ANALYSIS OF TARIFF AND TAX POLICIES IN BANGLADESH: A COMPUTABLE GENERAL EQUILIBRIUM APPROACH

A dissertation submitted

by

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to

The Department of Economics
University of Warwick
in partial fulfilment for
the degree of
Doctor of Philosophy

Coventry, CV4 7AL

August 1996

ABSTRACT

The prime objectives of the study are to analyse the effects of tax and tariff policies in Bangladesh. Toward this end, different variants of computable general equilibrium models are developed and used to assess the distributional consequence of tax reform and to examine the resource allocation and income distribution effects of tariff liberalisation within the paradigm of both 'traditional' and 'new' trade theories.

A computable general equilibrium model of the Bangladesh economy is developed to assess the distributional consequences of the indirect tax reform which involves the introduction of a value added tax system. The model captures specific features of a consumption-type and destination principle-based value added tax system which has been adopted in Bangladesh. An alternative model of the Bangladesh economy is also developed to analyse the effects of tariff liberalisation on resource allocation and income distribution under both competitive and non-competitive assumptions. The model explicitly incorporates 'market structure' variables such as marginal costs, the number of domestic firms, the excess profit condition, the market demand elasticities for domestic firms and increasing returns to scale.

The models are static in nature and are calibrated to a 1988/89 data set compiled within the framework of a social accounting matrix (SAM). The social accounting matrix integrates different data sources and the input-output table to depict the major macroeconomic relations and provides a consistent macroeconomic data set for policy modelling. Such a framework is particularly useful for a country such as Bangladesh with sparse and conflicting data sources. The SAM is an attractive framework for locating inconsistencies and for resolving them in best the possible ways.

The incidence effects of the indirect tax system under pre-VAT and VAT systems are based on two approaches: a simple approach and a computable general equilibrium approach.

Two sets of policy experiments are carried out. First, excise duties of domestic production activities and sales taxes on imports are replaced by a revenue-neutral single rate of value-added tax. In the second experiment, the VAT system is extended to the service sector with a revenue-neutral VAT rate. The results of policy experiments indicate that because of exemptions on subsistence agricultural products, and because of the progressive structure of the tariffs, the overall indirect tax system would remain progressive even after the introduction of a single rate VAT. However, the overall indirect tax incidence appears to be less progressive under the VAT system compared with the pre-VAT system.

The effects of tariff liberalisation on resource allocation and income distribution are also examined in this study. It is observed that the results of tariff liberalisation are sensitive to the way the model is specified. It is also observed that in the competitive and constant returns to scale model variant, resources move from the heavily protected sector to the less protected sectors as a result of tariff liberalisation. In contrast, the heavily protected manufacturing sectors turn out to be the main beneficiary of liberalisation when imperfect competition is introduced. Expansion of manufacturing output appears to come from the pro-competitive effects of tariff liberalisation. On the other hand, almost all the manufacturing sectors show much larger output growth with the incorporation of increasing returns to scale. The larger expansion of output of manufacturing sectors is due to a reduction in unrealised scale economies. The income distribution effects of tariff liberalisation are captured through the changes in income levels of the six household groups and changes in factor income and factor

returns. The redistribution of income under liberalisation appears to favour the low income household groups. However, it appears that the relative progressivity and regressivity in the distribution of household income depend on the relative changes of capital and labour income.

The association between market structure variables and profitability in the manufacturing sector of Bangladesh is also analysed in this study. This exercise provides some evidence on the association between industrial structure and profitability and assesses the importance of foreign and domestic factors on industry profitability. Two alternative measures of concentration namely concentration ratio and Hirschman-Herfindahl index and two foreign competition variables such as import shares and effective tariff rates are used to examine this association. The results of this exercise indicate that profitability is significantly related to concentration levels in the manufacturing sector of Bangladesh. It also reports that foreign competition variables play a significant role in affecting profitability in domestic industries. It is observed that the profitability is higher in those industries where concentration levels are high and import shares are low and effective tariff rates are high.

To my family

ACKNOWLEDGEMENT

I am grateful and indebted to individuals and institutions for rendering guidance, assistance, moral support and inspiration for successful completion of this dissertation. I would like to express my gratitude to the following:

Dr. Jeffery I. Round, under whose able and very patient guidance the work has been completed, for hours of discussion and reading the earlier drafts. His continuous supervision has substantially improved the quality of the write-up. I must also express my sincere gratitude to him for his concern for the well-being of all members of my family.

Dr. D. Collie, under whose co-supervision the work has started until he left Warwick. I am thankful to him for guidance, especially in preparing the thesis proposal.

Dr. C. Perroni, for the discussions with regard to modelling of imperfect competition and increasing returns to scale.

Dr. A. H. Mansur, who gave me the opportunity to acquire techniques of computable general equilibrium modelling and for suggesting the topic on the distributional consequence of value added tax system in Bangladesh.

I am also indebted to the University of Dhaka and the Government of Bangladesh for allowing me to pursue higher studies abroad.

I must also express my gratitude to the Association of Commonwealth Universities for awarding me a scholarship and for extending the scholarship for a fourth year. In this regard I am also indebted to Department of Economics, University of Warwick for waiving tuition fees for the fourth year of the study.

Roberto De Santis and Lisandro Abrego, for their help and continuous support. I have greatly benefited from discussions with them.

My friends and well-wishers for their help and support during our stay at Coventry. I would like to express my most sincere gratitude to Mr. Latif Ahmed and family, Dr. Mohammad Delwar Chowdhury and family, Mr. Saleem Ahmed and family and Mrs. Nasreen Hai for their help, concern and encouragement.

My parents, Mr. Shamsul Haque Khondker and Mrs. Suraiya Khondker, for their prayers and support. My father-in-law Mr. Kazi Mesbahuddin Ahmed and mother-in-law Mrs. Lutfunessa Ahmed for their prayers and encouragement. My brothers, Ziaul Haque Khondker and Shahidul Haque Khondker, sisters, Fawzia Khondker and Fahmida Khondker, brother-in-laws Shah Newaz, Kazi Iftikhar Ahmed, Shabbir Ahmed and Kazi Ishtiaque Ahmed, sister-in-laws Sima Tahmina Haque and Dr. Kaniz Khondker for all their moral support and encouragement. They always kept me going.

Finally, I am grateful to my wife, Jabeen and sons, Fahim and Farhaan, for bearing and sharing all the real costs throughout the period study, and for the enduring inspiration of their company.

Bazlul H. Khondker

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Chapter One

Analysis of Trade and Tax Policies in Bangladesh

1.1 Introduction and objectives

Trade policies have historically been restrictive in Bangladesh. Tariffs and non-tariff barriers such as quantitative restrictions have traditionally been used to restrict the free flow of imports into the domestic economy. Such restrictive policies tend to reflect the policy makers concern about the need to raise revenue, reduce balance of payments pressure and offer protection to domestic industries to encourage import substitution.

The costs of these policies to the national economy appears to be high. The inevitable price distortions resulting from these policies are expected to channel resources to import-competing industries because protection permits domestic industries to operate with value added higher than that prevailing under free trade thereby providing incentives for the movement of resources into protected industries. Incentives for import substitution and against exports are also provided by the fact that firms can obtain higher domestic price in the home market while getting the world market price on export sales, although paying the same price for imported inputs. Export activities have also been penalised by the coexistence of overvalued currency with the restrictive trade regime (Balassa et al, 1971; and Krueger, 1984). It is, thus only reasonable to expect that the restrictive trade policy in Bangladesh has unfavourable resource allocation and welfare consequences. Thus elimination of such restrictions is therefore expected to improve resource allocation and national welfare.

The restrictive trade polices could result in other important sources of wastages as well. For instance, while the quantitative restrictions could lead to rent-seeking (Krueger, 1974), tariff restrictions could lead to revenue-seeking (Bhagwati and

Srinivasan, 1980), both involving wastages. Further, since the elasticity of import duty is low, the lopsided dependence on import duty as a source of revenue could mean serious uncertainty for public expenditures.

Furthermore, over the last decade the incorporation of market structure variables and economics of scale, etc. into trade theory reveals additional sources of potential gains from trade. In many sectors (evidence suggests at least for the manufacturing sector), industrial structure is better depicted by a small number of large firms rather than a large number of small firms which individually have no control over market prices. Lack of competition allows a few domestic firms to use their monopoly power. Such monopoly power allows domestic firms to charge price a higher than the average cost of production thereby reaping excess profits. It is also argued that protection allows domestic firms to operate at production levels far below minimum efficient scale (Rodrik, 1988). Thus the domestic firms would be operating somewhere up the average cost curve. Under such circumstances, trade liberalisation can yield additional efficiency gains by reducing the monopoly power of domestic firms (i.e. pro-competitive effects) and rationalisation of domestic industry through exploitation of scale economies.

Chapter 5 of this study provides some estimates of the extent of concentration in the major manufacturing sectors in Bangladesh. These estimates (e.g. four-firm concentration ratios and Hirschman-Herfindahl index) suggest that the extent of competition is rather weak in most industries in Bangladesh. Even though the concentration ratios on their own can not show how collusive the behavioural outcomes in particular industries are, these numbers seem broadly indicative of the extent of imperfect competition (Rodrik, 1988). Furthermore, measures of concentration (i.e. concentration ratios and Hirschman-Herfindahl index) are found to be statistically significant determinants of 'profitability'-measured by price-cost margins. Considering the evidence of imperfect competition in the manufacturing sectors, it seems reasonable to include features of 'industrial organisation' within trade policy analysis in Bangladesh.

Possible consequences of such restrictive trade policy have already generated serious debates in Bangladesh with regard to its advisability. The recent wave of structural adjustment programmes, involving in particular trade liberalisation, all over the developing world perhaps also have influenced this debate. Accordingly, Bangladesh has been gradually liberalising her foreign trade regime since the early eighties. The trade liberalisation strategies in Bangladesh have involved gradual elimination of non-tariff barriers during the first phase and reduction of tariff rates during the later phase. Some features of the trade regime and trade reforms are discussed in Appendix A.1.

Thus one of the objectives of this study is to examine the resource allocation, welfare and income distribution effects of tariff liberalisation in Bangladesh within the paradigm of both the 'traditional' and 'new' trade theories. This also appears overdue in the absence of any study undertaken specifically to analyse the resource allocation, welfare and income distribution effects of the tariff liberalisation within the paradigm of 'new trade policy' involving imperfect competition and increasing returns to scale.

Apart from their protective role, tariffs have traditionally been the major source of tax revenue in Bangladesh. Taxes on imports such as customs duties (i.e. tariffs) and sales taxes account for a significant proportion of tax revenue in Bangladesh. It is observed that in 1974-79 period the proportion of taxes (i.e. customs duties and sales taxes) on imports was 60 percent of total tax revenue. The corresponding proportions for 1980-84 and 1985-90 were 57 and 52 percent respectively. Thus, on average taxes on imports account for 54 percent of tax revenue in Bangladesh. Another important source of tax revenue is excise tax. Over 97 percent of taxes on domestic production activities used to come from excise taxes which are levied ex factory on domestic production and also on some services. However, the contribution of excise tax in tax revenue is moderate, particularly in comparison to taxes on imports. On average excise taxes account for about 26 percent of tax revenue. On the other hand the contribution of direct taxes (e.g. income, land and other direct taxes) is around 16 percent of tax revenue in Bangladesh (Table A.3). The main features of the tax system are:

(i) Import-based taxation typically does not lead to an elastic tax system. A tax system is said to be elastic where tax revenue expands in line with GDP, without the need for frequent discretionary changes in the tax rates. However, heavy dependence on import taxation has made the indirect tax system inelastic in Bangladesh. The income elasticity of all taxes is estimated to be 0.71 for 1975/76 to 1984/85 period. The values of elasticity of customs duties and sales tax on imports are reported to be 0.55 and 0.56 for the same period. On the other hand the excise and income tax elasticities are 0.83 and 1.11 respectively for the same period (Table A.4).

(ii) Since the tax system is inelastic, in almost every budget government adopts some discretionary measures (e.g. changes in tax rates of some sectors) to raise additional revenue. Discretionary measures have not been adopted in a consistent and systematic manner. It is difficult to ascertain beforehand which sectors would be targeted for such measures. Thus such measures tend to create uncertainty in decision making (e.g. costing and pricing, etc.) and discriminate against such sectors.

(iii) The indirect tax system also relied on the taxation of intermediate goods. In the absence of tariffs, sales taxes and excise taxes relief on inputs used in production of exports, the systems tend to discriminate against exports, especially non-traditional exports.

(iv) The cascading effects of taxes on inputs, of taxes on inputs to those inputs, and so on made it difficult to ascertain how much different goods are taxed in production process and perhaps led to consequences different from those intended by the policy makers. Thus, input taxation can discourage sectors which government policy was originally formulated to encourage. Some estimates of extent of input taxation and the cascading effects of taxes on inputs are discussed in Appendix A.2.

It is argued by policy makers in Bangladesh that the objectives of efficiency, elasticity, automatic tax relief and transparency of the indirect tax system may be achieved by taxation on consumption. Accordingly the Government of Bangladesh introduced a consumption-type and destination-principle based value added tax in 1991.

It is too early to claim that the VAT system would achieve all the above mentioned objectives. However, limited experience with the VAT system in Bangladesh seems to suggest that the VAT system is efficient in term of revenue collection compared with the pre-VAT system. After the introduction of the VAT in 1991, revenue rose from 11 percent of GDP in 1992 to 12 percent of GDP in 1993. During the same period the share of trade taxes in total revenue fell from 37 percent of total revenue in 1992 to 34 percent in 1993. Lower tariff revenue was more than offset by improvements in VAT and direct tax collection. In particular, the revenue from the VAT system increased from 23 percent of total revenue in 1992 to 42 percent in 1993 (the World Bank, 1994). In this context it is relevant to note that Mansur and Khondker (1991) studied the revenue effects of the VAT in Bangladesh and concluded that the VAT system would improve revenue mobilisation in Bangladesh, provided that the system is administered properly. The above revenue collection statistics appear to support their findings.

However improvements in revenue mobilisation may be achieved at the expense of equity. The equity issue is no less important than the efficiency and revenue aspects of tax policies. To highlight the importance of equity issues Ferh et al (1994) in their conclusion argued that " beginning in the early 1970's, the public economics literature concentrated more on the efficiency aspects of fiscal policy whereas the older literature emphasised the redistributional side of the ledger. Our numerical findings suggest that emphasising efficiency effects may be highly misleading. We have even dare to say that the time is ripe for re-orientation, putting at least same or even more emphasis on distributional problems than on efficiency issues." Considering the importance of distributional consequences of tax reforms, another objective of this study to examine the distributional consequences of a uniform rate of VAT system in Bangladesh.

Though a partial equilibrium framework can be used to answer some questions of policy interest, the general equilibrium approach has clear advantages in dealing with multiple policy distortions in the economy. In recent years, computable general equilibrium models have been used to analyse the resource allocation, income distribution and welfare consequences of trade and tax policy reforms. Thus, in this study computable general equilibrium models have been developed to analyse different aspects of tax and tariff reforms in Bangladesh.

1.2 Overview of the chapters

Chapter 2 discusses the compilation of a social accounting matrix for 1988/89. The main purposes of this chapter are to discuss the methodological and statistical procedures used to compile the SAM by integrating different data sources and to highlight the importance of such a framework in simulation exercises using both SAM-based fixed-price models and flex-price computable general equilibrium models.

The social accounting matrix integrates different data sources and the input-output table to depict the major macroeconomic relationships between producers, institutions in Bangladesh. Such a framework is particularly useful for a country such as Bangladesh with conflicting data sources. The SAM is an attractive framework for locating inconsistencies and for resolving those in best possible ways. Since different data sources are not readily compatible, the compilation exercise needs various assumptions, extensive data manipulation, reconciliation and balancing items. In particular, the SAM integrates the system of national accounts, input-output table and census of manufacturing industries to depict income generation by different types of labour and the distribution of operating surpluses between institutions. An important feature of this SAM is the disaggregation of the household sector into six household groups. Sir Richard Stone (1985) pointed out the importance of this disaggregation. According to him " it seems to me that of all the interesting and useful things that could be done to improve the national accounts, the one most worthy of consideration is the disaggregation of household sector." It also brings together macroeconomic data (such as national accounts) and microeconomic data sets (such as 'Household Expenditure Survey'), within a consistent framework for decomposition of 'households', distribution of household income, consumption expenditure and savings patterns. It also captures the linkage between factoral and household distribution of income which is essential to examine the distributional consequence of policy reforms. A particular novelty of this SAM is the construction of an inter-household transfer matrix from limited and partial information. The methodology used to construct the inter-household transfer matrix is so general that it can be applied to any other SAM quite easily.

To rationalise the indirect tax system the government of Bangladesh introduced a value added tax on imports and manufacturing goods from 1991. The VAT replaced the prevailing excise tax on domestic production and sales taxes on imports at the import stage. The VAT system is consumption-type and is based on the destination-principle. It is generally believed that in its most conventional form, a single rate

VAT with a zero rate applied only to exports may be regressive. Therefore, in chapter 3 a model of the Bangladesh economy is developed to examine the regressiveness of the indirect tax system in general and the value added tax system in particular. Model explicitly captures specific features of a consumption-type and destination-principle based value added tax system which has been adopted in Bangladesh.

The results of indirect tax incidence under pre-VAT and VAT systems are discussed in chapter 4. The empirical analyses reported in this chapter are based on two approaches: a simple approach and a computable general approach. In the simple approach, the tax incidence of the indirect tax system with and without VAT is estimated by determining how much tax is borne by each household group in relation to their consumption expenditure, assuming that other things remaining unchanged. The general equilibrium analysis derives the benchmark solutions for incidence under the pre-VAT system by endogenously estimating the tax payments by the six household groups as a proportion of their consumption expenditures. The CGE approach allows for the effects of relative price changes and the consequent secondary effects on resource allocation, production, consumption and on the incidence of the indirect taxes. Both approaches indicate that because of exemptions on subsistence agricultural products, and because of the progressive structure of the tariffs, the overall indirect tax system would remain progressive even after the introduction of a single rate VAT. However, the overall indirect tax incidence appears to be less progressive under the VAT system compared with the pre-VAT system.

Empirical research on industrial organisation has revealed useful insights into the relationship between industrial structure and performance both for developed and developing countries. Most studies have confirmed the hypothesised relationship between market structure and profitability by finding a significant association between industrial concentration and profitability. However in recent years there is a growing consensus among economists that, along with concentration, the extent of foreign competition significantly affects the performance of domestic industries. Such consensus led to a number of industrial organisation studies incorporating a foreign competition variable. Such studies have also confirmed that foreign competition variables exerted a strong impact on the domestic profitability.

So far no study has been under taken to examine the relation between profitability and market structure variables in the manufacturing sector of Bangladesh. Thus the objective of chapter 5 is to provide some empirical evidence on the relation between industrial structure and profitability in the manufacturing sector of Bangladesh and to assess the importance of foreign and domestic factors on industry profitability. Two alternative measures of concentration, namely the concentration ratio and Hirschman-Herfindahl index, and two foreign competition variables e.g. import shares and effective tariff rates, are used to examine the robustness of the findings. The results of this study indicate that concentration is an important factor explaining differences in profitability between different industries. This result is robust even when alternative measures of concentration are employed. It is also observed that foreign competition variables play a significant role in affecting profitability in domestic industries. The results thus support the observation that the profits are higher in those industries where concentration levels are high and import shares are low or effective tariff rates are high.

Bangladesh has been gradually liberalising her foreign trade regime since the early eighties as an integral part of the structural adjustment programmes. The trade liberalisation strategies in Bangladesh have involved a gradual elimination or replacement of non-tariff barriers (by suitable tariff rates) during the first phase and reduction of tariff rates during the later phase. Given the evidence that the manufacturing sector in Bangladesh appears to be have imperfectly competitive features, it seems reasonable to examine the consequences of tariff liberalisation within the paradigm of both 'traditional trade theory', based on assumptions of perfect competition and constant returns to scale and 'new trade theory' involving imperfect competition and increasing returns to scale. Thus in chapter 6, a model of Bangladesh economy is developed to analyse the effects of tariff reform on resource allocation and income distribution under both competitive and non-competitive assumptions. The model explicitly incorporates market structure variables such as marginal costs, the number of domestic firms, the excess profit condition, the market demand elasticities for domestic firms and increasing returns to scale.

In chapter 7, alternative computable general equilibrium models are used to assess the resource allocation, welfare and income distribution effects of tariff liberalisation in Bangladesh. It is observed that the results of tariff liberalisation are sensitive to the way the model is specified. It is observed that in the competitive and constant returns to scale model variant, resources move from the heavily protected sector (e.g. manufacturing sector) to less protected sectors as a result of tariff liberalisation. When imperfect competition is introduced the heavily protected manufacturing sectors turning out to be the main beneficiary of liberalisation. Almost all the manufacturing sectors show much larger output growth with the incorporation of increasing returns to scale. This magnification comes from a reduction in unrealised scale economies in these sectors. The income distribution effects of tariff liberalisation are also examined. The change in the distribution of income appears to favour the low income household groups. It also appears that the progressivity and regressivity in income distribution of household groups depends on the relative change of the capital and labour income.

Appendix to chapter one

A.1 Some features of the trade regime and trade reforms in Bangladesh

A.1.1 Tariff structure

The tariff structure in Bangladesh conforms to the pattern observed in many developing countries: the lowest duties are levied on machinery and equipment, higher duties on unprocessed raw materials, higher still on processed raw materials and highest on non-durable consumer goods and consumer durables. The levels of import duties and spread of tariff structure have also increased over time. For instance, the statutory rates of import duties range from as low as 2.5 percent to as high as 400 percent (The World Bank: An agenda for Tax Reforms in Bangladesh, 1989). There are also inter-industry variations in the rates of import duties resulting from ad hoc actions taken at different times. There appears to be no adequate attention given to the interdependence of the decisions regarding the setting of tariff rates for different industries. As a result no evaluation seems to have been made with regard to the effects of tariffs on the inputs and outputs of the different industries. Two types of taxes are levied on imports in Bangladesh. These are customs duty and sales tax. These taxes are levied to achieve the twin objectives of providing protection to domestic industries and generating revenues for the government. Table A.1 shows average effective customs duties and sales tax rates for selected years in Bangladesh. It is observed that the effective customs duty and sales tax (CDST) rate in 1974-79 period was 61 percent. During 1980-84 period the corresponding rate was 43 percent. The effective CDST rate was 39 percent in 1985-90 period. The average effective CDST rate on imports is estimated to be 43 percent in 1974-90 period.

Table A.1 Effective Customs Duty and Sales Tax Rates for Selected Years

Taxes on Imports	1975-79	1980-84	1985-90	Average
Customs Duty	42.95	31.10	29.92	31.76
Sales Taxes	17.70	12.00	9.18	10.77
CDST	60.65	43.09	39.10	42.61

Source: Bangladesh Fiscal Statistics, 1992.

Tariff reforms started in early 1990's and it involves reduction and compression of customs duty rates (i.e. tariff rates). Some progress on tariff reform is reported in Table A.2. It is observed that the mean rate of nominal protection (weighted) declined from 42 percent in 1991 to 28 percent in 1994. There has also been significant reduction in dispersion, as indicated by the coefficients of variations. Over the same period, the number of HS-8 codes with customs duty rate above 100 percent reduced from 274 products to 17 products. The spread of duty rates has also been reduced considerably. The number of duty rates declined from 18 in 1992 to 12 in 1994. Compression of duty rate is also evident from the reduction in the number of HS-8 codes with duty rates of zero and duty rates above 100 percent.

Table A.2 Impact of Tariff Reforms in Bangladesh, 1991-94
(%, unless otherwise noted)

	1991	1992	1993	1994
Nominal Protection Rate[1]				
Weighted mean[2]	42	40	30	28
Coefficient of variation	59	68	62	63
No. of customs duty rates	16	18	15	12
No. HS-8 codes with				
Customs duty = zero	346	376	323	308
Customs duty = 100%	2460	2315	768	39
Customs duty > 100 %	274	249	46	17

Note 1: Expressed as percent of assessed import values.
2: These are import weighted mean. 1991 is weighted by 1991 imports; 1992 is weighted by 1992 imports; 1993 and 1994 are both weighted by 1993 imports.
Source: Bangladesh: From Stabilisation to Growth, The World Bank (1994)

A.1.2 Quantitative restrictions

Along with tariffs, Bangladesh also relied on quantitative restrictions to control international trade. Such restrictions were introduced by the British Indian government during the second world war and have continued in the countries of the sub-continent after 1947. However in 1985, the government's commitment to eliminate the restricted list of imports, the government initiated a new list of imports which covered 20% of all categories of items listed in Bangladesh tariff codes[1]. This new restricted list consisted of three components. The first component listed banned items that are importable by the established exporters and foreign-exchange-earning hotels. The second component listed items that required prior permission for imports. The third component listed items that are only importable by registered industrial enterprises, up to the value specified in their pass book (The World Bank: An agenda for tax reform in Bangladesh, 1989).

