readymade garments	46.16	9.98
7	Furniture and fixtures wooden	45.66	6.99
8	Wood and wood products	41.46	4.26
9	Paper and paper products	28.83	7.30
10	Printing and publishing	20.08	9.91
11	Leather footwear	51.28	7.97
12	Leather and leather products	36.81	5.66
13	Rubber products	52.55	6.20
14	Plastic products	44.91	9.83
15	Petroleum and coal tar products	43.67	-15.32
16	Inorganic and organic heavy chemicals	43.67	8.92
17	Fertilizers and pesticides	34.37	4.64
18	Paints, varnishes and lacquers	45.19	9.38
19	Drugs and medicines	44.03	9.26
20	Soaps, cosmetics, glycerine	52.98	8.89
21	Synthetic fibres, resin	47.28	8.85
22	Other chemicals	42.72	-1.30
23	Structural clay products	42.74	1.01
24	Cement	47.47	3.74
25	Other non-metallic mineral products	42.00	5.21
26	Iron and steel basic metals	43.01	8.26
27	Non-ferrous basic metals	42.16	8.68
28	Handtools, hardware	37.16	9.85
29	Miscellaneous metal products	46.29	9.42
30	Tractors, agricultural Implements	29.83	9.87
31	Non-electrical machinery except agricultural and office machinery	31.04	9.92
32	Office, computing machinery	34.07	9.96
33	Electrical industrial machinery	29.35	9.95
34	Other electrical machinery	40.25	9.92
35	Ships and boats	41.27	10.00
36	Rail equipment	27.50	9.95
37	Motor vehicles	46.31	25.09
38	Manufacturing of motor cycles, scooters, bicycles	49.55	24.06
39	Other transport equipment	49.83	9.84
40	Watches and clocks	36.35	10.00
41	Miscellaneous manufacturing industries	31.82	8.54
	Average	42.3	9.0
	Standard Deviation (excluding petroleum products)	11.6	6.6

Note: The ERP rates for food products is low and that for petroleum products is negative because the rate of protection for primary sectors (agriculture, mining, crude oil) are taken at the historical values. The nominal rate of protection for crude oil at 22 per cent is much higher than the tariff rate assumed for petroleum products in Scenario II.