However, not all these bans were effective due to the following reasons: (i) the extreme nature of the quota made many of the items redundant. There were many items that were on the list but which at the same time had a tariff declared against them; and (ii) many of the banned items were available in the market as they came via industrial importers. The above features of the quota regime imply that the premium commanded by these items (which in 1985 was estimated to be 35 percent) accrued to the licensed importers rather than in the form revenue to the government. This negated the protection objective without raising revenue. To redress the rent-seeking problem, the government decided to reduce the restricted list of imports with suitable customs duty and sales tax rates by middle of 1989. According to the World Bank (1989), " this will ensure that the reform of trade regime undertaken by government of Bangladesh yields revenue within the next year or two by transferring scarcity premium from licensed importers to the government."

[1] The Bangladesh tariff code lists a total 1192 products at the four-digit level of classification.

Table A.3 Proportion of Different Taxes in Total Tax Revenue

Taxes	1975-79	1980-84	1985-90	Average
Customs Duty	42.40	41.02	39.72	40.16
Sales Taxes	17.47	15.82	12.19	13.44
Excise Taxes	20.85	23.55	27.80	26.34
Other Duties	4.29	3.58	4.15	3.96
Income Tax	12.19	13.62	13.09	13.27
Land Tax	1.74	1.42	1.85	1.70
Oth. direct Tax	1.05	0.98	1.20	1.30

Note: Other duties include stamp duties and motor vehicle registration fee etc. Other direct tax consists of taxes on corporation income, taxes on immovable property, gift taxes and capital gains tax etc.
Source: Bangladesh Fiscal Statistics, 1992.

Table A.4 Tax Elasticities and Buoyancies in Bangladesh

Taxes	1975/76 to 1984/85		1979/80 to 1984/85	
	Elasticity	Buoyancy	Elasticity	Buoyancy
All Taxes	0.91	1.10	0.71	0.99
Tariffs	0.72	0.84	0.55	0.71
Sales Taxes	0.83	0.81	0.56	0.54
Excise Taxes	0.76	1.18	0.83	1.34
Income Tax	0.75	0.90	1.11	1.24

Source: Fiscal Statistics of Bangladesh, 1986.

A.2 Total Tax Element in Price

This section discusses the estimation of the total tax element in price. The section is based on the report " World Bank: An Agenda for Tax Reform in Bangladesh (1989)." To estimate the total tax element in price, one may start with answering the following question: what would be the increase in government revenue as a result of a unit increase in the final demand of a sector ? To see this, let X denotes gross output by sector and Y shows final demand by sector. In a closed economy the gross output equals the sum of intermediate and final demand. Thus

$$X = A \cdot X + Y \quad \text{(A.1)}$$

where A is the input-output matrix. Manipulation of A.1. yields the following

$$X = (1 - A)^{-1} \cdot Y \quad \text{(A.2)}$$

where $(1-A)^{-1}$ is the inverse of A. Also let t^X depict effective tax rates on gross output. Then

$$t^X \cdot X = t^X \cdot (1-A)^{-1} \cdot Y \qquad \text{(A.3)}$$

So that $t^X \cdot (1-A)^{-1}$ may be regarded as total tax on final demand.

The above arguments may be modified in an open economy as follows. Let A^d denote the domestic input-output matrix, A^m denote the matrix of imported inputs required per unit of domestic goods. According to this view imported inputs are assumed to be non-competitive with domestic output. Since tax on gross output is now the sum of domestic taxes (t^d) and import taxes (t^m) weighted by the proportion of imports in production, equation becomes

$$(t^d + t^m \cdot A^m) \cdot X = (t^d + t^m \cdot A^m) \cdot (1 - A^d)^{-1} \cdot Y \qquad \text{(A.4)}$$

Hence total tax is $(t^d + t^m \cdot A^m) \cdot (1 - A^d)^{-1}$. This consists of two components. Total tariffs and sales tax on intermediates is depicted by $(t^m \cdot A^m) \cdot (1 - A^d)^{-1}$. This is shown in column (1) of Table A.5. The total excise tax on intermediates is denoted by $t^d \cdot (1 - A^d)^{-1}$. This is depicted in column 2. The above model is used to calculate the extent of input taxation in Bangladesh.

The cascading effect of input taxation on the domestic economy is shown in Table A.5 which reports the total tax effects of excises and tariffs and sales tax on domestic production. The estimates are based on an input-output table updated to 1984/85 using the 1976/77 input-output table. Total amount of tariffs and sales elements in the price is shown in column 1 of Table A.5 while column 2 depicts the total excise elements in the price. The sum of these two elements yields the amount of total tax in the price which is shown in column 3. The total tax is the revenue accruing to the government as a result of a unit increase in the final demand of the sector, i. e., net of inter industrial demands. On the other hand the effective tax (column 4) is the revenue accruing to the government as a result of a unit increase in gross output of a sector. The base of effective tax rate is gross output while the base of total tax rate is final demand. Since values of final demand are smaller than gross output, the total tax rate is higher than effective tax rates. The difference between the total tax element and effective tax depicts the extent of taxation though cascading. This is denoted as Tdiff in column 5. An alternative explanation is Intax, which expresses Tdiff as a proportion of the total tax element. Therefore a value of Intax of 1 indicates that the sector is not taxed directly, hence the tax element of that sector is entirely due to the cascading effects of input taxation.

Table A.5 Total Tax Element by Sectors

Input-Output Sectors	Total Tariff 1	Total Excise 2	Total Tax 3	Effec-tive Tax 4	Tdiff 5=3-4	Intax 6=5/3
Rice	0.17	0.26	0.43	0.00	0.43	1.00
Wheat	0.27	0.99	1.26	0.00	1.26	1.00
Jute	0.07	0.12	0.19	0.00	1.19	1.00
Cotton	7.05	0.06	7.11	6.72	0.39	0.05
Tea	1.01	3.32	4.33	2.48	1.87	0.43
Oth. Crops	0.31	0.15	0.46	0.21	0.24	0.53
Livestock	0.14	0.29	0.42	0.00	0.42	1.00
Fisheries	0.28	0.28	0.55	0.00	0.55	1.00
Forestry	0.04	0.05	0.09	0.00	0.09	1.00
Sugar	3.41	1.24	4.65	4.19	0.46	0.10
Edible oil	1.43	0.44	1.87	0.99	0.89	0.47
Tobacco prd.	0.40	42.73	43.13	42.56	0.57	0.01
Other food	0.55	3.17	3.73	3.09	0.64	0.17
Cotton yarn	16.05	2.39	18.45	14.53	3.92	0.21
Cloth	2.78	1.41	7.20	0.39	6.81	0.94
Jute textile	0.19	3.05	3.24	2.25	0.98	0.30
Paper	10.07	6.61	16.68	12.94	3.74	0.22
Leather	0.74	0.55	1.29	0.00	1.29	1.00
Fertiliser	0.28	1.04	1.32	0.04	1.28	0.97
Pharm-Chem	6.25	1.61	7.85	6.61	1.24	0.16
Cement	10.94	3.97	14.91	12.31	2.60	0.17
Basic metal	25.41	0.19	25.60	20.91	4.69	0.18
Metal prd.	5.95	2.14	8.08	4.81	3.27	0.40
Oth. industry	7.07	3.92	10.98	8.28	2.70	0.25
Construction	5.74	0.97	6.69	0.00	6.69	1.00
Petroleum	2.88	3.71	6.59	1.19	5.39	0.82
Electric-gas	1.34	19.22	20.58	15.60	4.97	0.24
Transport	0.32	0.40	0.72	0.05	0.67	0.93
Housing	0.24	0.06	0.29	0.00	0.29	1.00
Health	1.41	0.41	1.82	0.00	1.82	1.00
Education	0.29	0.18	0.47	0.00	0.47	1.00
Public Adm.	0.67	0.34	1.01	0.00	1.01	1.00
Oth. services	0.18	0.41	0.60	0.26	0.34	0.57

Chapter Two

Numerical Specification of Bangladesh Economy

2.1 Introduction

In this chapter, the economy of Bangladesh is numerically specified within the framework of an input-output table and a social accounting matrix. An input-output table shows inter-relationships between economic activities in a economy in a given period of time. It traces the inter-industry transactions and maintains consistency between the supply and demand of commodities. A social accounting matrix is a generalisation of an input-output table and extends this information beyond the structure of production to include; (a) the distribution of value added generated by production activities; (b) formation of household and institutional income; (c) the pattern of consumption, savings and investment; (d) government revenue collection and associated expenditures and transactions; and (e) the role of the foreign sector in the formation of additional incomes for household and institutions.

Social accounting matrices can serve two basic purposes; (i) as a data system for descriptive analysis of the structure of the economy and (ii) as a basis for macroeconomic modelling. As a data framework, a SAM is therefore a snapshot of a country at a particular point in time (Pyatt and Thorbecke 1976). To provide as comprehensive a picture of the structure of the economy as possible, a particular novelty of the SAM approach has been to bring together macroeconomic data (such as national accounts) and microeconomic data sets (such as household surveys), within a consistent framework[2]. The second purpose of a SAM is the provision of a macroeconomic data framework for policy modelling and development planning. The

[2] Large discrepancies are often revealed between these two sources. Whilst the conflicting sources must somehow be reconciled, often by choosing the more reliable of them, the construction of SAM forces attention to the root of their cause (King, 1985). A consequence of this confrontation between data source is the highlighting of priority areas for improving and extending the statistical data base of a country (Hayden and Round, 1982).

framework of a SAM can often help in establishing the sequence of interactions between economic agents and accounts which are being modelled. A SAM provides an excellent framework for exploring both macroeconomic and multisectoral issues and is a useful starting point for more complex models (Robinson, 1989).

Since such a framework is not available for Bangladesh for any recent years, in this chapter a social accounting matrix is compiled for 1988/89. The purposes of this chapter are to show the major macroeconomic relations in a detailed framework and to provide a consistent macroeconomic data set for policy modelling. The choice of 1988/89 as the benchmark year is based on two grounds: (i) as most of the relevant data are available for that year and (ii) because tax and tariff reforms commenced in the early part of 1990s. Compilation of this SAM requires numerous data that are collected and compiled by different departments of government. For example, national accounts and trade statistics are reported by the Bangladesh Bureau of Statistics, the input-output table is prepared by the Planning Commission, tax and non-tax revenue statistics are provided by the National Board of Revenue, industry statistics are reported by the Census of Manufacturing Industries, and household classification, income and expenditure patterns are presented by the Household Expenditure Survey. Since sectoral classification and statistics of these different sources are not readily compatible, the exercise needs various assumptions, extensive data manipulation, reconciliation and balancing items in a way that reveals the macroeconomic structure of the economy and depicts the transactions between activities, factors, institutions, households and rest of the world.

In particular, the social accounting matrix integrates the system of national accounts, input-output table and census of manufacturing industries to show income generation by eight different kinds of labour factors and distribution of operating surpluses between institutions such as government, corporation and households. It also brings together national accounts, the input-output table and Household Expenditure Survey, within a consistent framework, for decomposition of 'households', distribution of household income, consumption expenditure and savings patterns. It also captures the flow of income from factors to the six household groups where households are distinguished by employment and income status. The linkage between factoral and household distribution of income constitute an important feature of the SAM which is essential to examine the distributional consequences of policy reforms. A particular novelty of this SAM is the construction of an inter-household transfer matrix from limited and partial information. The methodology used to construct the inter-household transfer matrix is so general that it can be applied to any other SAM without too much complication. It also clearly shows the three basic macro balances that are used to close the economic system. These are the balance of trade, the saving-investment balance, and the government surplus. This chapter consists of four sections. Section 2.2 describes the methodologies and data used to update the input-output table for 1988/89 using the I-O table of 1986/87. Section 2.3 discusses various methods and procedures adopted to compile the SAM for 1988/89. Concluding observations are presented section 2.4.

2.2 The input-output table for Bangladesh for 1988/89

This section is an exercise in updating the input-output table for Bangladesh for 1988/89. It involves collection of data for different components of supply and demand and derivation of inter-industry flows for 1988/89 using the most recent input-output table of 1986/87 prepared by the Planning Commission of Bangladesh (the Planning Commission, 1991). The main motivation for such an undertaking is to go on to construct a social accounting matrix for Bangladesh around a relevant and consistent input-output table for policy modelling and analysis for a more recent year.

2.2.1 Production accounts

The 48 production sectors classified in the 1986/87 input-output table are aggregated into 14 production sectors following a simple aggregation shown in Table 2.1. The sectors of the 1986/87 I-O table which constitute each of the new 14 sectors are grouped according to their similarities in use and in the pattern of sectoral trade. For example fertiliser, cement and basic metal sectors are pure intermediate sectors and showed no sectoral consumption in 1981/82 and 1986/87 I-O tables. Observing the similarities in use as intermediate sectors, the above three sectors are aggregated into one sector. On the other hand, since jute textile, leather and ready-made garments are mainly export-oriented they are grouped into one sector. It may be relevant to note that in this exercise no distinction is made between sectors (activities) and commodities and we treat these as synonymous.

Table 2.1. Sectoral Aggregation Scheme

Sectors of the Present Study	Sectors of the Input-Output Table
1. Subsistence-Agriculture	Rice, Wheat, Other Crops, Fisheries & Livestock
2. Commercial-Agriculture	Jute, Cotton, Sugarcane, Raw Tobacco & Tea
3. Forestry	Forestry
4. Food and Tobacco	Processed Food, Edible oil, Sugar, Salt & Tobacco Products
5. Clothing	Yarn, Cloth-Mill Made & Cloth-Hand Loom
6. Garments	Jute Textile, Leather and Ready Made Garments
7. Chemical	Chemical & Pharmaceuticals
8. Cement	Fertiliser, Basic Metal and Cement
9. Machinery	Machinery, Metal Product & Transport Equipment
10. Other Industries	Paper, Wood Products & Other Products
11. Construction	Urban and Rural House Building & Other Construction
12. Energy	Electricity, Gas & Petroleum Products
13. Services	Public Administration, Health, Education, Housing, Banking & Insurance & Other Serivces
14. Trade and Transport	Transport & Trade Services

The following data are collected to derive a reliable and consistent data set for 1988/89. These are: (a) sectoral and total value added; (b) sectoral and total intermediate consumption; (c) sectoral and total gross output; (d) public and private consumption; (e) gross capital formation; (f) sectoral and total imports; (g) sectoral and total exports; and (h) sectoral and total indirect taxes (e.g. excise tax, import duty and sales tax). Information on value added, intermediate consumption and hence gross output for the agriculture, livestock, fisheries, forestry, energy, construction, trade and government sectors is collected from the UN national accounts (UN 'National Aggregates', 1991). The UN national accounts, however, do not provide information on intermediate consumption for transport and other services, although it reports information on value added. The values of intermediate consumption are estimated for these two sectors using the information from the 1981/82 and 1986/87 I-O tables. Data on value added, intermediate consumption and gross output for the manufacturing sectors are obtained from the Census of Manufacturing Industries, 1988/89.

2.2.2 Imports, exports and indirect taxes

Sectoral imports and exports data are collected from the Bangladesh Trade Statistics (1990). These report imports (c.i.f.) and exports (f.o.b.) prices at a detailed level of classification which are easily aggregated into the 14 sectors. The amount of indirect taxes collected in 1988/89 is obtained from the National Board of Revenue. The National Board of Revenue (NBR) reports sales tax, import and excise duties by products, which are different from the sectors identified in the I-O table. So, the products classified by the NBR are mapped into I-O sectors according to the mapping scheme adopted in the 'Bangladesh revenue estimation model' of the World Bank (1989). This procedure then generates vectors of import and excise duties by I-O sectors.

2.2.3 Investment demand

The UN account provides aggregate information on gross fixed capital formation and changes in stock i.e. the components of the gross investment. Information on sectoral investment is not available in the UN accounts. The national accounts, however, report gross capital formation by sector. This information is used to derive investment by sectors of origin. The estimated sectoral investments are then scaled down in accordance with the discrepancy between the gross capital formation reported by the UN accounts (taka 80708 million) and the national accounts (taka 85191 million) to be consistent with the over all macro balances reported by the UN accounts.

2.2.4 Consumption demand

Total private consumption reported in the UN accounts is taka 584233 million. This is calculated residually given the estimated total supply and all but the private consumption components of total demand. The components of total supply are gross output and c.i.f. price of imports. The components of total demand are input demand, public and private consumption, gross investment and exports. Using the same procedure, the I-O accounts yield an estimate of total private consumption of taka 607717 million which is higher than the UN estimate by taka 23484 million. This discrepancy between the two estimates of private consumption is due to the differences in the valuation of imports. The UN accounts valued imports at the c.i.f. prices while the I-O table used the market or purchaser prices of imports. The imports valued at the c.i.f. prices are converted into imports at market prices by adding import duties and sales tax. The total of import duties and sales tax in 1988/89 is found to be taka 23487 million which is almost identical to the observed discrepancy between the two estimates of private consumption. Since the I-O tables in Bangladesh are valued at purchaser prices, the valuation of imports at market prices appears to be the appropriate method. It is also observed that both 1981/82 and 1986/87 I-O tables report much higher estimates of private consumption (i.e. taka 264101 and 561841 million respectively) than is reported in the national accounts (i.e. taka 223832 and 481995 million respectively) for the corresponding years. The treatment of margins on imports is a major problem which is dealt with separately in Appendix A.1. The resulting total supply and total demand, and derived components under the two accounts are shown in Table 2.2.

Table 2.2 Total Supply and Total Demand, 1988/89
(million taka)

Components	UN Accounts	National Accounts
1. Intermediate Input	334422	334479
2. Gross Value Added	659598	659598
3. Gross Output	994020	994077
4. Imports, C.I.F.	118955	118955
5. Import Duty & Sales Tax	0	23487
6. Imports at Market Prices	118955	142442
7. Total Supply (3+6)	1112975	1136519
8. Total Demand	1112975	1136519
9. Input Demand	334422	334479
10. Private Consumption	584233	607717
11. Public Consumption	62430	62430
12. Gross Investment	80708	80708
13. Exports	51185	51185

Values of sectoral consumption for 1988/89 are not available. The sectoral consumption patterns with respect to the total consumption observed in 1981/82 and 1986/87 I-O tables are used to estimate the sectoral consumption for 1988/89. Information on government consumption is obtained from the UN account.

2.2.5 Derivation of input demand and final reconciliation

Given the sectoral information on gross output, value added, intermediate consumption, imports, exports, investment, private and public consumption, sectoral input demands are calculated residually. This then provides two sets of control totals i.e. row (intermediate consumption) and column (input demand) control totals known as the 'RAS' multipliers to generate input-output flows for 1988/89 using the input-output coefficient matrix of 1986/87. Above estimation procedure generates a consistent inter-industry data set for 1988/89 with sectoral supply corresponding to sectoral demand. The updated I-O table for 1988/89 is shown in Table 2.3.

Table 2.3. Input-Output Table for Bangladesh, 1988/89 (million taka)

Sectors	Subsistence Agriculture	Commercial Agriculture	Forestry	Food and Tobacco	Clothing	Garments	Chemical
1. Subsistence-Agriculture	11328.00	221.85	0.13	1372.04	0	1130.70	454.72
2. Commercial-Agriculture	3.54	34.75	0	5662.18	1529.52	8634.91	0
3. Forestry	1019.67	2.86	137.59	73.60	4.66	34.10	131.90
4. Food and Tobacco	1680.52	0	0	1599.46	19.24	7.79	41.29
5. Clothing	65.54	0	0	0	1368.56	5985.99	3.25
6. Garments	2815.13	33.65	1.82	463.63	47.99	9392.43	40.19
7. Chemical	110.38	0.50	0.04	125.04	185.42	279.13	294.18
8. Cement	1910.23	185.73	0.10	82.84	0	0	0
9. Machinery	541.76	27.77	13.08	88.60	40.05	232.29	37.18
10. Other Industries	308.42	15.33	6.04	249.19	53.12	147.31	245.14
11. Construction	3744.91	92.83	6.01	452.67	125.91	416.81	367.13
12. Energy	2074.88	114.12	1.10	432.89	200.66	1010.51	116.22
13. Services	13202.38	659.33	459.25	1259.06	173.49	5441.74	351.03
14. Trade and Transport	31155.96	3458.29	2364.35	13874.93	1653.04	10632.56	5152.41
15. Input	69961	4847	2990	25736	5402	43345	7235
16. Value-added	205203	17716	24187	3303	8668	13470	5271
17. Indirect Tax	0	67	0	5060	160	533	987
18. Gross Output	275165	22630	27177	34099	14230	57347	13492
19. Import, C.I.F.	19782	3130	0	7934	9430	210	8320
20. Import Duty	820	20	0	2161	2228	102	1851
21. Sales Tax	0	0	0	1030	530	0	560
22. Import at Market Price	20602	3150	0	11125	12188	312	10732
Total Supply (18+22)	295767	25780	27177	45224	26418	57660	24224

Table 2.3. Input-Output Table for Bangladesh, 1988/89 (million taka) continued

Sectors	Cement	Machinery	Other Industries	Construction	Energy	Services	Trade & Transport
1. Subsistence-Agriculture	0	0	29.94	6.53	3.47	224.19	0
2. Commercial-Agriculture	0	0	20.24	214.55	0	24.49	0
3. Forestry	4.77	6.33	400.25	12390.30	0	0	60.40
4. Food and Tobacco	0	0	20.54	0	0	61.11	9.85
5. Clothing	0	2.09	45.60	0	0	388.24	616.01
6. Garments	630.07	4.19	29.02	213.80	0	101.14	781.65
7. Chemical	67.16	12.24	260.83	1817.24	4.81	246.77	0
8. Cement	652.25	134.22	65.70	29038.38	0.05	0	0
9. Machinery	58.13	38.06	117.71	3549.95	50.96	219.33	647.91
10. Other Industries	96.00	16.70	415.64	4929.52	11.60	421.70	267.91
11. Construction	183.39	174.96	404.47	4989.05	103.34	30138.57	11681.06
12. Energy	503.01	71.69	768.22	1149.10	2631.31	685.35	10526.38
13. Services	135.77	108.55	725.72	32.43	236.72	4161.72	8015.32
14. Trade and Transport	9324.61	8395.67	6611.18	562.45	7492.44	2492.93	3228.11
15. Input	11655	8965	9915	58893	10535	39166	35835
16. Value-added	7452	3490	4307	39262	2971	185340	124468
17. Indirect Tax	261	666	563	0	3591	488	2024
18. Gross Output	12356	13120	14875	98155	17097	224993	162327
19. Import, C.I.F.	12356	33126	4926	0	9264	10478	0
20. Import Duty	1490	6318	2168	0	1329	0	0
21. Sales Tax	500	982	1100	0	300	0	0
22. Import at Market Price	14346	40424	8193	0	10892	10478	0
Total Supply (18+22)	33715	53545	23068	98155	27989	235470	162327

Table 2.3. Input-Output Table for Bangladesh, 1988/89 (million taka) continued

Sectors	Input Demand	Private Consumption	Public Consumption	Export	Investment	Total Demand
1. Subsistence-Agriculture	14772	275979	0	5016	0	295767
2. Commercial-Agriculture	16124	5260	0	4396	0	25780
3. Forestry	14266	12910	0	0	0	27177
4. Food and Tobacco	3440	41751	0	34	0	45224
5. Clothing	8475	17941	0	2	0	26418
6. Garments	14555	14760	0	28345	0	57660
7. Chemical	3404	20741	0	80	0	24224
8. Cement	32069	0	0	1645	0	33715
9. Machinery	5663	12770	0	835	34277	53545
10. Other Industries	7184	14250	0	477	1157	23068
11. Construction	52881	0	0	0	45274	98155
12. Energy	20285	7200	0	503	0	27989
13. Services	34962	128225	62430	9852	0	235470
14. Trade and Transport	106398	55930	0	0	0	162327
15. Input	334479	0	0	0	0	0
16. Value-added	659198	0	0	0	0	0
17. Indirect Tax	14400	0	0	0	0	0
18. Gross Output	994077	0	0	0	0	0
19. Import, C.I.F.	118895	0	0	0	0	0
20. Import Duty	18485	0	0	0	0	0
21. Sales Tax	5002	0	0	0	0	0
22. Import at Market Price	142442	0	0	0	0	0
Total	1136519	607717	62430	51185	80708	1136519

2.3 Compilation of the social accounting matrix for 1988/89

This section describes the compilation of a SAM for 1988/89. The accounting relations of the matrix bring together the structure of production, income generation by factors of production, distribution of income by institutions in return for factor services and savings and investment patterns. In particular, the accounting matrix identifies the economic relations through four types of accounts: (i) production activity accounts for 14 sectors (described in the I-O table); (ii) nine factors of production with eight different types of labour and one capital; (iii) current account transactions between 4 main institutional agents; households and unincorporated capital, corporate enterprises, government and the rest of the world; and (iv) one consolidated capital account to capture the flows of savings and investment by institutions and sectors respectively.

The methodology and statistical procedures adopted here are based primarily on a fully disaggregated SAM for Pakistan prepared by Dhanani (1988). This choice is motivated by two considerations: (i) Dhanani relied exclusively on a fully disaggregated Malaysian SAM, compiled by Pyatt, Round and Denes (1984)[3], for methodological and data procedure issues and (ii) the observed similarities in description, compilation and generation of various statistics in Bangladesh and Pakistan, such as the household expenditure survey, census of manufacturing industries and the input-output table.

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[3] With reference to the Malaysian SAM, Dhanani argued that ' besides its extensive disaggregation and coverage, the study offered a detailed discussion on the conceptual difficulties arising from the fundamental objective of a SAM, which is to integrate social statistics with major economic data under a common base, and on ways of dealing with numerous sources of data varying in quality and coverage.'

2.3.1 An outline of an aggregate SAM of Bangladesh

For purposes of exposition the main economic relations are presented in an aggregate SAM for Bangladesh in Table 2.4. Twenty six sets of accounts contain four broad groups of accounts as follows; production (accounts 1-14), factors (accounts 15-16), institutions current accounts (accounts 17-25), and the consolidated capital account (account 26). The aggregate SAM satisfies the convention that the totals of corresponding rows and columns are equal and there is no leakage and injection into the system. Therefore, the aggregate SAM is a square matrix. The matrix presentation allows each transaction in the accounts to be represented by a single cell in the matrix[4]. The main objective of presenting the aggregated matrix is to summarise and to show the circular flow in Bangladesh's economy. It also provides a useful basis for describing the basic structure of accounts upon which subsequent discussion follows (Pyatt and Round, 1985).

[4] A SAM is a single entry system because the transactions are shown once only as elements of the matrix, so that the element (i, j) is the expenditure from account j which is received by account i. In contrast to the double-entry system, the accounts have to be 'fully articulated' in a SAM. In other words, both the origin and destination of each transaction (in terms of the accounts of the system) have to be specified. A display of origin and destination of each set of transactions can greatly facilitate understanding of inter-relationships between various parts of the macro economy (Hayden and Round, 1982).

Table 2.4. An Aggregate Social Accounting Matrix for Bangladesh, 1988/89 (million taka)

	Current Account								
	Production	Factors		Institutions					Total
	1. 14	Labour 15	Capital 16	Corporate sector 17	Government 18	Households 19. 24	Rest of the World 25	Consolidated capital A/C 26	
Current Account Production Activities 1 1 ... 14	Intermediate demand 334479				Government consumption 62430	Household consumption 607717	Exports 51185	Gross investment 80708	Total demand 1136519
Factors 2 15 Labour	Value added by labour 355697								Labour income 355697
16 Capital	Value added by capital 289501								Capital income 289501
Institutions 3 17 Corporate sector			Corporate capital 17781						Corporate income 17781
18 Government	Indirect taxes 37887		Governm-ent capital 19560	Corporate tax 5207		Direct tax 2800			Government income 65454
Households 19 24		Labour income 355697	Unincor-porated capital 252160	Dividend payment 460	Government transfer 1525	Inter-household transfer 48318	Remittances 23552		Household receipts 681712
25 Rest of the World	Imports C.I.F. 118955								Payments to abroad 118955
26 Consolidated 4 Capital Account				Corporate savings 12114	Government savings 1499	Household savings 22877	Foreign savings 44218		Savings 80708
Total	Total supply 1136519	Labour factor payment 355697	Capital factor payment 289501	Corporate expenditure 17781	Government expenditure 65454	Household expenditure 681712	Total current receipts from abroad 118955	Total investment 80708	

Source: Based on Pyatt and Round (1978); estimates as discussed in the text.

2.3.2 Derivation of labour income and operating surplus

It is observed from the aggregate SAM that value added at factor cost (taka 645198 million) is decomposed into labour income (taka 355697 million) and operating surplus (taka 289501 million). The I-O table shows the total as well as the sectoral breakdown of gross value added and into value added at factor cost and domestic indirect taxes. However in the aggregate SAM all types of indirect taxes are combined for the purpose of presentation. The total indirect tax of taka 37887 million comprises domestic indirect tax of taka 14400 million and import duty and sales tax of taka 23487 million. To split the sectoral value added at factor cost (V_i) into labour income and operating surplus, sectoral labour income by factors (L_{il}) is estimated first. The following procedures are adopted to estimate sectoral labour income by factors (L_{il}): (i) The employment coefficient matrix of the 986/87 I-O table and the vector of employment by labour factors for 1988/89 derived from the 'Household Expenditure Survey 1988/89' are used to derive the estimates of sectoral employment by factors for 1988/89. The estimation procedure may be expressed as:

$$\Omega_{il} = \Omega'_{il} \cdot \mathrm{T}_l$$

where, Ω_{il} is the estimated employment matrix for 1988/89, Ω'_{il} denotes the employment coefficient matrix of 1986/87 and T_l is the vector of employment by labour factors for 1988/89. (ii) In the absence of wage estimates for 1988/89, the wage coefficient matrix of 1986/87 is used assuming that the wage patterns observed in 1986/87 would remain fixed over these two year periods. Therefore, the sectoral wage coefficient matrix of 1986/87 and the estimated employment matrix of 1988/89 are used together to derive the sectoral labour income by factors for 1988/89. The derivation of sectoral labour income by factors is shown as:

$$L_{il} = \Omega_{il} \cdot W_{il}$$

where, W_{il} is the sectoral wage coefficient matrix of 1986/87. The derivation of labour income by sectors and factors is elaborated in Appendix A.2. The sectoral labour income is then deducted from sectoral factor cost value added to derive sectoral operating surplus (K_i) residually. The derivation of operating surplus may be expressed as:

$$K_i = V_i - \sum_l L_{il}$$

The distribution of sectoral value added into sectoral labour factor income and operating surplus is shown Table 2.5.

Table 2.5. Distribution of Value added at Factor Cost, 1988/89 (million taka)

Sectors	Value Added Factor Cost 1	Labour Income 2	Operating Surplus 3=1-2
1. Subsistence-Agriculture	205203	15927	45956
2. Commercial-Agriculture	17716	8028	9689
3. Forestry	24187	4383	19804
4. Food and Tobacco	3303	2294	1009
5. Clothing	8668	4243	4425
6. Garments	13470	6265	7205
7. Chemical	5271	3558	1712
8. Cement	7452	1494	5959
9. Machinery	3490	3490	1691
10. Other Industries	4307	2075	2322
11. Construction	39262	21164	18097
12. Energy	2971	1602	1397
13. Services	185340	85932	99408
14. Trade and Transport	124468	53719	70749
Total	645198	355697	289501

Source: Based on Table 2.3 and Table A.2.5.

2.3.3 Returns to corporate, unincorporated and government capital

The estimated returns to capital or operating surplus stand at taka 289501 million. This consists of returns to unincorporated capital, corporate capital and government capital. This decomposition of operating surplus is depicted in the aggregate SAM where unincorporated returns are taka 252160 million, corporate returns are taka

17781 million and government returns are taka 19560 million. Following methods are adopted to disaggregate the sectoral operating surpluses.

It is assumed that no operating surplus originated in the subsistence-agriculture, commercial-agriculture, forestry and trade and transport sectors. Therefore, all returns to capital or operating surpluses in these four sectors are assigned to unincorporated capital. The construction sector in Bangladesh is dominated by a large number of small individual firms and few large firms. Thus it is reasonable to assume that the operating surplus of the construction sector accrues both to unincorporated and corporate capital. Again relevant information is not available to distinguish between them. The information of the 1984/85 Pakistan SAM is used in this regard. In the Pakistan SAM, the operating surplus of the construction sector was distributed between unincorporated and corporate capital and their respective shares were 77.8 and 22.2 percent respectively. These shares are borrowed to distribute the operating surplus of the construction sector. Thus, the estimated amounts of the construction sector's operating surplus accrued to unincorporated and corporate capital are taka 14070 million (i.e. 77.8 % of 18097) and taka 4027 million (i.e. 22.2 % of 18097) respectively.

The eight manufacturing sectors together created operating surplus of taka 25799 million (Table 2.5). This consists of returns to unincorporated, government and corporate capitals since industries are owned by individual, government and private or corporate firms[5]. The information of 1988/89 CMI are used to distribute the total manufacturing operating surplus. The CMI shows the breakdown of consolidated manufacturing operating surplus by government, private and individual firms. The CMI also provides the breakdown of the manufacturing operating surpluses by

[5] In the 'CMI report' no distinctions are made between private and public limited corporations and both private and public limited corporations are treated as private or corporate firms. We retained this definition.

government and private firms at three-digit industry groups. This information is aggregated according to the I-O sector classification to derive the distribution of manufacturing operating surplus by government and private firms for the eight manufacturing sectors. The estimated sectoral operating surpluses of private corporations are further disaggregated into operating surpluses by individual and private corporations, following some assumptions and data manipulations. A detailed breakdown of manufacturing operating surplus by government, private and individual firms is provided in Appendix A.4.

The consolidated service sector consists of public administration, health and education, housing, bank and insurance (financial service), and other service sectors. Some of these sectors, such as public administration, and health and education are exclusively controlled by the government. So, the operating surpluses of these sectors are assigned to government capital. The housing sector, which consists of urban and rural house-building, is dominated by individuals and small firms as is the 'other service' sector, which includes professional services of doctors, lawyers, accountants and consultants. Thus, the operating surpluses of these two sectors are treated as unincorporated capital. The banking and insurance sectors are controlled both by corporate firms and government. Therefore, the operating surpluses of banking and insurance sectors are distributed between government and corporate capital on the basis of published information. The detailed distribution of the operating surpluses of the service sector is provided in Appendix A.5.

The sectoral distribution of operating surpluses between unincorporated, corporate and government capital is shown in Table 2.6.

Table 2.6. Distribution of Capital Income among Institutions, 1988/89
(million taka)

Sectors	Capital Income	Unincor-porated	Corporate	Gover-nment
1. Subsistence-agriculture	45956	45956	0	0
2. Commercial-agriculture	9688	9688	0	0
3. Forestry	19804	19804	0	0
4. Food and Tobacco	1009	147	435	427
5. Clothing	4425	941	2010	1474
6. Garments	7205	1656	4914	638
7. Chemical	1712	85	252	1374
8. Cement	5959	568	1685	3705
9. Machinery	1799	269	798	732
10. Other Industries	2322	364	1084	874
11. Construction	18079	14070	4029	0
12. Energy	1369	0	22	1348
13. Services	99408	87864	2555	8990
14. Trade and Transport	70749	70749	0	0
Total	289501	252160	17781	19560

Source: Based on Tables 2.5, A.2.9 and A.2.12.

2.3.4 Corporate profit, tax, dividend and savings

Total corporate tax collection in 1988/89 was taka 5200 million (Budget section, Statistical Year Book of Bangladesh, 1991). The corporate tax is levied on profits of the corporate establishments. It is observed that corporate profit originated in 10 sectors and the total corporate profit is taka 17781 million (column 3 of Table 2.6). Since information on the sectoral breakdown of total corporate tax is not available, the proportion of corporate profit of each of the nine sectors with respect to total corporate profit are used to distribute the total corporate tax among these 10 sectors.

The capital market in Bangladesh is at its early stage of development. The two main capital market institutions are the Dhaka Stock Exchange (DSE) and the Investment Corporation of Bangladesh (ICB)[6]. The securities market is almost non-existent. The

[6] The publicly owned ICB is the main financial institution in the securities market. It manages seven mutual funds, some 40,000 investor accounts and 300 underwriting commitments. The DSE is a privately owned non-profit member organisation. The exchange itself is still small with only 136 companies are listed as of September 1991, and a market capitalisation of taka 10300 million (US$ 257 million equivalent).

publicly owned ICB is the main financial institution in the securities market. It paid taka 20 million as dividends to its customers in 1988/89 fiscal year. Capital market instruments, almost exclusively stocks, are traded through the DSE. The total amount of dividend paid by the companies listed with the DSE was taka 440 million in 1988/89. The DSE and ICB provide information on dividen payments by ten sectors such as; food and tobacco, textiles, jute, leather, pharmaceutical, cement, oil and gas, engineering, bank and other industries. It is noted that except for the engineering sector, their sectoral classifications are very close to the I-O sector classification. The engineering sector is assumed to be a sub-sector of the machinery sector. The sectoral amounts of dividend payment by the I-O sectors are shown in column 4 of Table 2.7. Sectoral corporate savings are derived by deducting sectoral corporate taxes and dividend payments from sectoral profits.

Table 2.7. Corporate Profit, Tax, dividends and Savings, 1988/89
(million taka)

Corporate Sectors	Profit Amount	Profit %	Tax	Divi-dend	Savings
4. Food and Tobacco	435	0.025	127	53	252
5. Clothing	2010	0.113	588	28	1394
6. Garments	4914	0.276	1441	30	3463
7. Chemical	252	0.014	74	56	122
8. Cement	1685	0.095	493	17	1175
9. Machinery	798	0.044	233	39	526
10. Other Industries	1089	0.061	317	62	705
11. Construction	4027	0.227	1181	0	2846
12. Energy	22	0.001	6	6	10
13. Services	2555	0.144	747	169	1808
Total	17781	1.000	5200	460	12114

2.3.5 Government Account

The sources of government revenue are the tax and non-tax revenue. The main sources of tax revenue are (i) indirect taxes on imports and domestic production and (ii) direct taxes in the form of corporate and income taxes. The main sources of non-tax revenue are the income from the government owned corporations, financial institutions etc. Total government revenue is reported to be taka 65454 million in 1988/89. On the other hand total government expenditure is found to be taka 63955 million (Budget section, Statistical Year book of Bangladesh, 1991). Therefore estimated government savings is taka 1499 million.

2.3.6 Household classification and accounts

An important feature of this SAM is the decomposition of households into six groups. The household groups differ with respect to income levels, employment status and expenditure patterns. Pyatt and Thorbecke (1976) have suggested location, sociological and wealth criteria to classify the household groups[7]. However, it is observed that classification of household depends the issues that need to be addressed and also on the availability of information. For example, if the objective is to study poverty analysis then the household groups needs to classified by socio-economic groups rather than by income levels only. However, since information on income levels is readily available, households are seldom classified by levels of income. Indeed, grouping households by income levels is an informative approach to describe income distribution issues at a point in time. However, if the purpose is to provide a basis for diagnosis and policy change, then the grouping criteria should correspond to constituencies (e.g. socio-economic groups) which can be influenced differentially by policy means. It is argued that household groups based on income levels alone cannot be legislated for as such, on the ground that household units are mobile between these groups, and hence that target households are to identify with respect to policy measures (Pyatt and Thorbecke, 1976).

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[7] For instance, the location criterion which distinguishes a household as urban or rural is useful since it captures many aspects of duality. Depending on this distinction, individuals with otherwise similar characteristics are likely to be paid different wages, have different job opportunities and employment expectations and generally be subject to different sets of parameters in their socio-economic behaviour (Pyatt et al, 1984).

In this SAM, socio economic groups based on the employment status of the principal earner of the household are used to classify households. Besides the normal considerations of data availability and coverage, this criterion is likely to capture differences in lifestyle and assets among the household types which, in turn, have quite different relationships with factor markets, as previously found in the construction of SAMs for other countries. For Malaysia, see Pyatt, Round and Denes (1984). Consequently households are divided initially into self-employed and employed households. Furthermore, three different household groups based on income levels are distinguished within the two broad classifications of self-employed and employee household groups. The purpose of this is to capture the fact that two self-employed households, who have similar characteristics according to the first criterion, may be significantly different in other aspects, especially according to income and patterns of consumption expenditure. For instance, these differences are likely to be significant between a landless self-employed household and a self-cultivating land-owning household. So, according to the above two criteria, six different household groups are distinguished. The classification is summarised below;

a. Principal earner is self-employed

1. Low income household (SLI)
2. Middle income household (SMI)
3. High income household (SHI)

b. Principal earner is an employee

1. Low income household (ELI)
2. Middle income household (EMI)
3. High income household (EHI)

The main source of information for the above disaggregation of household groups is the 1988/89 Household Expenditure Survey (HES) published in August 1991. The HES provides a breakdown of earners by employment status of head of household and employment status of other than head of household according to the 16 income groups

(HES Table 1.06). The employment status are employer, self-employed, employee and others. According to the HES definition "employer implies persons who employ other persons (e.g. as agriculture wage labourers or industrial wage labourers) and relate to employers engaged in agricultural as well as non-agricultural sectors. Self-employed include owner-cultivators, owner-tenants, self-employees in forestry, livestock and fishery sectors as well as persons engaged in non-agricultural self-employed activities. Employee refers to persons who work as service-holders of government, semi-government and autonomous bodies, service workers of private sector enterprises (both organised and unorganised). The category of others includes agricultural wage labourers and non-agricultural labourers etc. " (HES, page 6).

Thus, initially, the head of household is isolated from other earners to obtain a distribution of head of household by employment status in percentage terms for each of the 16 income groups (i.e. column 2 to 5 of Table 2.8). Observing the similarities in the employment characteristics, the 'employer' class is merged with the 'self-employed' class and the 'other' category is merged with 'employee' class. This procedure then separates the head of households into self-employed and employee class in percentage terms for the 16 income groups. The distribution of households into self-employed and employee households is provided in column 6 and 7 of Table 2.8.

Table 2.8. Decomposition of Households by Employment Status, 1988/89.

Income Groups	Initial Distribution of Households				Final Distribution of HHs	
	Emp-loyer	Self-employed	Emp-loyee	Other	Self-employed	Emp-loyee
	2	3	4	5	6=2+3	7=4+5
<750		0.188	0.048	0.768	0.188	0.812
750-999		0.170	0.028	0.803	0.170	0.830
1000-1249		0.245	0.022	0.733	0.245	0.755
1250-1499		0.420	0.049	0.531	0.420	0.580
1500-1999	0.001	0.468	0.071	0.461	0.468	0.532
2000-2499	0.001	0.556	0.129	0.315	0.556	0.444
2500-2999	0.009	0.612	0.139	0.241	0.621	0.379
3000-3999	0.005	0.652	0.175	0.169	0.657	0.343
4000-4999	0.012	0.637	0.215	0.136	0.649	0.351
5000-5999	0.021	0.664	0.250	0.066	0.685	0.316
6000-6999	0.065	0.597	0.278	0.061	0.662	0.338
7000-7999	0.052	0.639	0.226	0.083	0.691	0.309
8000-8999	0.048	0.749	0.170	0.033	0.797	0.203
9000-9999	0.033	0.707	0.210	0.049	0.741	0.260
10000-12499	0.084	0.617	0.251	0.048	0.701	0.299
12500+	0.090	0.493	0.299	0.117	0.584	0.416
All Groups	0.008	0.498	0.119	0.375	0.506	0.494

Note: Each entry in this table shows the proportion of household by different employment status for each of the 16 income groups.
Source: Based on HES Table 1.06.

Finally, the 16 income groups are aggregated into three income groups using the following mapping; (i) households with incomes less than taka 2500 per month at 1988/89 prices are referred to as the low income household; (ii) households with incomes between taka 2500 and taka 6999 per month are called the middle income household; (iii) and households with monthly income of taka 7000 and above are labelled as high income households. The final distribution of households by these three income groups and the two employment categories is reported in Table 2.9. This table is quite central to the rest of this section concerned with the disaggregation of households with respect to income, receipts, expenditure, outlays and savings, because it preserves the 16 HES income group classifications on the one hand and presents the six household group classifications of the SAM on the other hand.

Table 2.9. Final Distribution of Households, 1988/89.

Income Groups	Self-employed Low	Self-employed middle	Self-employed High	Employee Low	Employee Middle	Employee High
<750	0.188			0.812		
750-999	0.170			0.830		
1000-1249	0.245			0.755		
1250-1499	0.420			0.580		
1500-1999	0.468			0.532		
2000-2499	0.556			0.444		
2500-2999		0.621			0.379	
3000-3999		0.657			0.343	
4000-4999		0.649			0.351	
5000-5999		0.685			0.316	
6000-6999		0.662			0.338	
7000-7999			0.691			0.309
8000-8999			0.797			0.203
9000-9999			0.741			0.260
10000-12499			0.701			0.299
12500+			0.584			0.416
All Group	0.239	0.227	0.036	0.358	0.123	0.016

Source: Based on Table 2.8.

2.3.6.1 Distribution of labour income among households

The total labour income generated by the eight labour factors is taka 355697 million. Households are the recipient of this total labour income. The HES, 1988/89 provides some information on the sources of income by the 16 income groups (HES Table 1.08). These include income from agriculture and professional activities. Presumably these incomes contained returns from both capital and labour factors employed in agriculture and professional activities. It does not report incomes from other sources such as income from service activities or trading and transport activities. Alternatively, HES Table 1.07 reports percentage of earners according to four major factors such as (i) administrative and professional (ii) service & sales workers (iii) farmers and fisherman and (iv) production and transport workers by the 16 income groups. In line with I-O factor classification we renamed (i) administrative and professional as administrative (ADM); (ii) service & sales workers as service (SERV); (iii) farmers and fisherman as agriculture (AGRL); and (iv) production and transport workers as workers. These percentage of earners derived from HES Table 1.07 and the number of earners obtained from Appendix Table A.2.3 are used to derive a distribution of earners by the four factors and the 16 income groups.

The income group specific to consolidated agricultural labour is further split into agricultural hired labour (AHL), agricultural family labour small farms (AFLSF) and agricultural family labour large farms (AFLLF) according to their shares in total agricultural employment. Similarly income group specific workers are separated into skilled (WSK), semi skilled (WSS) and unskilled (WUSK) workers according to their shares in total employed workers. The average wage rates of the eight labour factors, W_l and the estimated matrix of earners by the 16 income groups and labour factors, T_{jl} are employed to derive labour income by factors and income groups. Symbolically this can be captured by the following equation:

$$YL_{jl} = T_{jl} \cdot W_l$$

where, YL_{jl} shows the derived labour income by the 16 HES income groups. Derivation of labour income by the 16 income groups is discussed in Appendix A.5. The estimated labour income by factors and the 16 income groups are converted into labour income by the six household groups using the information of Table 2.9. The distribution of household's incomes from labour factors are presented in Table 2.10. It is important to note that, the procedure applied here to generate the linkages between labour factor income and the households may not be the most appropriate one. A more desirable approach would be to use the direct estimates of labour income by HES income groups or households. As mentioned earlier, this is available only for one or two labour factors. Therefore, given the paucity of relevant data on one hand and the essential requirement to establish the linkage between labour factors and household groups, the above method appears to be a reasonable alternative.

Table 2.10. Distribution of Labour Income by Household Groups, 1988/89 (million taka)

Labour Factors	SLI	SMI	SHI	ELI	EMI	EHI	Total
ADM	4655	15060	6004	5344	7897	2872	41833
SERV	12944	27010	8315	15584	14449	3896	82197
AHL	12226	13465	2524	17647	7301	1041	54204
AFLSF	14340	15782	2959	20692	8561	1222	63556
AFLLF	12161	13389	2510	17544	7260	1035	53889
WSK	1795	2164	448	2483	1163	206	8261
WSS	4481	5402	1119	6199	2902	515	20617
WUSK	6765	8156	1690	9361	4379	777	31129
Total	69367	100428	25569	94855	53914	11564	355697

Source: Based on Tables 2.9 and A.2.15.

2.3.6.2 Distribution of unincorporated capital income among households

The households are the recipients of the estimated total unincorporated capital income of taka 252160 million. Again no data are readily available to distribute the total unincorporated capital income among the six household groups. Due to lack of relevant data, average monthly incomes of each household by the 16 income groups as reported in the HES (HES Table 1.01) are used to perform this task. To perform this, the average monthly household income in each income group is separated into average monthly income by self-employed and employee household groups according to the observed proportion of self-employed and employee household groups in each income group. The disaggregation of average monthly household income of income groups into self-employed and employee components is elaborated in Appendix A.6. It is also noted that, on average, the self-employed household group receives 64.91 percent of total monthly income while the share of employee household group is 35.09 percent. According to these shares, the amounts of unincorporated capital income accrued to the self-employed and employee household groups are taka 163670 million (i.e. 252160*0.6491) and taka 88490 (i.e. 252160*0.3509) respectively. The amounts of unincorporated capital income accrued to the employee household groups may be viewed as income of members of family other than the head or income from land and properties. The amounts of unincorporated capital income of self-employed and employee household groups are now distributed to the 16 income groups according to the share of average monthly income of each of the 16 income groups under self-employed and employee household groups (i.e. column 1 and 3 of Table 2.11).

Table 2.11. Distribution of Unincorporated Income between Self-employed & Employee Households, 1988/89.

Income Groups	Self-employed		Employee	
	%	Amount	%	Amount
<750	0.0019	307	0.0150	1332
750-999	0.0027	439	0.0242	2142
1000-1249	0.0049	809	0.0282	2492
1250-1499	0.0103	1687	0.0263	2330
1500-1999	0.0146	2389	0.0307	2717
2000-2499	0.0222	3641	0.0328	2905
2500-2999	0.0.388	6349	0.0496	4387
3000-3999	0.0514	8419	0.0562	4979
4000-4999	0.0659	10791	0.0746	6606
5000-5999	0.0853	13962	0.0823	7286
6000-6999	0.0971	15894	0.1039	9197
7000-7999	0.0828	13557	0.0622	5498
8000-8999	0.1082	17706	0.0462	4084
9000-9999	0.1116	18266	0.0656	5800
10000-12499	0.1231	20151	0.0882	7804
12500+	0.1791	29303	0.2150	18929
Total	1.0000	163670	1.0000	88490

Source: Based on Appendix Table A.2.16.

Finally, the distributions of unincorporated capital incomes of self-employed and employee households by the 16 income groups (Table 2.11) are mapped into unincorporated capital income by the six household groups using the information of Table 2.9. The distribution of unincorporated capital income among the six household groups is presented in Table 2.12.

Table 2.12. Final Distribution of Unincorporated Income among Households, 1988/89
(million taka)

Sources	SLI	SMI	SHI	ELI	EMI	EHI	Total
Unincor -porated Income	9272	55415	98984	13918	32456	42116	252160

Source: Based on Tables 2.9 and 2.11.

2.3.6.3 Household income from other sources

Besides labour and unincorporated capital incomes, households also receive incomes from other sources, namely remittances or factor incomes from abroad, government transfers in the form of pension and dividend incomes from the corporations. We begin with the remittances or factor incomes from abroad. Assuming that the remittances are entirely worker's remittances, the remittances are then distributed among the six households according to their shares in total labour income.

Pension income is very limited in Bangladesh. Persons who are employed in government, semi-government and autonomous establishments are eligible for pension income. This is a transfer of resources from government to persons or households in accordance to their contributions made during their working period. Hence pension income is only distributed among the three employee household groups according to their shares in total labour income.

Given the uncertain, unattractive, risky and yet very low yield nature of the capital market, it is assumed that only the two high income household groups invest their money in this sector. Therefore, the total dividend of taka 460 million is distributed between the two high income household groups according to their respective shares in the total unincorporated capital income of the high income household group.

Table 2.13. Sources of Households Income, 1988/89 (million taka)

HH Groups	Labour Income	Unincor-porated	Remi-ttance	Pension	Dividend	Total*
SLI	69367	9272	4593	0	0	83232
SMI	100428	55415	6650	0	0	162943
SHI	25569	98984	1693	0	323	126559
ELI	94855	13918	6281	240	0	115294
EMI	53914	32456	3570	387	0	90326
EHI	11564	42116	766	898	137	55490
Total	355697	252160	23552	1525	460	633394

* Excludes inter-household transfer (see later)

2.3.6.4 Derivation of household's expenditure on goods and services

The derivation of consumption expenditure by households is quite straight forward. The aggregated I-O table depicts the sectoral breakdown of consumption expenditure on goods and services. The HES provides detailed breakdown of expenditure by 16 income groups and HES products. In particular, the HES identified 40 different sectors which are somewhat different from the I-O sector classification. So, the HES sectors are mapped to the I-O sectors according to the mapping scheme used by the World Bank in their revenue estimation model for Bangladesh (An agenda for tax reform in Bangladesh, 1989). The mapping between the HES sectors and the I-O sectors is shown in Appendix Table A.2.18. However, sectoral consumption estimated from HES estimates are found to be different from the I-O sectoral consumption estimates. Therefore, sectoral consumption expenditures by the 16 income groups are adjusted using sectoral scaling factors so that the sectoral consumption now corresponds to the I-O sectoral consumption estimates. The adjusted distribution of consumption expenditure by I-O sectors and the 16 income groups is shown in Appendix Table A.2.17. The consumption expenditures by I-O sectors and the 16 income groups are converted into sectoral consumption expenditure by the six household groups using Table 2.9. Table 2.14 reports the distribution of consumption expenditures by the six household groups.

Table 2.14. Distribution of Household's Expenditure on Goods and Services, 1988/89 (million taka)

Sectors	SLI	SMI	SHI	ELI	EMI	EHI	Total
1. Subs-Ag.	48932	76617	32012	62152	45334	10932	275979
2. Com-Ag.	561	1818	887	596	961	437	5260
3. Forestry	2088	4384	1056	2566	2347	470	12910
4. Food-Tobacco	3975	11827	9664	4746	6258	5280	41751
5. Clothing	2928	5527	1878	3783	2950	873	17941
6. Garments	1801	4911	2229	2160	2601	1058	14760
7. Chemical	3127	6634	2450	3906	3540	1084	20741
8. Cement	0	0	0	0	0	0	0
9. Machinery	1407	3632	2849	1092	1942	1247	12770
10. Oth. Industries	1060	4688	3248	1227	2468	1559	14250
11. Construction	0	0	0	0	0	0	0
12. Energy	1112	2211	859	1433	1179	406	7200
13. Services	15167	23402	38368	29009	10389	11890	128225
14.Trade-trans.	7979	13576	11821	10198	7243	5112	55930
Total	90137	159228	107324	123468	87212	40349	607717

Source: Based on Tables 2.9 and A.2.17.

2.3.6.5 Inter-household transfers

A specific feature of the SAM is the transfer of resources among households in Bangladesh. The 'Household Expenditure Survey' reports total as well as distribution of transfer receipts and payments by the 16 income groups. The total receipt of taka 48316 million (or 7.5 percent of total income by all income groups) appears to be quite large compared with the total transfer receipt observed in the past years. In particular, the share of transfer receipts increased from less than 1 percent of total income of household in 1985/86 to 7 percent in 1988/89. According to the HES, the dramatic increase in transfer receipts in 1988/89 was due to adverse effects of the floods (in 1986/87 and 1987/88) leading to greater dependence of many vulnerable households on gifts and remittances from other households. The total transfer payment should have been taka 48316 million to match receipts. However, the total transfer payment is reported to be taka 7248 million (or 1.3 percent of total expenditure) for 1988/89. Therefore, there is a large discrepancy (taka 41068 million) between the total transfer receipts and payments. Considering the special nature of problem in 1988/89, the total receipts of taka 48316 million is judged to be more reliable. Hence the transfer payment by each of the 16 income groups is adjusted upwards to total taka 48316 million. The distribution of the total receipts and payments by the 16 income groups is presented in Table 2.15.

Table 2.15. Transfer Receipts and Payments by Income Groups, 1988/89
(million taka)

Income Groups	Transfer Receipts	Transfer Payments Unadjusted	Transfer Payments Adjusted
<750	7773	42	277
750-999	4790	77	512
1000-1249	3025	64	427
1250-1499	2227	102	683
1500-1999	2209	157	1045
2000-2499	1782	246	1643
2500-2999	2945	333	2218
3000-3999	2293	323	2154
4000-4999	2497	387	2581
5000-5999	3470	448	2986
6000-6999	2370	643	4288
7000-7999	3590	470	3136
8000-8999	872	1181	7871
9000-9999	2840	810	5397
10000-12499	1425	1059	7061
12500+	4191	906	6037
Total	48316	7248	48316

Source: Based on HES Table 1.08.

The transfer receipts and adjusted transfer payments by income groups (Table 2.15) are mapped into transfer receipts and payments by the six household groups using again Table 2.9. This is shown in Table 2.16. As expected it is observed that transfers of resources flow mainly from the high income households to the low income households. This is captured in the net transfer column of Table 2.16.

Table 2.16. Transfer Receipts and Payments by Household Groups 1988/89, (million taka)

HH Groups	Transfer Received Amount	%	Transfer Payments Amount	%	Net Transfer
SLI	8530	0.177	1565	0.032	6966
SMI	8892	0.184	9315	0.193	-423
SHI	8178	0.169	18660	0.386	-10482
ELI	13278	0.275	3024	0.063	10254
EMI	4690	0.097	4914	0.102	-223
EHI	4750	0.098	10840	0.224	-6090
Total	48318	1.000	48318	1.000	0

Source: Based on Table 2.15.

The inter-household transfers however require further disaggregation because although total transfer amounts received and paid are known for each household group, what is not shown yet is who transfers what to whom. The full disaggregation of inter-household transfers is based on some assumptions and some data manipulation. (i) It is assumed that inter-household transfer flows from richer households to either same or poorer households. For instance, transfer from low income self-employed household only benefits the low income employee household and vice-versa but not any middle or high income households. Therefore, the initial coefficient of transfers is 1 (one) between these two low income households. (ii) The middle income household groups first exchanged resources between themselves according to their observed shares in the total transfer received by the middle income household. For example, self-employed middle income household receives 34.53 percent of its total transfer from the employee middle income household. Similarly, employee middle income household receives 65.47 percent of its total transfer from the self-employed middle income household.

Table 2. 17. Transfer Received by Middle and High Income Groups and Proportions, 1988/89.

Income Groups	Total	Self-employed Amount	%	Employee Amount	%
Middle Income	13582	8892	0.655	4690	0.345
High Income	12927	8177	0.633	4750	0.368

Source: Based on Table 2.16.

Then remaining transfer payments of middle income household groups are distributed between the two low income household groups according to the shares of the two low income households in total transfer receipts, adjusted so that the three coefficients add to one. For instance, the self-employed middle income household group pays 34.53 percent of its total transfer payments to the employee middle income household. Then the remaining 65.47 percent is distributed between self-employed and employee low income households. Their observed shares in total transfer receipts are 17.65 and 27.48 percent respectively, together generating 45.13 percent. These two shares are then adjusted by a scaling factor of 1.45 so that the three coefficients add to one (see column 2 of Table 2.18). (iii) A similar procedure is adopted to determine the coefficients for the two high income household groups. Accordingly, the high income household groups first transfer resources between themselves according to their observed shares in the total transfer received by the high income household. For instance, self-employed high income households receives 36.75 percent of its total receipts from the employee high income households. On the other hand, employee high income households receive 63.25 percent of its total receipts from the self-employed high income households. Then the remaining transfer payments of high income household groups are distributed among the four other household groups according their shares in total transfer receipts, adjusted so that five coefficients add to one.

Table 2.18. Initial Coefficients and Estimates of Inter-Household Transfer, 1988/89

HHs	SLI	SMI	SHI	ELI	EMI	EHI	Total
	Initial Coefficients						
SLI		0.256	0.153	1.000	0.135	0.089	1.632
SMI			0.159		0.655	0.092	0.906
SHI						0.633	0.633
ELI	1.000	0.399	0.237		0.210	0.138	1.984
EMI		0.345	0.084			0.049	0.478
EHI			0.368				0.367
Total	1.000	1.000	1.000	1.000	1.000	1.000	
	Initial Estimates (million taka)						
SLI		2385	2845	3024	664	960	9878
SMI			2966		3217	1001	7183
SHI						6857	6857
ELI	1565	3713	4429		1033	1494	12234
EMI		3217	2564			528	5309
EHI			6857				6857
Total	1565	9315	18661	3024	4914	10840	48318

(iv) Table 2.18 shows the initial coefficients and estimates of inter-household transfers. Although the derived estimates of transfer payments satisfied the payment control totals, the derived estimates of transfer receipts violated the receipt control totals. Hence given these initial coefficients and using the receipt and payment column of Table 2.16 as column control and row control vector respectively-the 'RAS' method is used for this typical constrained matrix problem to arrive at the final inter-household transfer matrix as depicted in Table 2.19.

Table 2.19. Final Coefficients and Estimates of Inter-Household Transfers, 1988/89

HHs	SLI	SMI	SHI	ELI	EMI	EHI	Total
	Final Coefficients						
SLI		0.219	0.136	1.000	0.088	0.045	1.489
SMI			0.240		0.724	0.079	1.043
SHI						0.754	0.754
ELI	1.000	0.467	0.289		0.188	0.096	2.035
EMI		0.314	0.080			0.026	0.420
EHI			0.255				0.255
Total	1.000	1.000	1.000	1.000	1.000	1.000	
	Final Estimates (million taka)						
SLI		2044	2543	3024	434	485	8530
SMI			4476		3556	857	8892
SHI						8177	8177
ELI	1565	4347	5406		924	1037	13278
EMI		2927	1483			284	4690
EHI			4750				4750
Total	1565	9315	18661	3024	4914	10840	48318

2.3.6.6 Total receipts, outlays and savings by households

Personal savings by the six household groups are derived in this section. The personal savings of each household group is calculated residually by deducting household's total outlays and income taxes from household's total receipts. The total income tax collection was taka 2800 million in 1988/89. The HES information on income tax payments by the 16 income groups is used to determined the amount of income tax paid by the four household groups. It is noted that only middle and high income household groups pay income tax. This indeed is the reflection of the HES data on income tax, where low income groups are not reported to have paid income tax. The total personal savings is estimated to be taka 22877 million. It is noted that the national accounts only report consolidated domestic savings amount of taka 36490 million in 1988/89. It is therefore imperative to check whether the sum of the corporate, government and household savings satisfies the consolidate domestic savings. It is observed that the sum of these three saving components satisfies the consolidated savings of taka 36490 million. Total receipts, outlays and savings by the household groups are shown in Table 2.20.

Table 2.20. Total Receipts, Outlays and Savings by Household Groups, 1988/89 (million taka)

Sources	SLI	SMI	SHI	ELI	EMI	EHI	Total
Total Income	83232	162493	126559	115294	90326	55490	633394
Transfer Received	8530	8892	8178	13278	4690	4751	48318
Total Receipts	91762	171385	134737	128572	95010	60240	6817712
Total Ex-penditure	90137	159228	107324	123468	87211	40439	607717
Transfer Payment	1565	9315	18660	3024	4914	10840	48318
Total Outlays	91702	168543	125984	126492	92125	51189	656035
Income Tax	0	477	1392	0	240	691	2800
Savings	60	2365	7361	2080	2651	8360	22877

Source: Based on Tables 2.13, 2.14 and 2.16.

2.4 Conclusion

This chapter has discussed the numerical specification of the Bangladesh economy within the framework of an input-output table and a social accounting matrix. The main achievements of this exercise are:

(a) The compilation of the SAM has been shown as an outcome of integration of different data sources and the input-output table. It provides a quantitative description of production, income generation by factors of production, distribution of income by institutions and savings and investment patterns in a detailed framework. The present SAM provides a useful framework for exploring both macroeconomic and multisectoral issues in Bangladesh which are not readily observable from different and disconnected data sources.

(b) The SAM integrates numerous data that are collected and compiled by different departments of government. Since sectoral classification and statistics of these different sources are not readily compatible, the exercise employs various assumptions, extensive data manipulation, reconciliation and balancing items to compile the SAM. The methodology and statistical procedures used to compile the SAM are also discussed in detail. It therefore provides a framework to generate and extend future social accounting matrices in Bangladesh.

(c) The exercise highlights the importance of the SAM as a useful aid to policy analysis which can focus on socio-economic linkages in the economy and on simulation of policy reforms using both SAM-based fixed-price models and flex-price computable general equilibrium models. The present SAM is also suitable for income distribution analysis as it shows the linkages between factoral distribution of income by nine factors and personal distribution of income by the six household groups. A particular novelty of this SAM is the construction of an inter-household transfer matrix from limited and partial information. The methodology used to construct the inter-household transfer matrix is so general that it can be applied to any other SAM without to much complication. This feature may be used to examine the role of inter-household transfers in affecting the income distribution or poverty situation of different household groups.

Appendix to chapter two

A.1. Problems with the treatment of margins on imports in Bangladesh

The transactions in I-O tables are usually expressed in value terms either at producers' or at purchasers' prices (market prices). " The difference between the two sets of values gives the distributive trade margins and the transport margins. The gross output of the distributive trade and transport units is equal to the value of their gross margins on internal and external trade (system of material products balance, UN aggregate account)." The I-O tables of Bangladesh (i.e. 1976/77, 1981/82 and 1986/87) are based on transactions valued at purchasers' prices. This implies that all internal as well as external transactions or trade must be valued at purchasers' prices (market prices). In published trade statistics the values of exports and imports are recorded at f.o.b. and c.i.f. prices respectively. In the I-O tables of Bangladesh, exports at f.o.b. prices are treated as equivalent to exports at market prices. However, imports valued at c.i.f. prices are converted into imports at market prices by adding the following (domestic) margins to c.i.f. imports. The margins added to the c.i.f. imports are: (i) transport margin (domestic); (ii) trade margin (domestic); (iii) import duty and (iv) other margins (e.g. the 'scarcity premium' on restricted imports).

Identification of problems and possible ways of treating these margins

A detailed inspection of the I-O table of 1986/87 reveals a major problem in the treatment of these margins added to c.i.f. imports to derive imports at market prices and the corresponding domestic sources of supply of these margins.

The treatment of import duty is straightforward; it is a transfer of resources from the private sector (in Bangladesh, most of the official imports are exempt from such duties) to the government sector.

The transport and trade margins are from domestic activity and the source of supply of these margins should be the transport and trade sector in Bangladesh. The transport and trade sector generates a composite activity which then is distinguished according to its usage i.e. transport and trade margins on internal and external trade. The I-O table of 1986/87 showed substantial trade and transport margins on c.i.f. imports but the corresponding supplies were not reflected in the flows of trade and transport sector. The I-O table of 1981/82 (from which the 1986/87 was updated) is however consistent in this regard. It showed that the gross output of the distributive trade and transport unit is equal to the value of their gross margins on internal and external transactions or trade.

The scarcity premium is a pure rent activity which accrued to the import license holders when the importation of certain items is restricted. If these license holders are public agencies then the treatment of the scarcity premium is straightforward and is similar to an import duty: these are transfer of resources from private to public sector. In Bangladesh, as in other developing countries, these quota rents are being appropriated by the private import license holders or agencies who in turn lobbied for such a license. Being a domestic private sector activity these rents should be reflected in the flows of the I-O table of 1986/87. However, no equivalent entries for the scarcity premium added to c.i.f. imports are shown in the flows of the I-O table of 1986/87. The text of I-O table of 1986/87 does not provide any explanation of the domestic treatment of these margins. Also the consistent 1981/82 I-O table failed to take account of the appropriate treatment of the scarcity premium. However, assuming that commercial importers are a subset of the trading activity these margins may then be considered an activity of the trade sector.

The adjustment procedures

Having identified the problems, the next step is to derive a consistent I-O table for Bangladesh that maintains the material balance conditions and subsequently be consistent with the macro aggregates (e.g. private and public consumption, gross fixed capital formation, change in stocks, exports etc.). The macro aggregates published by the United Nations are used for this purpose.

The I-O table of 1986/87 depicts that substantial amounts (taka 39306 million) of transport and trade margins are added to c.i.f. imports. However, the total activity produced and supplied by the transport and trade sector as reported in I-O table is significantly lower. For example, the total value added of the transport and trade sector reported in the UN accounts (and in the national accounts) is much higher (taka 107784 million) than the corresponding value added (taka 68392 million) reported in the 1986/87 I-O table. Therefore, we decided to boost the value added of the transport and trade sector to be consistent with the UN accounts and, at the same time, augment the supply of the transport and trade sector by adding the sectoral transport and trade margins to the sectoral c.i.f. imports. At this point we arrived at a consistent data set except for the treatment of the other margins. The data set is consistent in terms of total value added, sectoral value added (i.e. transport and trade sector) and other macro aggregates. The reported scarcity premia of taka 21789 million in 1986/87 appears to be very high considering the import trade regime of Bangladesh. Assuming that the value of all imports in 1986/87 (i.e. taka 80088 million) is binding (in terms of quota) and the average scarcity premia is 20 percent, the total scarcity premia is taka 16018 million which is smaller than taka 21879 million reported in 1986/87 I-O table[8]. Although no estimate is available regarding the value of importables under the restricted list, it is believed that the value of restricted imports as a proportion of total

[8] A study by the Planning Commission reported that the overall scarcity premium is 35 percent, of which 15 percent may be considered as the normal profit margin. Therefore, the average (pure) scarcity premium is around 20 percent.

import value is quite low[9]. Therefore this estimate appears to be spurious and hence the reliability of such an estimate is in question. At this stage this problem may be handled in two possible ways; (a) drop the scarcity premium assuming that the scarcity premium is being included in the transport and trade margin; or (b) add the scarcity premium to the value added of the transport and trade sector, which in turn would generate a higher sectoral (i.e. transport and trade) as well as total value added.

We have decided to adopt the first approach since it is consistent with the macro aggregates and at the same time maintains the material balance condition. The second approach might lead to some double counting.

A.2. Estimation of labour income by sector and factor

This section elaborates the derivation of labour income by sector and factor. The information of 1986/87 input-output table is used to estimate sectoral labour income for 1988/89. The 1986/87 I-O table reports the breakdown of sectoral employment and sectoral value added at factor cost by capital and eight major labour factors or occupational groups. These are two types of professional labour-administrative (ADM) and service (SERV) and six types of non-professional labour-agricultural hired labour (AHL), agricultural family labour small farms (AFLSF), agricultural family labour large farms (AFLLF), workers-skilled (WSK), workers-semi skilled (WSS) and workers-unskilled (WUSK). We preserve this labour factor classification. The employment coefficient matrix of 1986/87 and the employment by labour factors for 1988/89 are used to derive the estimates of sectoral employment by factors for 1988/89. Information is not readily available to update or generate the employment and employment coefficient matrix for 1988/89. The Household Expenditure Survey (HES) of 1988/89 and the provisional Labour Force Survey (LFS) of 1989 report

[9] The World Bank estimated that roughly 20 percent of all imports categories (i.e. 1192 items) at the four digit SITC level are under the restricted list of imports in 1984/85.

some estimates of employment for 1988/89. The estimated total employment of 29.2 million reported by the HES is close to the provisional LFS estimates of 30.8 million reported in the Bangladesh Statistical Yearbook 1991. The provisional LFS does not report the breakdown of employment by occupation. On the other hand, the HES provides some estimates of employment by major occupation groups which are close to the I-O factor classification albeit not same. Therefore, the HES employment estimates are used to generate a vector of employment by labour factor following a mapping between I-O and HES factor classification.

Table A.2.1. Mapping of HES Factor Classification and I-O Factor Classification

HES Classification	Numbers	I-O Classification	Numbers
Agriculture labour and Fisherman	5512695	Agriculture Hired Labour (AHL)	5512695
Tenant Farmer & Farmer Small Farm	11950115	Agriculture Family Labour Small Farm (AFLSF)	5815268
		Large Farm (AFLLF)	6134847
Administrative & Professional Officer	820262	Administrative (ADM)	82062
Other Office Staff, Services & Others	5597054	Service (SERV)	5597054
Transport and Production Workers	5328637	Workers	627900
		Skilled (WSK)	1658240
		Semi-Skilled (WSS)	3042947
		Unskilled (WUSK)	
Total	29208763		29208763

Source: Based on HES Table 4.19 and I-O table 1986/87.
Note: The estimated total employment of family labour and transport and production workers are then further classified according to the size of farms and skills of workers according to their shares observed in 1986/87 employment data.

The employment coefficient matrix of 1986/87 (Ω'_{il}) and the vector of employment by labour factors for 1988/89 (T_l) are used to derive the estimates of sectoral employment by factors for 1988/89 (Ω_{il}). Sctoral wage coefficient matrix of 1986/87 and estimated employment matrix of 1988/89 are then used to derive the sectoral labour income by factors for 1988/89. The estimated sectoral labour income is shown in Table A.2.5.

Table A.2.2. Employment Coefficient Matrix, 1986/87

Sectors	ADM	SERV	AHL	AFLSF	AFLLF	WSK	WSS	WUSK
1. Subsistence-agriculture			0.881	0.952	0.931			
2. Commercial-agriculture			0.095	0.028	0.041			
3. Forestry			0.024	0.020	0.028			
4. Food and Tobacco	0.017	0.005				0.045	0.067	0.063
5. Clothing	0.021	0.014				0.153	0.036	0.017
6. Garments	0.034	0.007				0.052	0.097	0.058
7. Chemical	0.017	0.006				0.007	0.013	0.010
8. Cement	0.020	0.004				0.007	0.004	0.007
9. Machinery	0.022	0.004				0.020	0.027	0.034
10. Other Industries	0.019	0.004				0.056	0.091	0.102
11. Construction	0.022	0.012				0.197	0.202	0.209
12. Energy	0.020	0.011				0.011	0.012	0.011
13. Services	0.697	0.688				0.054	0.054	0.058
14. Trade & Transport	0.113	0.248				0.398	0.398	0.437

Source: The I-O table of Bangladesh, 1986/87

Table A.2.3. Estimated Employment by Sector and Factor, 1988/89

Sectors	ADM	SERV	AHL	AFLSF	AFLLF	WSK	WSS	WUSK	Total
1. Subsistence-agriculture			4855092	5536120	5712390				16103602
2. Commercial-agriculture			525210	162574	250253				938036
3. Forestry			132393	116574	172204				421172
4. Food and Tobacco	13890	26574				28230	110600	191331	370625
5. Clothing	26996	88009				95984	70073	75651	356714
6. Garments	37591	57074				32628	186447	250891	574631
7. Chemical	14070	30612				4633	20680	29456	99450
8. Cement	16058	21352				4261	6411	20135	68218
9. Machinery	7856	10820				12567	19665	28465	79373
10. Other Industries	15864	20848				35302	150452	309613	532079
11. Construction	18003	64123				123890	335186	636204	1177406
12. Energy	6062	28701				6585	9179	9675	60203
13. Services	571551	3852831				33834	89352	177748	4725316
14. Trade and Transport	92321	1386110				249986	660195	1313327	3701939
Total	820262	5597054	5512695	5815268	6134847	627900	1658240	31129	29208763

Source: Based on Tables A.2.1 and A.2.2.

Table A.2.4. Wage Coefficient Matrix, 1986/87

Sectors	ADM	SERV	AHL	AFLSF	AFLLF	WSK	WSS	WUSK
1. Subsistence-agriculture			0.0098	0.0110	0.0089			
2. Commercial-agriculture			0.0098	0.0075	0.0066			
3. Forestry			0.0105	0.0117	0.0095			
4. Food and Tobacco	0.0312	0.0095				0.0087	0.0058	0.0038
5. Clothing	0.0234	0.0081				0.0083	0.0134	0.0154
6. Garments	0.0341	0.0118				0.0166	0.0090	0.0079
7. Chemical	0.1102	0.0332				0.0279	0.0203	0.0150
8. Cement	0.0386	0.0159				0.0281	0.0263	0.0122
9. Machinery	0.0553	0.0287				0.0227	0.0158	0.0124
10. Other Industries	0.0348	0.0142				0.0082	0.0026	0.0017
11. Construction	0.2152	0.0156				0.0138	0.0180	0.0135
12. Energy	0.0730	0.0152				0.0271	0.0327	0.0254
13. Services	0.0474	0.0148				0.0102	0.0083	0.0040
14. Trade and Transport	0.0536	0.0144				0.0145	0.0137	0.0123
Average	0.0510	0.0147	0.0098	0.0109	0.0088	0.0132	0.0124	0.0102

Source: The I-O table of Bangladesh, 1986/87.

Table A.2.5. Labour Income by Sector and Factor, 1988/89 (million taka)

Sectors	ADM	SERV	AHL	AFLSF	AFLLF	WSK	WSS	WUSK	Total
1. Subsistence-agriculture			47657	60979	50611				159247
2. Commercial-agriculture			5152	1215	1661				8028
3. Forestry			1395	1366	1627				4383
4. Food and Tobacco	433	253				244	641	723	2294
5. Clothing	631	709				798	941	1465	4243
6. Garments	1281	794				542	1668	1980	6265
7. Chemical	1551	1016				129	420	442	3558
8. Cement	620	340				120	168	246	1494
9. Machinery	434	311				285	310	350	1691
10. Other Industries	551	296				291	396	540	2075
11. Construction	3875	998				1711	6017	8563	21164
12. Energy	443	435				178	300	246	1602
13. Services	27067	57078				345	739	703	85932
14. Trade & Transport	4948	19767				3618	9016	16170	53719
Total	41833	82197	54204	63556	53899	8261	20617	31129	355697

A.3. Derivation of sectoral capital stock estimates

Sectoral capital stocks for 1988/89 are derived using the capital output ratios of the 1986/87 input-output table and the sectoral outputs of 1988/89. Estimated sectoral capital stocks are shown in Table A.2.6.

Table A.2.6 Capital Stock by Sectors, 1988/89 (million taka)

Sectors	1986/87 Capital out-put ratio	1988/89 Output	Capital stock
1. Subsistence Agriculture	1.1057	275165	304240
2. Commercial Agriculture	0.6771	22630	15322
3. Forestry	0.5287	27176	14368
4. Food and Tobacco	0.2265	34099	7722
5. Clothing	0.3613	26409	9541
6. Garments	0.7517	45168	33951
7. Chemical	1.4753	13492	19905
8. Cement	1.5883	19368	30763
9. Machinery	1.4515	13120	19044
10. Other Industries	1.5064	14874	22407
11. Construction	0.8124	98155	79742
12. Energy	4.3338	17096	74093
13. Services	3.3449	224992	752588
14. Trade & Transport	1.5156	162623	246471

A.4. Distribution of manufacturing operating surplus

The operating surpluses of the eight manufacturing sectors stand at taka 25799 million. This consists of returns to corporate, unincorporated and government capitals since industries are owned by individual, government and private or corporate firms. The information of 1988/89 CMI are used to distribute the total manufacturing operating surplus. The CMI reports manufacturing operating surplus of taka 10826 million for government, taka 11506 million for private firms and taka 4128 million for individual firms. Together they generated manufacturing operating surplus of taka 26426 million which is very close to I-O estimates of taka 25799 million. A scaling factor of 0.9763 (i.e. 25799/26426) is employed to adjust the CMI estimates so that the total manufacturing operating surplus reported by CMI conforms to taka 25799 million. Consequently, the adjusted manufacturing operating surpluses for government, private and individual firms are taka 10569 million, taka 11200 million and taka 4030 million respectively (Table A.2.7).

Table A.2.7. Manufacturing Value Added and Operating Surplus by Ownership, 1988/89 (million taka)

Types of Ownership	Value added	Wage or Salary	Indirect Tax	Operating Surplus CMI	Operating Surplus Adjusted
Government	23158	8106	4226	10826	10569
Private	28726	8962	8258	11506	11200
Individual	8974	3807	1039	4128	4030
Total	60858	20875	13523	26426	25799

Note: Here the value added refers to gross value added.
Source: Table 11A, CMI 1988/89.

The CMI also provides the breakdown of the manufacturing operating surpluses by government and private firms at three-digit industry groups. This information is aggregated according to the I-O sector classification to derive the distribution of manufacturing operating surplus by government and private firms for the eight manufacturing sectors (i.e. columns 1 and 2 of Table A.2.8). It is observed that sectoral as well as total manufacturing operating surpluses derived from CMI are different from the estimated sectoral and total manufacturing operating surpluses (see Table A.2.7). Therefore, sectoral totals derived from CMI are adjusted by their respective scaling factors to generate estimated sectoral control totals. This process however, produced government and private totals of taka 10548 and 15251 million respectively which differed slightly from the government and private control totals of taka 10569 and 15230 million. To reconcile this, the 'RAS' technique is adopted. The 'RAS' technique while preserving the sectoral as well as the government and private control totals, produces some new shares for the government and the private corporation. The final distribution of manufacturing operating surpluses between government and private corporations is shown in columns 8 and 9 of Table A.2.8.

The estimated sectoral operating surpluses of private corporations are further disaggregated into operating surpluses by individual and private corporations (Table

A.2.9). It is noted that the share of individual operating surplus is taka 4030 million out of total private operating surplus of taka 15230 million. The following procedures are adopted to carry out this disaggregation due to lack of relevant information. The consolidating clothing sector is composed of yarn, mill-made clothing and hand loom sub-sectors. The hand loom sub-sector is predominantly rural small-scale cottage activity, employing less than 10 persons. It is, therefore, assumed that the operating surplus of the hand loom sub-sector may be considered as part of individual operating surplus. The estimated operating surplus of the hand loom sector is taka 941 million. It is also assumed that no more individual operating surplus originated in the clothing sector and there was no operating surplus at all in the energy sector. The remainder of the total individual operating surplus i.e. taka 3089 (4030-941) million is then distributed among the remaining six manufacturing sectors (i.e. except clothing and energy sectors) according to their shares of private operating surpluses in the total private operating surpluses of these six sectors[10].

[10] An illustration may make this clear. The total operating surplus of these six sectors is taka 12257 million (i.e. 12257=15230 -2951-22). The share of food and tobacco sector with respect to this total is 0.0475 (i.e. 582/12257). When this share is multiply by the remainder of the total individual operating surplus i.e. 0.0475*3089, the food and tobacco sector's operating surplus of taka 147 million is obtained.

Table A.2.8. Breakdown of Manufacturing Operating Surplus between Government and Private Corporation (million taka)

Sectors	CMI Breakdown			Scale	Adjusted Breakdown			Final Breakdown	
	Govt.	Pvt.	Total	Factor	Govt	Pvt.	Total	Govt	Pvt.
	1	2	3=1+2	4	5=4*1	6=4*2	7=5+6	8	9
4. Food & Tobacco	563	771	1334	0.7564	426	583	1009	427	582
5. Clothing	1573	3161	4734	0.9347	1470	2955	4425	1474	2951
6. Garments	679	7052	7731	0.9378	633	6572	7205	638	6567
7. Chemical	1673	414	2087	0.8203	1372	340	1712	1374	338
8. Cement	3031	1851	4882	1.2204	3699	2259	5958	3705	2253
9. Machinery	548	807	1355	1.3277	728	1071	1799	732	1067
10. Other Industries	1127	11780	2907	0.7988	872	1450	2322	874	1448
12. Energy	1375	22	1396	0.9807	1348	22	1369	1348	22
Total	10569	15857	26426	0.9763	10548	15251	25799	10569	15230

Source: Based on CMI Table 13, Table 2.5 and Table A.2.7.

Table A.2.9. Distribution of Manufacturing Operating Surplus between Government, individual and Private Corporation, (million taka)

Manufacturing Sectors	Government	Individual	Private	Total
4. Food and Tobacco	427	147	435	1009
5. Clothing	1474	941	2010	4425
6. Garment	638	1656	4914	7205
7. Chemical	1374	85	252	1712
8. Cement	3705	568	1685	5958
9. Machinery	732	269	798	1799
10. Other Industries	874	365	1083	2322
12. Energy	1348	0	22	1369
Total	10569	4030	11200	25799

Source: Based on Table A.2.8.

A.5. Distribution of operating surplus of the service sector

This section reports the estimation of the operating surpluses of the five sub-sectors of the consolidated service sector. The National accounts section of Bangladesh Statistical Year Book, 1991, reports operating surpluses of private and public sector banks and insurance companies. This information is presented in Table A.2.10.

Table A.2.10. Breakdown of Operating Surplus of Financial Services, (million taka)

Types	Operating Surplus	Government Share	Corporate Share
1. Commercial Banks & Insurance Companies	3030	1365	1665
2. Private Banks	890		890
3. Central Bank	2630	2630	
Total	6550	3995	2555

Source: Based on Tables 9.19, 9.20, 9.21, 9.22 and 9.24; Statistical Year Book of Bangladesh, 1991, Bangladesh Bureau of Statistics.

The operating surplus of the Central bank, taka 2630 million, is assigned to the government. On the other hand, the operating surplus of taka 890 million generated by private banks is treated as corporate capital. Furthermore, it is also reported that the government received taka 1365 million from the nationalised commercial banks and insurance companies. Having incorporated this amount as the government share, the corporate share of taka 1665 million is determined residually from the operating surplus of the commercial banks and insurance companies.

Information is not readily available to estimate the operating surplus of the remaining four sub-sectors of the service sector. So a different method is adopted to estimate the operating surpluses of these sub-sectors. Information on value added by these sub-sectors for 1988/89 is obtained from the Bangladesh Statistical Year Book, 1991. The 1986/87 I-O table reports the ratio of operating surplus to value added by these sub-sectors. These observed ratios and the reported value added for 1988/89 are used to derive the operating surpluses of these sub-sectors for 1988/89. The estimated operating surpluses of these sub-sectors, along with other relevant information, are provided in Table A.2.11.

Table A.2.11. Breakdown of Service Sector's Operating Surplus (million taka)

Sectors	1986/87			1988/89	
	Value Added	Op. Surplus	Ratio	Value Added	Op. Surplus
	1	2	3=2/1	4	5=4*3
Housing	48508	48508	1.000	59866	59866
Public Administration	16369	819	0.050	29203	1460
Health & Education	19580	2147	0.110	32245	3535
Other Services	31201	17000	0.545	51384	27998

Source: Based on I-O table, 1986/87 and Table 11.07, the Statistical Year Book of Bangladesh, 1991.

Table A.2.12 Distribution of Operating Surplus of Service sector among Institutions, (million taka)

Service Sectors	Government	Unincorporated	Corporate	Total
Housing	0	59886	0	59886
Financial Service	3995	0	2555	6550
Public administration	3535	0	0	3535
Health & Education	1460	0	0	1460
Other Services	0	27998	0	27998
Total	8990	87864	2555	99408

Source: Based on Tables A.2.10 and A.2.11.

The information of Table A.2.10 and A.2.11 is assembled in Table A.2.12 to depict the final distribution of the operating surplus of the service sector. It is observed that more than 88 percent of the service sector's operating surplus accrued to unincorporated capital. The shares of government and corporate capital are 9 percent and 2.6 percent respectively.

A.6. Distribution of labour income by HES income groups

This section discusses the distribution of labour income by the 16 HES income groups. The information of HES Table 1.07 and Appendix Table A.2.1 is used for this purpose. First, the percentage of earners by four factors derived from HES Table 1.07 and the number of earners obtained from Appendix Table A.2.1 are used to derive a distribution of earners by the four factors and the 16 income groups. This distribution is presented in Appendix Table A.2.13.

Table A.2.13. Initial Distribution of Earners by HES Income Groups, 1988/89.

Income Groups	ADM	SERV	AGRL	PRTRW	Total
<750	9594	36939	442778	160376	651407
750-999	8498	100190	941797	228168	1270945
1000-1249	6764	158712	1345759	335951	1836841
1250-1499	29120	307561	1439443	364569	2131293
1500-1999	54815	626548	3072364	857064	4599032
2000-2499	87288	712608	2381988	813921	4003564
2500-2999	70075	583739	1961916	492784	3000680
3000-3999	128440	1054986	2546492	763259	4493161
4000-4999	89737	607111	1233188	470518	2411656
5000-5999	88621	332761	636573	243349	1308374
6000-6999	73267	244445	412014	176416	913178
7000-7999	43761	228830	228173	90723	595002
8000-8999	22274	115653	308821	109360	557924
9000-9999	27916	74049	231379	31778	361919
10000-12499	19782	171406	137910	40700	370511
12500+	60311	241524	242216	149701	703276
Total	820262	5597054	17462810	5329087	29208763

Source: Table 1.07, the Household Expenditure Survey of Bangladesh, 1988/89.

The income group specific to consolidated agricultural labour is further split into agricultural hired labour (AHL), agricultural family labour small farms (AFLSF) and agricultural family labour large farms (AFLLF) according to their shares in total agricultural employment as observed in Table A.2.1. Similarly income group specific workers are separated into skilled (WSK), semi skilled (WSS) and unskilled (WUSK) workers according to their shares in total employed workers (see Table A.2.1). This is shown in Table A.2.14.

Table A.2.14. Further Distribution of Agriculture Labour and Production and Transport Workers by Factors & HES Income Groups, 1988/89.

Income	Agriclulture Labour			Production & Transport Workers		
Groups	AHL	AFLSF	AFLLF	WSK	WSS	WUSK
<750	139777	147449	155552	18896	499004	91576
750-999	297308	313627	330862	26884	70999	130286
1000-1249	414832	448150	472778	39584	104537	191831
1250-1499	454406	479347	505690	42955	113442	208172
1500-1999	969890	1023124	1079350	100984	266691	489390
2000-2499	751951	793223	836815	95900	253266	464755
2500-2999	587773	620043	654108	58062	153339	281383
3000-3999	803886	848004	894606	89931	237502	435827
4000-4999	389295	410662	433230	55439	146410	268669
5000-5999	200955	211984	223634	28673	75722	138954
6000-6999	130065	1372004	144744	20786	54895	100375
7000-7999	72030	75984	80159	10689	28230	51803
8000-8999	97489	102840	108492	12885	34029	62445
9000-9999	73042	77051	81285	3797	10028	18403
10000-12499	43536	45925	48449	4795	12664	23250
12500+	76463	80660	85093	17639	46582	85481
Total	5512695	5815268	6134847	627900	1658240	3042947

Source: Based on Tables A.2.1. and A.2.13.

The average wage rates of the eight labour factors, W_l and the estimated matrix of earners by the 16 income groups and labour factors, T_{jl} are employed to derive labour income by factors and income groups. The distribution of labour income by the 16 HES income group is shown in Table A.2.15.

Table A.2.15. Distribution of Labour Income by HES Income Groups, 1988/89 (million taka)

Income Groups	Adm	Serv	Ahl	Aflsf	Afllf	Wsk	Wss	Wusk
<750	489	542	1374	1611	1367	249	621	937
750-999	433	1471	2923	3428	2907	354	883	1333
1000-1249	345	2331	4177	4898	4154	521	1300	1963
1250-1499	1485	4517	4468	5339	4443	565	1411	2130
1500-1999	2796	9201	9537	11182	9483	1329	3316	5007
2000-2499	4452	10465	7394	8669	7352	1262	3149	4755
2500-2999	3574	8573	5779	6776	5747	764	1907	2879
3000-3999	6550	15493	7904	9268	7860	1183	2953	4459
4000-4999	4577	8916	3828	4488	3806	729	1820	2749
5000-5999	4520	4887	1976	2317	1965	377	942	1422
6000-6999	3737	3590	1279	1500	1272	273	683	1031
7000-7999	2232	3361	708	830	704	141	351	530
8000-8999	1136	1698	959	1124	953	170	423	639
9000-9999	1424	1087	718	842	714	49	123	186
10000-12499	1009	2517	428	502	426	63	157	238
12500+	3076	3547	752	882	748	232	579	875

Source: Based on Tables A.2.3 and A.2.13 and A.2.14.

A.7. Distribution of the average monthly incomes of households

The average monthly income of each household by the 16 income groups is separated into average monthly income by self-employed and employee household groups according to observed proportion of self-employed and employee household groups in each income group. The disaggregation of average monthly incomes by self-employed and employee households is shown in Table A.2.16. The first column shows the average monthly income of households as reported in HES Table 1.01. For example, the average monthly income of households with income less than 750 taka per month is 557.99 taka. The shares of self-employed and employee households for this income group are 0.1880 and 0.8120 respectively (see Table 2.9). Multiplying amount 557.99 by 0.1880 and 0.8120 we get amounts 104.90 and 453.09 respectively. These are the estimated average monthly incomes by self-employed and employee households for the first income group. This procedure is repeated for other income groups to separate the average monthly income into the average monthly income by self-employed and employee households. The estimated average monthly incomes of these two household groups are then used to derive the share of average monthly income of each of the 16 income groups under self-employed and employee household groups.

Table A.2.16. Breakdown of Average Monthly Income of Per Household, 1988/89.

Income Groups	Av. Monthly Income per HH	Self-employed Amount	%	Employee Amount	%
<750	557.99	104.90	0.0019	453.09	0.0150
750-999	881.43	149.93	0.0027	731.50	0.0242
1000-1249	1127.29	276.19	0.0049	851.10	0.0282
1250-1499	1371.82	576.03	0.0103	795.79	0.0263
1500-1999	1744.03	816.03	0.0146	928.00	0.0307
2000-2499	2235.55	1243.41	0.0222	992.14	0.0328
2500-2999	2735.39	1698.68	0.0.388	1036.71	0.0496
3000-3999	3429.06	2252.55	0.0514	1176.51	0.0562
4000-4999	4448.30	2887.39	0.0659	1560.91	0.0746
5000-5999	5457.04	3735.89	0.0853	1721.70	0.0823
6000-6999	6426.03	4252.75	0.0971	2173.28	0.1039
7000-7999	7514.84	5191.25	0.0828	2323.59	0.0622
8000-8999	8506.13	6780.24	0.1082	1725.89	0.0462
9000-9999	9445.74	6994.57	0.1116	2451.17	0.0656
10000-12499	11015.77	7716.55	0.1231	3298.12	0.0882
12500+	19220.82	11221.11	0.1791	7999.72	0.2150
Total	55894.37	55897.37	1.0000	30219.22	1.0000

Source: Based on HES Table 1.01 and Table 2.9.

Table A.2.17. Distribution of Household's Expenditure on Goods and Services, (million taka)

Income	Input-Output Sectors												
Groups	1	2	3	4	5	6	7	9	10	12	13	14	Total
<750	2565	29	119	165	210	80	164	68	10	109	916	449	4957
750-999	6795	43	310	466	461	206	355	165	91	161	2090	1215	12521
1000-1249	12126	44	385	687	744	342	213	293	168	267	3489	1911	21270
1250-1499	15456	92	596	1130	914	544	1018	365	328	315	4599	2494	27861
1500-1999	37415	411	1538	3013	2187	1269	2214	983	850	847	11048	6357	68132
2000-2499	36455	557	1705	3259	2195	1520	2468	1224	831	845	12019	5748	68837
2500-2999	29192	481	1491	2803	1747	1310	1981	1233	1022	714	10452	4140	56566
3000-3999	46218	938	2245	5214	2816	2329	3088	1640	1965	1103	19422	6630	93607
4000-4999	26622	584	1542	5147	1832	1675	2397	1192	1833	665	12906	4475	60869
5000-5999	16319	454	910	2805	1106	1133	1185	734	1168	480	7820	2483	36595
6000-6999	11600	322	543	2116	976	1066	1524	776	1167	429	8225	3091	31834
7000-7999	8667	294	450	1482	614	669	720	616	875	239	5618	3163	23408
8000-8999	6321	228	293	1052	469	495	686	639	533	190	4255	2812	17974
9000-9999	4819	116	168	2195	319	454	537	1270	779	192	4008	3233	18099
10000-12499	4972	134	241	1825	483	526	679	471	963	211	5476	2895	18881
12500+	10159	552	374	8390	868	1143	911	1092	1657	433	15883	4833	46507
Total	275970	5260	12910	41750	17940	14760	20740	12770	14250	7200	128225	55930	607717
Scaling Factor	2.629	1.489	1.212	0.496	0.762	1.740	2.628	2.929	4.425	0.835	1.230	1.000	1.022

Source: Based on HES Table 1.11.

Table A.2.18. Mapping between HES Sectors and Input-Output Sectors

Sectors of the Present Study	HES Sectors
Subsistence-Agriculture	Rice, Wheat, Other Crops, Fruits, Fish, Meat, Milk
Commercial-Agriculture	Jute, Sugarcane, Raw Tobacco and Tea
Forestry	Firewood
Food and Tobacco	Bread, Biscuits, Edible oil, Sugar, Salt & Tobacco Products
Clothing	Textiles
Garments	Footwear and Wearing Apparel
Chemical	Chemical & Pharmaceuticals
Machinery	Machinery, Crockery and Kitchen Equipments
Other Industries	Furniture, TV-Radio and Other Products
Energy	Electricity, Gas and Kerosene
Services	Public Administration, Education, Housing, Personal Care and Personal Effects
Trade and Transport	Travel and Transport and Trade Services

Chapter Three

A General Equilibrium Value Added Tax Model of Bangladesh Economy

3.1. Introduction

In this chapter a model of the Bangladesh economy is developed to analyse the tax incidence of the indirect tax system in general and the value-added tax system in particular. Except for the VAT specification this model closely follows the models developed by Condon et al (1986) and J. D. Lewis (1995). The model explicitly captures the specific features of the consumption-type and destination-principle-based value-added tax system which has been adopted in Bangladesh. The methodology is quite general and can be applied to other developing economies where a similar type of VAT system is adopted. The model also shows decomposition of sectoral and household consumption expenditures into committed and supernumerary expenditure within a linear expenditure system. The equilibrium base of the model is assumed to replicate the economy of Bangladesh for 1988/89 set out in the SAM data base. The plan of the chapter is follows. Section 3.2 sets out the equations of the computable general equilibrium model. Section 3.3 describes the general equilibrium formulation of the VAT system. The parameterization of the model is discussed in section 3.4. Concluding observations are presented in section 3.5.

3.2 The model structure

3.2.1 Production and supply

The production structure used in this model is represented by a set of nested functions. Domestic output is a Cobb-Douglas function of value added and composite intermediate inputs. The production structure is presented in figure 2.1.

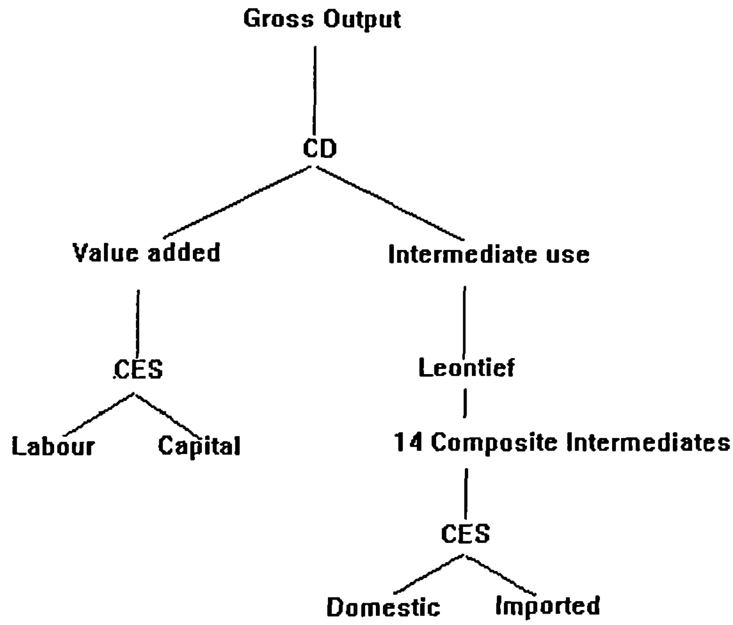

Figure 2.1: Production Structure of the Bangladesh Model

The production technology is described by the following equation:

$$X_i = AX_i \prod_i V_i^{\lambda_i} \cdot IN_i^{(1-\lambda_i)} \qquad (3.1)$$

where, X_i is sectoral output. AX_i and λ_i are the production function shift and share parameters respectively. V_i is sectoral value added and IN_i is aggregation index of intermediate inputs. The composite intermediate input demand function is derived from the first order condition of equation (3.1):

$$IN_i = V_i \cdot [\frac{PV_i \cdot (1-\lambda_i)}{PN_i \cdot \lambda_i}] \qquad (3.2)$$

where, PV_i and PN_i are the value added and composite intermediate input prices respectively.

The value added is a CES aggregate of nine factor inputs which includes capital and eight different categories of labour inputs. The value added function is therefore specified as:

$$V_i = AV_i \cdot [\sum_f \alpha_{if} \cdot FD_{if}^{-\mu_i}]^{\frac{-1}{\mu_i}} \tag{3.3}$$

where, AV_i and α_{if} are value added function shift and share parameters respectively. μ_i denotes the elasticities of substitution between factors. FD_{if} shows sectoral factors. The factor demand function is derived from the cost minimisation condition. Minimisation of (3.3) with respect to cost yields following factor demand function:

$$FD_{if} = V_i \cdot [\frac{\alpha_{if} \cdot PV_i}{AV_i^{\mu_i} \cdot W_f \cdot \varpi_{if}}]^{\frac{1}{1+\mu_i}} \tag{3.4}$$

where, W_f is the average return of factor f and ϖ_{if} is a sector-specific parameter derived from base year data which captures the fact that in a developing economy factor returns generally differ across sectors. This sector-specific parameter measures the extent to which the sectoral marginal revenue product of the factor deviates from the average return across the economy[11]. As a consequence of such factor market distortions, the economy is operating inside the production possibility frontier rather on it thereby providing scope for changes in overall production even with full employment of factors (Dervis et al, 1982).

[11] This sector-specific parameters (ϖ_{if}) depict the usual characteristic of factor markets in developing countries that factors in the same category do not earn the same return in each sector. In the bench mark data, the factor bill divided by factor employed reveals that the factor return is not equal across sectors for the same category. The difference between these factor returns is generally attributed to sector-specific features, assuming that they (i.e. sector-specific features) are a fixed fraction of the endogenous factor return in that category . Thus, the actual payment to factors in category f by sector i is $W_{if} = W_f \cdot \varpi_{if}$ where W_f endogenous factor return and ϖ_{if} is the the sector-specific parameters derived from the base year data.

3.2.2 Prices

3.2.2.1 Domestic price of imports

On the import side we retain the price-taker small-country assumption of classical trade theory. This implies that the domestic price of imports, PM_i is determined exogenously and is linked to the world price in dollars, $\overline{PWM_i}$ by:

$$PM_i = \overline{PWM_i} \cdot ER \cdot (1 + tm_i + st_i) \qquad (3.5)$$

where tm_i and st_i are the tariff and sales tax rates on sector i and ER is the nominal exchange rate between US dollars and Bangladesh currency, taka.

3.2.2.2 Domestic price of exports

On the export side, Bangladesh is assumed to have some market power. This assumption is particularly relevant for traditional exports, such as jute and jute products, where Bangladeshi exports are significant and where Bangladesh has some market power. For other sectors, Bangladesh may not have such market power. However, given such a high level of sectoral aggregation it is difficult to identify sectors with and without market power. In such a situation both the domestic price of exports and the world price of Bangladeshi exports are endogenous. The domestic price of exports is defined as a function of world price of exports PWE_i, and the nominal exchange rate, ER:

$$PE_i = PWE_i \cdot ER \qquad (3.6)$$

The world price of Bangladeshi exports are determined by the domestic production costs of exports, and by exchange rate policy. Following Dervis et al (1982) the world price of Bangladeshi exports may be estimated as $PWE_i = PE_i / ER$.

3.2.2.3 Composite price

The composite or unit price is defined by the following equation[12]:

$$P_i = \frac{PD_i \cdot D_i + PM_i \cdot M_i}{Q_i} \tag{3.7}$$

where, D_i and M_i are the domestic and imported goods respectively. PD_i is the price of domestic goods.

3.2.2.4 Sales or activity prices

The sales or activity price is composed of domestic price of domestic sales and domestic price of exports activities:

$$PX_i = \frac{PD_i \cdot (1 - td_i) \cdot D_i + PE_i \cdot E_i}{X_i} \tag{3.8}$$

where, td_i is the production or excise tax on sector i.

3.2.2.5 Composite intermediate input price

The composite intermediate input price is specified by the following equation:

$$PN_i = \sum_j \tau_{ji} \cdot P_j \tag{3.9}$$

where, τ_{ij} are the input-output coefficients.

[12] Following the approach of Devarajan et al (1995), both the composite price and sales or activity price equations (e.g. 3.7 and 3.8) specified here are the linear approximation of the dual price equations for the import aggregation (CES) and export transformation (CET) functions. Devarajan et al argued that although the dual price equations may be expressed as CES and CET forms, in practice it is often convenient to replace the dual price equations with expenditure indentities, invoking Euler's theorem for linearly homogenous functions. Considering its convenience, it has been a common practice in CGE models to use expenditure identities in place of price equations. Since this approach is well accepted in CGE models, expenditure identities are adopted here instead of actual price equations.

3.2.2.6 Value-added price

The value-added price is defined as:

$$PV_i = \frac{PX_i \cdot X_i - PN_i \cdot IN_i}{V_i} \tag{3.10}$$

3.2.2.7 Composite capital goods price

The composite capital goods price is defined as:

$$PK_i = \sum_j \kappa_{ji} \cdot P_j \tag{3.11}$$

where, κ_{ij} is a capital composition matrix.

3.2.3 Imports and exports

3.2.3.1 Imports

The specification of foreign trade and its interaction with the domestic economy constitutes the important part of the model. In the classical trade theory of international trade, a traded good is assumed to be one for which (i) the country is a price-taker (i.e. the small-country assumption) and (ii) the domestically produced good is a perfect substitute for imported goods. This specification leads to the results that the domestic price of a traded good is equal to its world price. Certain models adhere to the framework of pure trade theory assuming perfect substitutability between domestic and imported goods (e.g. Taylor and Black, 1974; and Clarete and Whalley, 1988). This assumption implies that cross-hauling is ruled out and net trading status of a country takes place, commensurately reducing the revenue figures. Secondly, imports become a residual and except for the case of complete specialisation, there are no explicit import demand functions; rather there are demand functions for imported goods. Thirdly, since domestic prices are determined completely by world prices, given the small country assumption, there is a tendency for over-specialisation, a feature pointed out as early as 1953 by Samuelson and later discussed by Travis (1972) and Melvin (1968). The over-specialisation problem arises because of the assumptions of: constant returns to scale; perfect competition; perfect substitutability; small-country; and number of factors being less than number of traded goods. In such a situation, there are more price equations in the models than unknowns (factor prices) and overdetermination clearly results. In the literature, the problem is tackled in several ways. Taylor and Black (1974) assume capital to be sector-specific, whereas Clarete and Whalley (1988) avoid this problem by bringing in a new set of sector-specific factors rather than fixing capital sectorally. Finally, when domestic and imported goods are perfect substitutes, the trade creation effects of trade policies tend to be larger than when products are imperfect substitutes.

On other hand a large part of literature adopts a specification of imperfect substitutability between domestic and imported goods (Dervis et al, 1982 and Devarajan et al, 1995). These models invoke the Armington (1969) assumption which treats goods of the same type but different countries of origin as imperfect substitutes. According to this assumption, each country produces a unique sets of goods which, to a varying degree, are substitutes for, but not identical to, goods produced in other countries. This has two advantages. First, it can accommodate cross-hauling in trade data. Second, it avoids the over-specialisation problem discussed earlier. According to Fretz, Srinivasan, and Whalley (1986) this is achieved by 'bounding the production response to trade policy changes from the demand side, since commodities subscripted by country are treated only as imperfect substitutes'. Since imported and domestic goods are only imperfect substitutes a certain percentage change in the domestic price of imports due to say a change in trade tax will lead to a smaller percentage change in the price of the domestically traded goods. Thus, dropping of perfect substitution between imports and domestic goods solves the specialisation problem noted above (de Melo, 1987).

In this model the Armington specification is adopted because the perfect substitution assumption seems unrealistic for two reasons. First, in Bangladesh there are quality differences between imports and domestic substitutes for most products. Second, at such a high level of aggregation each sector represents a bundle of different goods. For example the machinery sector includes goods which are produced in Bangladesh (i.e. machine tools) and others (i.e. heavy machinery) which are not. It is therefore reasonable to suggest that these two goods are not perfect substitutes; rather they are imperfect substitutes.

Thus for each commodity category an "aggregate" or composite commodity Q_i is defined, which is a CES function of imports M_i and domestic goods D_i. Domestic consumers are assumed to have a CES utility function over these two goods:

$$Q_i = AQ_i \cdot [\delta_i \cdot M_i^{-\rho_i} + (1-\delta_i) \cdot D_i^{-\rho_i}]^{-1/\rho_i} \qquad (3.12)$$

where, AQ_i and δ_i are shift and share parameters respectively and σ_i, elasticity of substitution is given by $\sigma_i = \frac{1}{1+\rho_i}$. This formulation implies that consumers will choose a mix of M_i and D_i depending on their relative prices. Minimising the cost of obtaining a 'unit of utility', subject to (3.12) yields the following import demand function:

$$M_i = D_i \cdot [\frac{PD_i \cdot \delta_i}{PM_i \cdot (1-\delta_i)}]^{\sigma_i} \qquad (3.13)$$

As a result of this specification, PD_i is no longer equal to PM_i and PD_i is endogenously determined in the model[13].

[13] Not only does this specification make PD_i different from PM_i but it also allows for a richer set of responses. Condon et al (1986), argued that " equation (3.13) allows for a richer set of responses, but as σ_i gets larger, the sentivity of $\frac{M_i}{D_i}$ to changes in $\frac{PD_i}{PM_i}$ rises".

3.2.3.2 Exports

As mentioned earlier Bangladesh is assumed have some market power for her exports. Thus, following Devarajan et al (1995) a downward sloping world demand curve for all exports is assumed. The export demand function can be shown as:

$$E_i = E_i^0 \cdot [\frac{PWE_i}{\overline{PWSE_i}}]^{\eta_i} \quad (3.14)$$

where, E_i^0 is a constant, η_i is the price elasticity of export demand and $\overline{PWSE_i}$ is world price of goods which are close substitutes of Bangladeshi exports.

A substantial part of the literature assumed that producers are indifferent between sales on domestic and export markets as long as they receive the same price. Thus there is no supply function for exports as such, but rather a supply function for domestic and exports as a whole, derived from production function (Drud et al, 1983 and Drud and Kendrick, 1986). In such models, domestic and export market prices are identical before tax. As a consequence, the supply of exports may exhibit strong response to changes in domestic prices. When a domestic price rises, producers are induced to increase supply and consumers to reduce their demand. The net effect is a dramatic increase in exports (i.e. the difference between supply and domestic demand). However, in reality, exports may not rise this fast, because there may be differences in the quality of goods produced for exports and for domestic consumption. A classic example of this in Bangladesh is the ready made garment sector where there are significant quality differences between garments produced for home and abroad. To capture this, following Dervis et al (1982) we postulate a constant elasticity of transformation (CET) function between domestically consumed goods D_i and exported goods E_i :

$$X_i = AT_i \cdot [\gamma_i \cdot E_i^{\phi_i} + (1-\gamma_i) \cdot D_i^{\phi_i}]^{1/\phi_i} \quad (3.15)$$

where X_i is domestic output, AT_i and γ_i are constant and the elasticity of transformation is given by $\psi_i = \frac{1}{1-\phi_i}$. Maximising revenue from given a output, subject to equation (3.15) yields the export supply function as:

$$E_i = D_i \cdot [\frac{PE_i \cdot (1-\gamma_i)}{PD_i \cdot (1-td_i) \cdot \gamma_i}]^{\psi_i} \tag{3.16}$$

The treatment of imports and exports allows two-way trade (that is simultaneous exports and imports, known as cross-hauling) at the sectoral level, again reflecting empirical realities in developing countries. Similar reasons were put forward by Condon et al (1986) to model the foreign trade regime of Cameroon based on CES and CET specifications.

3.2.4 Incomes

3.2.4.1 Household income

There are several sources of income for households in the model. The main sources of household income are income from labour and capital. These primary factors (i.e. different types of labours and capital) earn income from their contributions to value added. These factor incomes are in turn allocated to institutions who supply these primary factors. In this model, incomes from different labour categories are distributed across the six households according to an allocation matrix. However, not all the capital income accrues to households, part of the capital income goes to government and corporations according to their initial endowment of capital. Therefore, capital income is distributed to the six households, government and corporations according to an allocation matrix. This allocation matrix is derived directly from the SAM data base and provides the crucial linkage between functional (i.e. factors) and institutional distribution of income. The household income from factors is specified as:

$$YF_h = \sum_f \Phi_{hf} \cdot Y_f \tag{3.17}$$

where, YF_h, Φ_{hf} and Y_f define household income from factors, the factors to households allocation matrix, and income by factors, respectively. The following equation is used to calculate factor income:

$$Y_f = \prod_i W_f \cdot \varpi_{if} \cdot FD_{if} \tag{3.18}$$

Besides factor incomes, the households also receive remittances from abroad, dividend income from corporations, direct transfers from government and net transfer of resources from other households. The shares from all these sources are fixed in the benchmark level and thus relative shares do not change across experiments. Spendable income equation of household is specified as:

$$Y_h = [YF_h + \overline{RM_h} \cdot ER + \overline{DV_h} + \overline{GTR_h} + \overline{NHTR_h}] \cdot (1 - th_h - s_h) \tag{3.19}$$

where, $\overline{RM_h}$, $\overline{DV_h}$ and $\overline{GTR_h}$ are the shares of household income from remittances, dividends and government transfers respectively. $\overline{NHTR_h}$ is the net transfer of resources among households. This is calculated as $\overline{NHTR_h} = \overline{HTR_h} - \overline{HYP_h}$, where $\overline{HTR_h}$ and $\overline{HPY_h}$ are transfer receipts and transfer payments by the same household groups. Income tax rates and savings rates for different household groups are denoted by th_h and s_h respectively.

3.2.4.2 Government income

Government derives income from all indirect and direct taxes and part of capital income to reflect the income generated from public sector corporations. The income equation has the form:

$$\begin{aligned} YG = & \sum_h th_h \cdot Y_h + \sum_i tm_i \cdot \overline{PWM_i} \cdot M_i \cdot ER + \sum_i st_i \cdot \overline{PWM_i} \cdot M_i \cdot ER \\ & + \sum_i td_i \cdot X_i \cdot PD_i + tc \cdot YC + YFG \end{aligned} \tag{3.20}$$

where, t_c denotes the corporate tax rate. YFG shows government income from capital. This is endogenously derived as $YFG = \zeta_f \cdot Y_f$. Where, ζ_f is a scalar showing government share of income from the capital factor only.

3.2.4.3 Corporation income

Corporations generate all their income from capital only. There are no other sources of income for the corporate institutions in the model. Corporation income is represented by the following equation:

$$YC = \chi_f \cdot Y_f \tag{3.21}$$

where, χ_f is a scalar showing corporation share of income from the capital factor only.

3.2.5 Product demand

3.2.5.1 Consumption demand

Total consumption demand is composed of private and government consumption. Consumption behaviour of each household is specified in the form of a representative household (for each household group), maximising a Stone-Geary utility function subject to the budget constraint of the household:

$$U_h = \prod_i (CD_{ih} - \varphi_{ih})^{\beta_{ih}} \tag{3.22}$$

Maximisation of utility function subject to the household income constraint yields a linear expenditure system of the form:

$$CD_{ih} = \varphi_{ih} + (\beta_{ih}/P_i) \cdot (Y_h - \sum_i \varphi_{ih} \cdot P_i) \tag{3.23}$$

where, CD_{ih} is consumption of good i by household group h, φ_{ih} denotes floor or committed consumption of good i by household h and β_{ih} depicts the marginal budget share of good i by household h and $Y_h - \sum_i \varphi_{ih} \cdot P_i$ denotes the supernumerary income of each household.

3.2.5.2 Government demand

The government is assumed to keep the real level of expenditure on each commodity fixed. Hence, government demand for commodity i is:

$$\overline{GD_i} = \beta_i^g \cdot \overline{GTOT} \qquad (3.24)$$

where, $\overline{GTOT}$ is total real government expenditure which is assumed to be fixed. In the applied model β_i^g is zero for all sector except services, for which $\beta_i^g = 1$.

3.2.5.3 Intermediate demand

Since the shares among different intermediate inputs in a sector and the ratios of intermediate inputs to total outputs are fixed, one can write the demand for intermediate inputs as:

$$INT_i = \sum_j \tau_{ij} \cdot IN_j \qquad (3.25)$$

where, τ_{ij} are input-output coefficients and IN_j are sectoral intermediate inputs.

3.2.5.4 Investment demand

Total investment is always equal to savings in equilibrium. Total investment is composed of fixed capital formation only (i.e. inventory investments as stock change are not modelled due to the lack of data). Capital investment by sector of destination is given by:

$$PK_i \cdot DK_i = \xi_i \cdot I \qquad (3.26)$$

where, DK_i is capital investment by sector i, PK_i is the composite price of capital installed in sector i and ξ_i is the proportion of total capital investment accounted for by sector i. Investment by sector of destination is then translated into demand for capital goods by sector of origin (ID_i), using a capital composition matrix κ_{ij}:

$$ID_i = \sum_j \kappa_{ij} \cdot DK_j \qquad (3.27)$$

3.2.6 Savings

Total savings is the sum of household, government, corporate and foreign savings. Households save a fixed proportion of their income. The following equation specifes the savings behaviour of households:

$$SH_h = s_h \cdot Y_h \qquad (3.28)$$

Government saving is the difference between the endogenous government income and exogenous government expenditure and transfers to the household groups. Government saving is thus:

$$SG = YG - \sum_i \overline{GD_i} - \sum_h \overline{GTR_h} \qquad (3.29)$$

Corporate saving is the difference between endogenous corporate income and corporate tax and dividend payments. Corporate saving is thus:

$$SC = YC - \sum_h \overline{DV_h} - tc \cdot YC \qquad (3.30)$$

The last component of aggregate saving is the foreign saving. Foreign saving is the difference between the value of imports and the value of exports, at world prices. The dollar value of foreign savings is then converted into domestic currency value using the relevant exchange rate. The aggregate or total saving is thus:

$$S = \sum_h SH_h + SG + SC + SF \cdot ER \qquad (3.31)$$

3.2.7 Equilibrium conditions

3.2.7.1 Factor market equilibrium

Labour is generally considered a mobile factor in CGE models[14]. Almost all models also assume full employment of labour. In most models, labour supply is exogenously given and full employment is assured through the equality of labour demand and supply with average wage rates as the equilibrating variables. In certain models unemployment of labour is also assumed. In such models, unemployment of labour is assumed to allow examination of issues relating to the labour market such as the effects of elimination of a minimum wage rate (Devarajan et al, 1995b) and rural-urban labour migration effects (Clarete and Whalley, 1988). Alternatively unemployment of factors can be assumed. In this case, changes in wage rates may have some effects on labour supply and hence unemployment of certain factors. Accordingly this may have some ramifications on for households income. However, unemployment of labour is considered here as data on unemployment by factors and sectors are not available in Bangladesh.

Analogously, full employment of capital is assumed in all models. Since in most models capital is fixed sectorally, distinct capital market for each sector needs to be specified. With sector-specific capital stocks, sectoral rental rates will vary to each of these distinct capital market. In certain models (Devarajan and Rodrick, 1990 and Clarete and Whalley, 1988) where capital is mobile between sectors the full employment of capital is assured when the demand for capital equals the fixed supply of capital.

Since issues relating to labour market are not examined here and the labour market is particularly simple, full employment of factors (i.e. labour and capital) is assumed. Thus, the factor market clearing requires that total factor demands equal exogenously fixed factor supplies and the equilibrating variables are the average factor prices (W_f).

[14] One exception to this rule is the ORANI model of Australia (Dixon et al, 1982), where a sector-specific labour is considered.

$$\sum_i FD_{if} - FS_f = 0 \quad (3.32)$$

All primary factors are also assumed to be mobile across sectors. In fact, the factor mobility assumption can be viewed in the context of the time period of a model: a model may assume short or long run character according to the factor mobility assumption. In the long run, all primary factors (including capital) can be considered inter-sectorally mobile and market clearing is achieved through variation of factor prices. On the other hand, a model assumes short run character when capital stocks are fixed sectorally. The core CGE model is static, with aggregate capital stock fixed exogenously. Within the single period, the model does generate savings, investment and demand for capital goods. However, this capital goods are not installed during the period, so investment simply denotes a demand category with no effect on supply in the model. In a longer-term or dynamic model both investment and capital stocks are endogenous and affect the properties of different growth paths.

3.2.7.2 Product market equilibrium

$$Q_i = INT_i + \sum_h CD_{hi} + GD_i + ID_i \quad (3.33)$$

Equation (3.33) is the material balance equation for each sector, requiring that total composite supply (Q) is equal to the sum of composite demands. The equilibrating variables for equation (3.33) are sectoral prices. This adjusted market clearing condition implies that no separate market clearing condition is required for domestic output (X), since this involves adding exports to both sides of the equation (3.33).

3.2.7.3 Balance of payments

We impose the balance of payment (BOP) equation to clear the foreign exchange market. The inflows are exogenous but imports and exports are determined endogenously in the model. Since the nominal exchange rate is fixed in this model, foreign savings are allowed to vary to clear the foreign exchange market.

$$\sum_i \overline{PWM_i} \cdot M_i - \sum_i PWE_i \cdot E_i - \sum_h \overline{RM_h} - SF = 0 \quad (3.34)$$

In this model government expenditure is fixed, investment is also fixed exogenously revealing that the model is 'investment driven'. The neutrality of government revenue is also maintained in all experiments by adjusting the indirect tax rates, so that government savings are not altered in different equilibria. In such a situation, changes in foreign savings are used to achieve the savings and investment balance. Changes in foreign savings are not likely to affect income and expenditures of government. This specification may have some effects on household income, consumption and saving behaviour. However, as our objective is to examine income distribution effects of policy reforms, this specification appears to be a reasonable external closure[15].

Alternative foreign exchange market closures are also discussed in the literature. One alternative is to fix foreign savings exogenously and allow the nominal exchange rate to vary. In that case the equilibrating variable is the nominal exchange rate. Equilibrium will be achieved through the movement in the nominal exchange rate which affects import and export prices relative to domestic prices, i.e. by changing the relative price of tradables and nontradables (Devarajan et al, 1995).

3.2.7.4 Savings-investment balance

The final macro closure is achieved through the equality of endogenously determined aggregate savings and exogenously fixed total investment. Thus, this closure is "investment driven", in which total investment is fixed and the saving components are endogenous:

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[15] A similar foreign exchange market closure is adopted by Devarajan and de Melo (1987) in a CGE model applicable to Franc-zone African countries. In these countries, the local currency is pegged to the French Franc. It is also observed that both government expenditure and investment are fixed exogenously. Tax rates are also fixed. The balance of trade or foreign savings is treated as an endogenous variable. In such a situation any short fall in government budget and private savings are financed by foreign borrowing. If neutrality of government revenue is maintained, say by changing taxes, the effect will be to change the foreign savings to equate aggregate savings and investment. It is the macro equilibrating variable which will vary to equate savings and investment.

$$I = S = \sum_h SH_h + SG + SC + SF \cdot ER \qquad (3.35)$$

In applied general equilibrium models only relative prices are determined. Thus it is necessary to normalise the price system. We make the nominal exchange rate the numeraire against which all relative prices will be determined. One can virtually normalise around any nominal magnitude because it has no effect on real variables. On the other hand normalisation basically closes the system and generally allows one to solve the model for prices as a function of exogenous parameters and policy variables.

3.3 General equilibrium formulation of the value-added tax system

The theory of value added tax suggests three broad types of value added taxes which differ in their treatment of capital goods and depreciation of the capital stock in calculating their respective tax bases (Ferh et al, 1994 and Shoup, 1990). These are consumption, income, and gross product type VAT. For instance, under the consumption type, each firm computes its tax base by subtracting all its purchases of intermediate inputs and capital goods and depreciation of the capital stock from its total sales. The tax base for an income type VAT is calculated by deducting purchases of intermediate inputs and depreciation of the capital stock from total sales. The gross product type VAT base is computed by subtracting only the purchases of intermediate inputs from total sales. Purchases of capital goods and depreciation are not subtracted. Thus the difference between the three types of value-added tax bases is in their treatment of capital goods and depreciation of the capital stock. Under the consumption type VAT, both purchases of capital goods and depreciation are deductible. In the case of income VAT, only the depreciation of the stock is subtracted. Neither deduction of purchases of capital goods, nor even depreciation, is allowed under the gross product type VAT.

Sullivan (1965) also argued that the three concepts of national income accounts are related to the three bases suggested for the value-added tax. These three concepts of national income accounts are personal consumption expenditures; national income, proper; and gross national product. The corresponding tax bases are the consumption type, income type and gross product type respectively. To show the linkages between national income accounts and the tax bases Ferh et al (1994) consider a closed economy at an aggregate or macro level. At an aggregate level total sales minus total outlays on intermediate inputs yields the gross national product. Purchases of capital goods are equal to gross investment expenditures (net investment and depreciation). When gross investment is deducted from gross national product, one obtains aggregate consumption as the aggregate tax base. Under the income VAT, only the depreciation is subtracted from gross national product. In this case, the aggregate tax base equals aggregate net value added or national product. In the case of gross product type VAT, gross investment is not deductible from gross national product. The aggregate tax base, therefore, equals the gross national product.

With respect to international trade taxation two distinct principles are in operation (Ferh et al, 1994 and Shoup, 1990). Under the 'destination principle' exports leave a country free of any VAT, while imported commodities are subject to (import) VAT at the rate applied to comparable domestic goods. The 'destination principle' ensures that commodities are taxed in a country where they are consumed (the country of destination), regardless of the country where they are produced. Exports are zero rated under this principle. This means that no VAT is charged on export sales, and that VAT on all inputs used in the production of exports is rebated. In contrast, under the 'origin principle' there is no rebate for VAT on exports, and imports are not taxed in the importing countries. If this principle is applied, commodities are taxed in the country where there are produced, regardless of the country where they are consumed.

There are three methods by which a taxpaying firm can assess its tax liability. These are subtraction, tax credit and addition. However, the tax credit method is widely used as it is compatible with consumption type VAT system.

Almost all countries that have introduced a value-added tax system, adopted the consumption type VAT because it is much easier to compute and because all purchases, including purchases of capital goods from other firms, are deductible from a firm's sale (Shoup, 1990). However, certain countries such as Argentina, Peru and Turkey have adopted the income type VAT. On the other hand Finland, Morocco and Senegal have employed a gross product type VAT. The gross product VAT, as it does not allow deduction of both purchases of capital goods and depreciation, discriminates strongly against the use of capital goods which perhaps explains its restricted use (Shoup, 1990). It is also observed that the developed and semi-industrialised economies that adopted the VAT system, have been using the VAT system in its comprehensive form. A comprehensive VAT refers to a system that includes producers, wholesaler and retailers. Thirty-nine countries were using a comprehensive VAT in 1990 according to Shoup (1990), while some twenty countries use the value added technique that does not extend through the retail sector and it is usually restricted to manufacturing and extractive industries and imports. Most of these countries are in Africa and Asia.

The Government of Bangladesh introduced a value added tax (VAT) in 1991. Like many other developing economies, at present VAT is restricted only to domestic manufacturing activities and imports. The VAT system introduced in Bangladesh is of the consumption type and is based on the destination-principle. Thus, all imports and domestic production, excluding primary agriculture type products and most services, intended for final consumption in Bangladesh are subject to VAT. In accordance with the destination-principle, all exports are zero-rated. This means that no VAT is charged on export sales, and that VAT and other indirect taxes on all inputs used in the production of exports are rebated. The VAT is consumption type since all VAT paid on intermediate inputs and capital machinery is creditable against VAT payable on the sale of domestic output.

To incorporate the VAT system in the above model, we start with revenue specification of the VAT system and subsequently modify the income equation of government (i.e. equation 3.20). Under the VAT formulation the excise duty on domestic manufacturing activities and sales taxes on imports are replaced by the VAT, and the VAT paid on intermediate and capital goods are credited to the domestic manufacturers as offset against the VAT on domestic output. Thus, only the domestic sales are subject to the VAT and there is no VAT on intermediate and capital inputs. In a generalised framework, assuming that domestic sales (D_i) equal the sale of the i-th manufactured product and that the VAT paid on composite intermediate inputs are rebated against the VAT on domestic sales, revenue under the VAT system (VATREV) should equal:

$$VATREV = \sum_i PD_i \cdot D_i \cdot tv_i + \overline{PWM_i} \cdot M_i \cdot ER \cdot tv_i - \sum_j \tau_{ji} \cdot (P_j - PN_j) \cdot IN_j \qquad (3.36)$$

where, tv_i is the uniform value-added tax rate. The first component of the above equation denotes revenue from the domestic VAT base; the second part shows the VAT from imports and the third component captures the rebated amount of VAT paid on composite intermediate inputs. Subsequently, the government income equation is modified by incorporating the revenue from the VAT system (i.e. VATREV).

$$YG = \sum_h th_h \cdot Y_h + \sum_i tm_i \cdot \overline{PWM_i} \cdot M_i \cdot ER + \sum_i td_i \cdot X_i \cdot PD_i + tc \cdot YC + YKG + VATREV \qquad (3.20\ *)$$

The rebate or credit mechanism is specified through the composite intermediate input price equation (i.e. equation 3.9). The adjusted composite intermediate input price is defined as:

$$PN_i = \sum_j \tau_{ji} \cdot [P_j - \frac{\{(PD_j \cdot D_j + \overline{PWM_j} \cdot M_j \cdot ER) \cdot tv_j\}}{Q_j}] \quad (3.9^*)$$

The second part of the right hand side of 3.9* $[\{(PD_j \cdot D_j + \overline{PWM_j} \cdot M_j \cdot ER) \cdot tv_j\} / Q_j]$ depicts the amount of VAT paid on composite intermediate inputs which is deducted from the gross price of composite intermediate inputs.

The domestic price of imports is also modified to incorporate the value added tax payable on c.i.f. imports:

$$PM_i = \overline{PWM_i} \cdot ER \cdot (1 + tm_i + tv_i) \quad (3.5^*)$$

The other price that is directly influenced by the VAT system is the sales or activity price. Thus, the sales or activity price is adjusted to include the VAT specification:

$$PX_i = \frac{PD_i \cdot (1 - td_i - tv_i) \cdot D_i + PE_i \cdot E_i}{X_i} \quad (3.8^*)$$

Subject to the condition that when $tv_i > 0$, $td_i = 0$, and when $tv_i = 0$, $td_i > 0$, so that, the VAT and excise duty can not be applied on the same product simultaneously.

The export supply equation is also modified to take into account the influence of the value added tax;

$$E_i = D_i \cdot [\frac{PE_i \cdot (1 - \gamma_i)}{PD_i \cdot (1 - td_i - tv_i) \cdot \gamma_i}]^{\psi_i} \quad (3.16\ ^*)$$

3.4 Parameterization of the model

Once the equilibrium data as contained in the SAM and the model structure are put in place, the next step is to specify the parameters of the model. The values of all parameters in the model are estimated using the given equilibrium data set (i.e. the SAM) as point estimates in combination with a literature search for key additional parameters such as the elasticities of substitution between factors, the elasticities of substitution between imports and domestic goods, elasticities of transformation between exports and domestic goods and price elasticities of demand for exports. Since these elasticities are not based on direct econometric estimation, sensitivity analysis is usually carried out for the parameters as these are pivotal to the results. In fact, as Mansur and Whalley (1984) have pointed out, it is not even possible to define a likelihood function necessary to econometrically estimate the elasticities for a complete general equilibrium model. From the structure of the general equilibrium model, it is noted that the parameters for four different kinds of functions need to be specified. These are the: (i) production function, (ii) value added function, (iii) CES substitution function and CET transformation function and (iv) export demand function.

3.4.1 Production function parameters

The production side of the model is specified by a Cobb-Douglas production function. In order to express numerically the sectoral production and composite intermediate input demand equation, it is necessary to determine the value added shares (λ_i) in the production process. It is possible to obtain value added shares from the following equation:

$$\lambda_i = \frac{PV_i \cdot V_i}{PX_i \cdot X_i} \tag{3.36}$$

The values of V_i and X_i are given by base year SAM, assuming all prices to be unity in keeping with Harberger convention of decomposing value terms into prices and quantities, where the quantities are so defined that the prices are unity. The values of PX_i are obtained from equation (3.8). On the other hand, the composite intermediate input shares are determined residually. Once the values of λ_i and $(1-\lambda_i)$ are obtained, AX_i can be determined from the production function (3.1);

$$AX_i = \frac{X_i}{\prod_i V_i^{\lambda_i} \cdot IN_i^{(1-\lambda_i)}} \tag{3.37}$$

3.4.2 Value-added function parameters

Value added is a CES aggregate of factor inputs. In order to express numerically the sectoral factor demand equation, it is again necessary to determine the factor shares (α_{if}) given the values of the elasticity of substitution between factors. The factor shares can be obtained from the factor demand function (3.4):

$$\alpha_{if} = \frac{W_f \cdot \varpi_{if} \cdot (FD_{if})^{1+\mu_i}}{PV_i \cdot (V_i)^{1+\mu_i}} \qquad (3.38)$$

For generating the values of (α_{if}) it is necessary to specify the elasticity of substitution between factors. No studies have so far been conducted to estimate econometrically these values for Bangladesh. Devarajan et al (1995b) used a uniform substitution elasticity of 0.5 among the primary factors (and across all sectors) in generating value added in their CGE model for Bangladesh and these are assumed hare too. The shift parameter of the value added function can be calculated from the value added function (3.3):

$$AV_i = \frac{V_i}{[\sum_f \alpha_{if} \cdot FD_{if}^{-\mu_i}]^{-1/\mu_i}} \qquad (3.39)$$

3.4.3 CES and CET function parameters

CES and CET functions are characterised by an elasticity of substitution (different from one), share parameters (sum to one), and a shift parameter. The share parameter of the CES function, δ_i can be obtained from the import demand function (3.13):

$$\delta_i = (PM_i/PD_i) \cdot (M_i/D_i)^{(1/\sigma_i)} \qquad (3.40)$$

The values of M_i and D_i are available from the base year SAM. As already mentioned following the Harberger convention, the relevant prices are set equal to one in the base year. For generating the values of δ_i 's it is necessary to specify the sectoral elasticities of substitution. Again no studies have so far been conducted to estimate econometrically these values for Bangladesh. The values used here are obtained from Chowdhury for Bangladesh (1993). The substitution elasticities for subsistence and commercial agriculture sectors are assumed to be 1.8 and 1.6 respectively. For clothing, garments and other industry sectors the elasticities are 1.3. While for all other sectors the substitution elasticities are 1.2. However, these values were used to specify both the CES substitution and CET transformation elasticities. Once the share parameters are determined, only the shift parameters remain to be calibrated. The shift parameter can be calculated from the Armington function (3.12):

$$a_i^q = Q_i/[\delta_i M_i^{-\rho_i^q} + (1-\delta_i) D_i^{-\rho_i^q}]^{-1/\rho^q} \qquad (3.41)$$

The computation of share and shift parameters of the export supply (CET) function is similar.

3.4.4 Export demand elasticities

The values of the price elasticities of export demand are taken from Shilpi's (1989) study on "estimating income and price elasticities of imports and exports of Bangladesh." She estimated the income and price elasticities for major exports items of Bangladesh and the elasticities are estimated for the period 1972-73 to 1986-87. In particular, the elasticities are estimated for the major export sectors such as raw jute, tea, frozen food, jute products, leather products, ready-made garments. We used the weighted elasticity values of raw jute and tea to specify the elasticity of subsistence and commercial agricultural products. The elasticity estimate of frozen food is taken to model the elasticity of food and tobacco product. Finally the weighted elasticity values of jute products, leather products and ready-made garments are used to specify the export demand elasticity for all other exporting sectors. The export demand elasticities for subsistence and commercial agriculture sectors are -3. For food and tobacco sector it is -1.7. For other sectors the export demand elasticities are -1.5.

3.4.5 Consumption demand parameters

As indicated earlier, the household demand function is specified by a Stone-Geary Linear Expenditure System (LES). The LES is a complete set of consumer demand equations linear in total expenditures. The demand equation for each household group is given by:

$$CD_{ih} = \varphi_{ih} + (\beta_{ih}/P_i)\cdot(Y_h - \sum_i \varphi_{ih}\cdot P_i) \qquad (3.42)$$

In the LES demand functions, only two parameters are required to be estimated: (a) floor consumption levels (φ) and (b) marginal budget shares (β). The above two parameters can be estimated in a number of ways although it is appropriate to estimates these parameters econometrically by using household expenditure data (Lluch, Powell and Williams, 1977).

In Bangladesh, the 'Household Expenditure Survey' (HES) reports are published every two years by the Bangladesh Bureau Statistics. The most recent household survey is available for 1988/89 and was published in 1991. The survey reports income and expenditure patterns of the 'HES' income groups. It also provides information on income and expenditure patterns of urban and rural income groups. The information of the survey, however, is not sufficient to estimate the floor consumption levels of the household groups and marginal budget shares. For the present study, thus, these parameters are computed, using the information of average budget shares, expenditure elasticities and the Frisch parameter (Frisch 1959).

Differentiation of equation (3.42) shows that the expenditure elasticities (Engel elasticity) are given by:

$$\vartheta_{ih} = \frac{\beta_{ih} \cdot Y_h}{P_i \cdot CD_{ih}} = \frac{\beta_{ih}}{o_{ih}} \tag{3.43}$$

where, $o_{ih} = \frac{P_i \cdot CD_{ih}}{Y_h}$ is the average budget share of good i by household group h.

Since no econometric estimates for the expenditure elasticities are available in Bangladesh, the expenditure elasticities are estimated using the modified household expenditure data for 1988/89[16]. Following Deaton and Case (1987) the expenditure elasticities are estimated as:

$$\vartheta_i = 1 + b_i / Z_i \tag{3.44}$$

where, ϑ_i is total expenditure elasticity, Z_i is mean budget share and b_i is regression coefficient of per capita expenditure. The derivation of the total expenditure elasticity is discussed in Appendix A.1. The values of b_i coefficients are obtained from the following equation:

$$Z_i^h = a_i + b_i \cdot \ln PCE^h \tag{3.45}$$

where, PCE^h denotes per capita expenditure by household group h. The estimated values of b-coefficients, mean budget shares and total expenditure elasticities are shown in Appendix Table A.3.1. It is noted that the values of estimated expenditure elasticities appear to be reasonable when compared with the expenditure elasticities reported for Sri Lanka in Deaton and Case (see Appendix Table A.3.2). Again the information is not sufficient to estimate total expenditure elasticities for each of the six household groups. Thus, it is assumed that the expenditure elasticities estimated

[16] It is relevant to note that the modified household expenditure data are derived from the household expenditure data reported in the HES, 1988/89. As mentioned earlier, the sectoral classification used in the household expenditure survey data is converted into I-O sectors according to a mapping scheme shown in the SAM. This mapping scheme generates household expenditure data by the 14 I-O sectors. Although some aggregation problems may be present, the modified household expenditure data are preferred over the HES data since expenditure elasticities for the 14 sectors are derived directly from the modified data set. Alternatively, the HES data may be used to estimate the expenditure elasticities for the HES sectors. Then some kinds of adjustment are required to make these estimates conform to the 14 I-O sectors.

for the 14 sectors are same for the six household groups. Further manipulation of equation (3.43) yields the marginal budget shares as:

$$\beta_{ih} = o_{ih} \cdot \vartheta_{ih} \tag{3.46}$$

The imposition of Engel aggregation condition leads to:

$$\sum_i \beta_{ih} = \sum_i o_{ih} \cdot \vartheta_{ih} = 1 \tag{3.47}$$

The values of Frisch parameters are now needed to estimate the floor consumption levels. The Frisch parameter measures the elasticity of marginal utility of expenditure with respect to expenditure. Lluch, Powell and Williams (1977) showed an approximate relationship between Frisch parameter, $-\Theta$ and GNP per capita in 1970 U.S. dollars. The approximate relationship is depicted as $-\Theta \cong 36 \cdot PCY^{36}$. Following their approach, Frisch parameters for the six household groups ($-\Theta_h$) are computed using the per capita income (PCY_h) of the six household groups. The estimated Frisch parameters for the self-employed low, middle and high income household groups are -3.72, -2.70 and -1.75 respectively. For the employee low, middle and high income household groups the corresponding estimates are -3.86, -2.68 and -1.68 respectively. The above estimates conform with Frisch's (1959) conjecture that the expenditure elasticity of the marginal utility of expenditure is negative, and declines in absolute values with per capita income or GNP.

Given the values of Frisch parameter, average budget shares and estimated marginal budget shares, the values of floor consumption levels are computed using the following equation:

$$\varphi_{ih} = Y_h \cdot (o_{ih} + \beta_{ih}/\Theta_h \cdot P_i) \tag{3.48}$$

The estimated values of floor consumption by sectors and the six household groups are shown in Table 3.1. Total subsistence expenditure is 62 percent of total consumption expenditure. This appears to be a reasonable bench mark given that the per capita GNP of Bangladesh lies between $100-500. Lluch, Powell and Williams suggested that total subsistence expenditure would be around 62 percent of total expenditure for countries with per capita GNP between $100-500.

Table 3.1. Floor Consumption Levels by Sectors and Household Groups, (million taka)

Sectors	SLI	SMI	SHI	ELI	EMI	EHI	Total
Subsistence-Ag.	38276	54268	18942	49353	31779	6343	205504
Commercial-Ag.	431	1254	502	465	665	242	3475
Forestry	1702	3299	690	2118	1752	303	9716
Food and tobacco	2430	5670	2622	3002	2918	1325	16992
Clothing	1919	2976	665	2550	1554	294	9574
Garments	1285	3025	1031	1574	1557	473	8704
Chemical	2110	3744	956	2705	19591	404	11461
Cement	0	0	0	0	0	0	0
Machinery	883	1822	861	708	950	353	5301
Other Industries	666	2351	982	795	1270	441	6117
Construction	0	0	0	0	0	0	0
Energy	858	1533	492	1123	809	227	4939
Services	9941	12601	13581	19557	5474	3993	62631
Trade & Transport	5406	7711	4673	7088	4036	1935	29778
All Households	65907	100254	45995	91037	546705	16333	374195
% of Total Consumption	73	63	43	74	63	40	62

3.5 Conclusion

In this chapter a model of the Bangladesh economy is developed to examine the incidence of the indirect tax system in general and a value added tax system in particular. The model incorporates specific features of a consumption-type and destination-principle based value added tax system which has been adopted in Bangladesh. The model shows the revenue specification of the VAT system and subsequently modifies the income equation of the government. It also shows the credit mechanism of the VAT system. The credit mechanism is specified through the composite intermediate input price equation. Equations for the domestic price of imports, sales or activity price and export supply are also modified to take into account the influence of the value added tax. The model also shows the decomposition of sectoral and household consumption expenditures into committed and supernumerary expenditure within a linear expenditure system.

Appendix to chapter three

A.1 Derivation of a formula for total expenditure elasticity

This section discusses the derivation of a formula for total expenditure elasticity. According to Deaton (1981) the derivative of $\ln Z_i$ with respect to the logarithm of total expenditure is b_i/Z_i which, in turn, is the elasticity ϑ_i less unity. Thus, it is calculated as:

$$\vartheta_i = \frac{b_i}{Z_i} +$$

To derive the total expenditure elasticity equation (3.45) is modified by replacing per capita expenditure with total expenditure. Hence the re-specified equation takes the following form[17]:

$$Z_i = a_i + b_i \ln TE \qquad \text{(A.1)}$$

Differentiation of Z_i with respect to $\ln TE$ yields b_i. However, we are interested in deriving a formula for the expenditure elasticity. Thus, $\ln Z_i$ is differentiated with respect to $\ln TE$ to get the following:

$$\frac{\partial \ln Z_i}{\partial \ln TE} = \frac{\partial \ln Z_i}{\partial TX} \cdot \frac{\partial TX}{\partial \ln TE} = \frac{1}{Z_i} \cdot b_i = \frac{b_i}{Z_i} \qquad \text{(A.2)}$$

Deaton and Muellbauer (1980) argued that many economists see the estimation of elasticities as the primary objective of empirical demand analysis. The following equation has frequently been estimated on time series data of expenditures, outlays and prices.

[17] An important feature of this formulation is that, unlike most other empirical Engel curves, it satisfies the most obvious requirement of an allocation model that, if applied to all goods in the budget, its predicted budget shares add up to unity. From (A.1), this will happen if $\sum_i a_i = 1$ and $\sum_i b_i = 0$. Also note that for those goods with $b_i > 1$, the budget shares increases with expenditures, for those with $b_i < 1$, the share declines and when $b_i = 0$, the share is independent of expenditures. Hence, luxuries and necessities are naturally indentified by the model (Deaton and Case, 1987).

$$\log q_i = a_i + \vartheta_i \log TE + \sum_k \vartheta_{ik} \log p_k + u_i \qquad \text{(A.3)}$$

where q_i is expenditure on goods i, TE is total expenditure and p_k is the price of goods k, ϑ_i and ϑ_{ik} denote total expenditure elasticities and price elasticities respectively. Estimates of ϑ_i and ϑ_{ik} can be obtained from ordinary least square regression applied to equation (A.3). On the other hand the logarithm of budget shares (e.g. $Z_i = p_i \cdot q_i / TE$) can be specified as:

$$\log Z_i = \log q_i + \log p_i - \log TE \qquad \text{(A.4)}$$

Now substitution of equation A.3 for $\log q_i$ in equation A.4 yields

$$\log Z_i = a_i + (\vartheta_i - 1)\log TE + (\vartheta_{ii} + 1)\log p_i + \sum_{k \neq i} \vartheta_{ik} \log p_k \qquad \text{(A.5)}$$

Differentiation of $\log Z_i$ with respect to $\log TE$ yields

$$\frac{\partial \log Z_i}{\partial \log TE} = \vartheta_i - 1 \qquad \text{(A.6)}$$

It is observed that left hand sides of equations A.2 and A.6 denote expressions for elasticities. Hence by combining equations A.2 and A.6 the following formula for total expenditure elasticity can be obtained.

$$\vartheta_i = \frac{b_i}{Z_i} +$$

Where ϑ_i is the total expenditure elasticity. Deaton and Case (1987) " argued that these elasticities are not constant as Z_i and PCE vary, so that they are usually presented at the sample mean of Z_i, where predicted and actual budget shares automatically coincide. The above elasticity formula also implies that, if ϑ_i is not unity, then it falls as PCE increases. This is simply an automatic feature of Engle curves like (3.45), and it may or may not be true in reality."

Table A.3.1. Mean Budget Shares, b-Coefficients and Expenditure Elasticities, Bangladesh 1988/89

Sectors	Mean budget share (S. deviation)	b-coefficient (S. Errors)	Expenditure Elasticities
Subsistence-Agriculture	41.74	-12.73	0.70
	(12.67)	(1.64)	
Commercial-Agriculture	0.82	0.14	0.84
	(0.20)	(0.08)	
Forestry	1.90	-0.63	0.67
	(0.68)	(0.100	
Food and Tobacco	7.00	2.86	1.41
	(2.75)	(0.14)	
Clothing	2.71	0.69	1.25
	(0.68)	(0.08)	
Garments	2.77	0.88	1.04
	(0.32)	(0.16)	
Chemical	3.14	0.56	1.18
	(0.62)	(0.16)	
Machinery	1.99	0.69	1.35
	(0.69)	(0.11)	
Other Industries	2.39	0.83	1.35
	(0.85)	(0.15)	
Energy	1.10	-0.19	0.83
	(0.19)	(0.03)	
Services	21.50	5.36	1.25
	(10.48)	(4.74)	
Trade and Transport	9.17	1.54	1.17
	(1.85)	(0.72)	

Source: Household expenditure data, 1988/89.

Table A3.2. b-Coefficients and Expenditure Elasticities: Sri Lanka, 1969-70 and 1980-81

Sectors	1969-70		1980-81	
	b-coefficient	Elasticities	b-coefficient	Elasticities
Food	-16.08	0.75	-11.72	0.84
Liquor-Tobacco	0.62	1.09	0.68	1.15
Housing	3.02	1.44	2.25	1.49
Fuel	-0.67	0.82	-1.54	0.76
Clothing	5.08	1.83	1.68	1.42
Household	1.31	1.50	2.03	1.71
Health	1.02	1.39	1.24	1.47
Transport	1.22	1.50	3.78	2.18
Recreation	2.46	2.16	1.44	1.95
Communication	0	0	0.16	2.48
Durables	2.03	2.46	0.16	2.48

Source: Deaton and Case (1978)

Chapter Four

Equity Aspects of the Value-Added Tax System in Bangladesh

4.1 Introduction

The Government of Bangladesh introduced a Value Added Tax (VAT) at the import and manufacturing stage from 1991. The VAT replaced the prevailing excise tax on domestic production and sales tax on imports at the import stage. The VAT was, and still is levied at a uniform rate of 15 percent on both domestic manufactures and imports. Based on international experience and given the proposed broad-based structure, it is expected that the VAT system should improve the revenue mobilisation efforts of the Government[18]. It is generally believed that in its most conventional form, a single rate VAT with a zero rate limited only to exports would imply that the payment of tax by low income households will be a higher proportion of household expenditure or income than under the pre-VAT tax system. Thus, questions may arise whether the VAT system with single primary rate of tax and zero rates limited to exports would make the tax system regressive in Bangladesh.

The revenue and welfare effects of the VAT system in Bangladesh have already been analysed by Mansur and Khondker (1991). Thus, in this chapter we examine the regressiveness of the VAT system. In line with this objective the following important aspects are considered:

(i) whether a revenue-neutral uniform rate of VAT is more regressive than the combined effect of the excise duty and sales tax;

[18] For more on the revenue effects of the VAT system in Bangladesh please see, "Revenue Effects of the VAT system in Bangladesh" by Mansur and Khondker (1991). Mansur and Khondker concluded that the VAT system would improve revenue mobilisation in Bangladesh, provided that the system is administered properly. Limited experience with the VAT system seems to support these findings. After the introduction of the VAT in 1991, revenue rose from 10.9 percent of GDP in 1992 to 11.7 percent of GDP in 1993. During the same period the share of trade taxes in total revenue fell from 36.5 percent of toal revenue in 1992 to 33.7 percent in 1993. Lower tariff revenue was more than offset by improvements in VAT and direct tax collection. In particular, the revenue from the VAT system increased from 23.3 percent of total revenue in 1992 to 41.9 percent in 1993 (the World Bank, 1994).

(ii) what might be the overall progressivity or regressivity of the overall indirect tax system after the introduction of VAT compared with the situation prevailing prior to its introduction;

(iii) how might the overall progressivity or regressivity of the VAT system be affected by the extension of the VAT base compared to the situation observed before the extension of the VAT base.

The empirical analyses reported in this chapter are based on two approaches:

(i) in the simple approach the information on expenditure patterns by the household groups, effective tax rates and revenue data is combined to derive the incidence of the indirect tax system by household groups; and (ii) combining the first approach with the computable general equilibrium (CGE) model already elaborated in chapter three, to derive the tax incidence by household groups. Both approaches indicate that because of exemptions on subsistence agricultural products, and because of the progressive structure of the tariffs, the overall indirect tax system would continue to remain progressive even after the introduction of a single rate VAT.

The plan of the chapter is as follows. Section 4.2 provides a brief outline of the VAT system in Bangladesh and discusses how the equity issue was addressed in other countries adopting the VAT. Section 4.3 describes the methodologies used in this chapter to analyse the equity aspect of the VAT and pre-VAT system. Section 4.4 reports the findings on the tax incidence by the six household groups based on both the simple and the CGE approaches. Also in section 4.4 the findings of the CGE approach are compared with the findings based on the simpler methodology. Some concluding observations are reported in section 4.5.

4.2 The Value-added tax system in Bangladesh and international experience of incidence

4.2.1 The Value-added tax system in Bangladesh

The VAT system introduced in Bangladesh is a consumption-type system and is based on the destination-principle. Thus, all imports and domestic production, excluding unprocessed primary agriculture type products and most services, intended for final consumption in Bangladesh is subject to VAT. In accordance with the destination principle, all exports are zero-rated in the sense that no VAT is payable on exports.

It has previously been estimated (Mansur and Khondker, 1991) that a uniform value added tax rate of 15 percent would ensure neutrality of government revenue. On the basis of effective excise and sales tax bases, alternative VAT rates were used within a CGE model to calculate the 15 percent revenue-neutral value added tax rate. The VAT is thus levied at 15 percent uniform rate for all taxable sales at the import and domestic manufacturing stage. The sectors that are covered by the VAT system in Bangladesh are; food and tobacco; clothing; leather-jute-garments, chemical and pharmaceuticals; cement and fertiliser; other industries; and energy. Sectors such as commercial agriculture, services and trade and transport still remained under the excise tax system. The subsistence agriculture, forestry and construction sectors are exempted from the VAT system. Thus all sales of unprocessed agricultural activities are exempted from the VAT. In the VAT literature "exemption" means that no VAT would be payable on sales of exempt products, while VAT should be payable on taxable inputs without being able to claim any credit for the VAT paid on inputs (Shoup, 1990). Thus, under the VAT system, exemption essentially relieves the value added of exempt sellers from the VAT, but all his intermediate purchases, including capital machinery, are taxed.

The provisions for zero rating and exemptions have been determined on the basis of three important justifications:

(i) the exemptions to subsistence or primary agricultural products are designed to improve the progressivity of the VAT system;

(ii) following Musgrave's (1959) terminology[19], the exemption of most services (e.g. private educational and training institutions, clinics, water and sewerage disposal, many professional activities, etc.) may be considered as "merit" goods;

(iii) some goods and services (e.g. primary agricultural products, many forms of services rendered in an organised or unorganised manner) are administratively too difficult to tax.

Exemption of subsistence agricultural products could be justified under all three headings. Like many other countries, in the case of Bangladesh the exemptions are limited to only unprocessed agriculture type products and most services. The VAT system does not allow for successively exempting the inputs used into the production of these commodities. The brief description of the VAT system noted above reveals that in terms of its simplicity, coverage, and the rate structure, the VAT system for Bangladesh is similar to the standard type of rudimentary VAT. Thus, the international experience of other countries coping with the potential equity aspects of this type of standard VAT system should be of some interest.

4.2.2 International experience in coping with equity issue of the VAT system

International experience indicates that countries adopting the VAT reacted to the issue of regressivity in various ways. As noted earlier, the only way to remove entirely the incidence of VAT on low income household groups is to apply a zero-rate to products with a higher weight in the consumption basket of low income household groups. In practice, however, most countries (including the members states of European Union),

[19] According to him this is a category of goods where the state makes a judgement that certain goods are "good" and "bad", and attempts to encourage the former (e.g. education) and discourage the later (e.g. alcohol).

have not extensively used the zero rate facility. The United Kingdom and Ireland used a zero rate on such products as processed and basic foods and medical drugs. A review by Tait (1988) shows that Ireland and the United Kingdom adopted zero rating more than in other countries. In the United Kingdom 35 percent of consumption was zero rated, and the corresponding proportion was 36 percent for Ireland. On the other hand in countries like Belgium, Denmark, and Italy, zero rating was used very selectively. A review of the VAT system in developing countries by Tait (1988) also indicated that most of the essential goods and services were exempted in these countries but not zero rated.

In general, zero rating has been used less extensively than exemptions, even though it is the only true way to ensure that goods are provided free of tax. Experience shows that, extensive use of zero rating leads to a significant loss of revenue and enormously increases the cost of administering the system. As indicated in Tait (1991), zero rating of food can eliminate up to 40 percent of the tax base and clothing and housing may take out another 10 and 15 percent respectively from the potential taxable spending. Collecting revenues and again refunding these to traders or manufactures in zero rated goods, introduce administrative inefficiencies into the tax system.

Some countries have also resorted to other special devices to ensure greater equity among households or among manufacturers. In Turkey, an expensive structure of VAT rebates to households has been introduced to reduce the impact of the tax on lower income households and to simultaneously help enforcement of the VAT system under the scheme. The scheme requires the consumers to submit receipts showing purchases of "eligible" basic items on a monthly basis and get VAT rebate on the sale or purchase price on a progressive scale. The complex scheme seems to increase compliance, but almost half the revenue is returned through a cumbersome method. In India, in order to maintain or enhance the competitiveness of small manufactures under the value added tax (in India the VAT system is known as modified VAT or

MODVAT) system, a "notional credit" scheme was introduced, so that, the firms buying inputs from these small manufacturers would be able to take input tax credit at a rate much higher than the rate at which VAT was paid by the small manufacturers. Review of special programs under the Turkish or Indian system indicates that such structures create implicit multiple rates of VAT and add considerable stress to the administrative system.

In most countries, exemption of unprocessed agricultural products has been used as a way of softening the regressivity of the VAT system. Although such exemptions do not entirely escape the VAT, since unlike zero rating no credit is allowed for the VAT paid on their purchases, the overall tax incidence is generally very small for such products. Apart from basic foods, in many countries (both industrial and developing types) medicines, newspapers, sports, museums and financial services are exempted from the VAT mostly on the criteria of "merit good or service". Experiences also indicate that, lobbyists, special groups and politicians seek to extend exemptions to numerous other types of manufactured goods and services rendered. The pressures for exemption of new products may become overwhelming. Such exemptions not only cause direct loss of revenue, but cut the credit chain and introduce other major economic and administrative distortions into the system. International experience also indicates that, once more than one rate is allowed, many countries adopt an increasing number of VAT rates over time because of political considerations. Some of these countries are Belgium, Cote d' Ivoire, France, Italy, Taiwan and Turkey.

In many countries, the policy makers have used multiple rates to soften the regressivity of the VAT system. Generally, a higher rate is applied to non-essential products and lower rates are applied to essential basic types of goods and services. A summary of 60 countries adopting VAT, as reported in Tait (1991), reveals that about half of these countries adopted more than one positive rate of VAT. More over, about two-thirds of them have three or more positive rates of VAT. For instance, the numbers of VAT rates are as high as five in some countries such as Belgium, Colombia, France, Morocco, Sweden and Turkey. In India, the value added tax rates are product-specific, numbering more than one hundred rates. However, value added tax may be progressive even with a zero rate and a single rate. For example, with reference to the United Kingdom where a single rate for most products and a zero rate for selected products are used, Davis and Kay (1985) showed that the VAT and the overall tax structure is progressive with the average rate of tax increasing with income. However, the contribution of VAT to the overall progressivity was small compared to the income tax.

4.3 Methodology and the data

The incidence analyses reported in this chapter are based on estimates obtained from simple and general equilibrium approaches. In the simple approach, the tax incidence of the indirect tax system with and without VAT is estimated by determining how much tax is borne by each household group in relation to their consumption expenditure, assuming that other things remaining unchanged. Tax payments by household groups are determined by exploiting the household expenditure patterns of each household group and determining the average tax rates for those class of products. The general equilibrium analysis derives the benchmark solutions for incidence under the pre-VAT system by endogenously estimating the tax payments by the six household groups as a proportion of their consumption expenditures. The CGE model allows for the effects of relative price changes and the consequent secondary effects on resource allocation, production, consumption and on the tax burden of the indirect taxes. The incidence effect of the VAT at revenue-neutral alternative rates on the six household groups are determined in the CGE framework to compare with the original solution under the pre-VAT system.

4.3.1 The simple approach to derive the tax incidence of indirect tax system

The derivation of the incidence of the indirect tax was not particularly complicated as the required information is readily available from the SAM data base for 1988/89. The information needed to calculate incidence patterns of the indirect tax system are; consumption expenditure of the six household groups; the expenditure patterns of the six household groups in terms of proportion of consumption expenditure on each type of product; the average rates of excise duty on domestic taxable products, the average rates of tariff and sales tax on imported items; and finally the total amount of revenues collected from excise duty, tariffs and sales tax. The derivation involved the following steps:

(1) Household consumption expenditures are derived directly from the information provided in the SAM data base. In particular the SAM data base shows the distribution of consumption expenditure of six household groups by the fourteen I-O sectors (for detailed discussion on the derivation of household's consumption expenditure please see Table 2.14, chapter 2). Summing over the I-O sectors generates the benchmark consumption expenditure by each of the six household groups:

$$CON_h = \sum_i CON_{ih} \qquad (4.1)$$

where CON_{ih} shows the consumption expenditure by household group h on commodity i.

(2) The expenditure pattern of the six household groups in terms of proportion of consumption expenditure on each type of product (HES_{ih}) is:

$$HES_{ih} = \frac{CON_{ih}}{CON_h} \qquad (4.2)$$

(3) Revenues from the indirect tax system are calculated. Under the base scenario for each sector ($INDEX_i$) are:

$$INDEX_i = EXREV_i + TARIFF_i + ST_i \tag{4.3}$$

where $EXREV_i$, $TARIFF_i$ and ST_i are revenues from excise duty, tariffs and sales tax respectively. The corresponding revenue under the VAT scenario is:

$$INDVAT_i = EXREV_i + DOMVAT_i + TARIFF_i + IMPVAT_i \tag{4.4}$$

where $DOMVAT_i$ is the VAT on domestic manufacturers, and subject to the condition that when $DOMVAT_i > 0$, $EXREV_i = 0$, and when $EXREV_i > 0$, $DOMVAT_i = 0$, so that, the VAT and excise duty cannot be applied on the same product. $IMPVAT_i$ is the import stage VAT.

(4) The amount of indirect tax paid by each household group ($RPAID_h$) is:

$$RPAID_h = \sum_i (HES_{ih} \cdot ETR_i \cdot CON_h) \tag{4.5}$$

where HES_{ih} depicts proportion of household expenditure by household group h on products i; ETR_i is the economy wide average tax rate by sector i for each type of taxes depending upon the VAT and pre-VAT system under consideration; and where the economy wide effective tax rates are derived by using their respective economy wide tax bases. While deriving $RPAID_h$, the overall tax revenue constraints have also been imposed without disturbing the relative shares of tax paid by household groups under each scenario. This ensures total annual payments of indirect taxes by all household groups correspond to the annual collection of indirect tax revenue. This re-scaling is essential as estimated indirect tax revenues from sectoral consumption bases are different from the actual collection of indirect tax revenue from sectoral production and import bases (i.e. the actual indirect tax bases).

(5) The indirect tax revenues paid by the six household groups are then expressed as a percent of their corresponding consumption expenditure to derive the indirect tax incidence under the VAT and pre-VAT regimes:

$$INDT_h = \frac{RPAID_h}{CON_h} \cdot 100 \qquad (4.6)$$

where $INDT_h$ shows the amount of indirect taxes paid by each of the six household groups as a percentage of their consumption expenditure.

4.3.2 The computable general equilibrium approach

Incidence of indirect tax system under the pre-VAT and VAT scenarios are based on a multi-sector, multi-factor and multi-household CGE model in the CGE approach. Under the general equilibrium analysis the initial values of tax incidence of the indirect tax system with and without VAT are endogenously estimated by determining how much tax is borne by each household group in relation to their total consumption expenditure. The amount of indirect tax paid by each household group ($REVPAID_h$) is determined by the following the equation:

$$REVPAID_h = \sum_i (HES_{ih} \cdot P_i \cdot ETR_i \cdot CON_h) \qquad (4.7)$$

where HES_{ih} depicts the proportion of household expenditure by household group h on products i; ETR_i is the average tax rate by sector i for each type of taxes depending upon the VAT and pre-VAT system under consideration. P_i are consumer prices, assumed to be unity in the benchmark equilibrium; and CON_h shows the base consumption levels by household groups. Again deriving $REVPAID_h$ the overall tax revenue constraint is imposed without disturbing the relative shares of tax paid by household groups under each scenario. This ensures total annual payments of indirect taxes by all household groups correspond to the annual collection of indirect tax revenue. It is noted that, contrary to the simple approach both P_i and CON_h would now change following tax reforms. Hence in the CGE approach, total amount of tax paid by each household group would be affected by changes in P_i, CON_h and ETR_i. Finally, the incidence patterns of indirect tax system of the six household groups are computed as follows:

$$INDT_h = \frac{REVPAID_h}{CON_h} \cdot 100 \qquad (4.8)$$

The numbers indicate the respective amount of tax paid by the six household groups as a percentage of their total consumption expenditure.

4.3.3. Design of policy experiments

As noted earlier, the uniform rate of 15 percent VAT was approximately revenue neutral on the basis on effective excise and sales tax bases. The effective excise and sales tax bases which take into account numerous exemptions are smaller than the economy wide excise and sales tax bases. Conversely, the indirect tax rates estimated on the basis of economy wide bases are smaller than the effective indirect tax rates based on effective tax bases. In the SAM data base and in the CGE model the economy wide tax bases are used rather than the effective tax bases. Therefore, when the 15 percent VAT rate and the economy wide bases are used together, the revenue from the indirect tax system would be significantly higher than the revenue reported in the SAM. There are two alternative ways to mitigate this problem. One approach is to retain the economy wide tax bases and use the economy wide indirect tax rates that are significantly smaller than the effective indirect tax rates. An alternative approach is to convert the economy wide tax bases into effective tax bases and then apply the effective indirect tax rates. The first approach has been adopted to design policy experiments. Two policy experiments are now conducted to examine tax incidence of the value-added tax system in Bangladesh.

(i) According to the first approach it is estimated that a uniform rate of 7 percent value-added tax would ensure revenue neutrality. Therefore, in experiment one, excise duties on domestic production activities and sales taxes on imports are replaced by a revenue neutral uniform rate of 7 percent value-added tax.

(ii) In experiment two, the value-added tax is extended to the service sector with a revenue neutral uniform value-added tax rate of 3.5 percent. It is again estimated that, with the extension of the VAT system to service sector, a uniform rate of VAT that would keep government revenue neutral is 3.5 percent rate.

4.4 Incidence of indirect tax system under pre-VAT and VAT system

4.4.1 Incidence of indirect tax system under pre-VAT system

Estimates of indirect tax incidence before the introduction of VAT are provided in Table 4.1. It reports the incidence of excise duty, sales tax, tariffs and overall indirect tax system by the six household groups.

Table 4.1 Incidence of Indirect Tax System in Bangladesh, Base Scenario (as percent of consumption)

HH Groups	Excise Duty		Sales Tax	Tariff	Total	Total Replaced by VAT
	Retained	Replaced				
	(1a)	(1b)	(2)	(3)	(1+2+3)	(1b+2)
Self-employed	0.428	1.942	0.810	3.100	6.276	2.752
Low Income	0.385	1.589	0.616	2.553	5.143	2.205
Middle Income	0.363	2.233	0.935	3.523	7.053	3.168
High Income	0.537	2.004	0.878	3.213	6.631	2.882
Employee	0.435	2.104	0.859	3.164	6.562	2.933
Low Income	0.390	1.428	0.545	2.100	4.463	1.973
Middle Income	0.344	2.166	0.906	3.442	6.558	2.960
High Income	0.570	2.719	1.127	3.950	8.366	3.846

For the purpose of analysis the incidence of excise duty is reported under two separate headings: the incidence of excise duty collected from sectors that remained under the existing excise system and incidence of excise duty from sectors that are replaced by the value added tax. It is observed that except for the middle income self-employed households, the incidence of excise duty from replaced sectors is significantly progressive in nature. In particular, the incidence is 1.589 percent of consumption expenditure for the self-employed low income household group compared with 2.233 percent and 2.004 percent of consumption expenditure for self-employed middle income and high income household groups respectively. For households under the employee category, the pattern of excise tax incidence appears to be more progressive with tax incidence of low income households of 1.428 percent compared with 2.166 and 2.719 percent for the middle and high income household groups respectively.

In the case of sales tax, the incidence of tax as percent of household consumption steadily increases with the income level for the employee household groups. Like the excise tax system, the pattern of tax incidence appears to be more progressive for employee household groups than the self-employed household groups. Therefore, the combined incidence of replaced excise duty and sales tax is also significantly progressive in nature. Except for the self-employed middle income household, the combined incidence increases with the level of income revealing that the excise and sales tax system, notwithstanding its indirect form, is inherently progressive in terms of its incidence.

The incidence of overall indirect tax system including the effect of tariffs is also progressive, with the incidence of tariffs being 3.213 and 3.950 percent for the self-employed and employee high income household groups compared with 2.553 and 2.100 percent for the self-employed and employee low income household groups respectively. Therefore tariffs, which accounted for around 40 percent of the indirect tax revenue are progressive and much of this progressivity is attributable to variations in the rate structure and partly to exemptions, both favouring the low income household groups in terms of tax incidence. In Bangladesh tariffs apart from their conventional protective role, also served revenue and equity purposes like excise duty and sales tax, thus making it progressive.

The degree of progressivity in the indirect tax structure before the introduction of VAT is the result of tax exemption and very low effective tax rates for products which constituted the major part of the consumption basket of the low income household groups. All primary agricultural products including forestry are exempted from the indirect tax system. Although some services are taxed under the excise tax system , the effective tax rate is very low. Further more, services are exempted from the tariff and sales tax system. These measures have made the indirect tax system progressive in nature. Our observations indicate that, because of these mixed objectives followed by policy makers and because of progressive tariff structure, the overall indirect tax system is largely progressive in Bangladesh.

4.4.2 Incidence of the indirect tax system under alternative VAT scenarios: a simple approach

Table 4.2 reports the incidence of value added tax on domestic manufacturing activities and on imports, tariffs and overall indirect tax system by the six household groups under alternative VAT scenarios.

Table 4.2. Indirect Tax Incidence in Bangladesh under Alternative VAT Scenarios: Simple Approach (as percent of consumption)

HH Groups	Excise Duty (1a)	Domestic VAT (2a)	Import VAT (2b)	Total VAT 2=(2a+2b)	Tariff (3)	Total (1a+2+3)
			The VAT Scenario			
Self-employed	0.428	1.733	0.993	2.726	3.100	6.254
Low Income	0.384	1.419	0.821	2.240	2.553	5.177
Middle Income	0.364	2.055	1.123	3.178	3.523	7.066
High Income	0.535	1.724	1.036	2.760	3.213	6.507
Employee	0.435	1.840	1.003	2.844	3.164	6.440
Low Income	0.388	1.272	0.648	1.920	2.100	4.409
Middle Income	0.346	1.992	1.093	3.085	3.442	6.873
High Income	0.571	2.257	1.269	3.526	3.950	8.046
			The EVAT Scenario			
Self-employed	0.343	2.189	0.620	2.803	3.100	6.268
Low Income	0.320	1.714	0.506	2.200	2.553	5.093
Middle Income	0.309	1.819	0.662	2.481	3.523	6.372
High Income	0.399	3.036	0.691	3.727	3.213	7.338
Employee	0.353	2.210	0.622	2.832	3.164	6.349
Low Income	0.299	2.061	0.436	2.497	2.100	4.896
Middle Income	0.301	1.676	0.636	2.312	3.442	6.054
High Income	0.459	2.894	0.794	3.688	3.950	8.097

Except for the self-employed middle income households, the combined incidence of domestic and import stage VAT appears to be progressive with low income households paying less tax as proportion of their total consumption expenditure compared with high income households. For example, the combined incidence of domestic and import stage VAT are 1.23 and 1.84 times higher for the self-employed and employee high income household groups compared with the self-employed and employee low income household groups respectively. Incidence estimates of high income household groups are divided by the incidence estimates of low income household groups to derive the degree of progressivity of the tax system. The corresponding estimates under the pre-VAT scenario are 1.31 and 1.95 for the self-employed and employee household groups respectively. It is also observed that the incidence of import VAT is somewhat higher than sales tax. This is because more revenue is now collected from the import base which is different from the pre-VAT scenario. On the other hand, since less revenue is now collected from domestic base compared with pre-VAT scenario the incidence of domestic VAT is lower than the incidence of excise duty from sectors replaced by VAT.

These estimates, therefore, suggest that the VAT system is still progressive although the progessivity is lower than that observed under the excise or pre-VAT scenario due to the uniformity in the rate structure. However the effect on incidence is small since only a small part of consumption expenditure is affected by the uniformity in the rate structure. On the other hand, the factors that may have attributed to a progressive value added tax system are exemption of primary agricultural type operations and services. These activities remain outside the VAT system. Further more, the taxable products had relatively low weights for the low income households, so the effect of small variations in tax rates would have only a marginal change in tax incidence[20].

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[20] It is observed that although the excise and sales tax structure allowed for variations in tax rates, in practice, the variations are small, most products were taxed within 3 to 8 percent range on an economy wide base.

As the combined incidence of value added tax is progressive and the incidence of tariffs is unaffected, it is expected that the overall indirect tax incidence remains progressive even after the introduction of a uniform rate of value added tax. The overall incidence of the indirect tax system with VAT is still 1.26 times higher for the self-employed high income household compared with the self-employed low income household (the relevant estimate in the pre-VAT case was 1.29). On the other hand, the overall indirect tax incidence is 1.82 times higher for the employee high income household compared with the employee low income household (the relevant estimate in the pre-VAT case is 1.87), revealing that the tax incidence appears to be more progressive for employee household groups than the self-employed household groups even after the introduction of the VAT. Like the base scenario, except for the self-employed middle income households, the incidence of indirect tax is greater on the high income household groups compared to the low income household groups.

The experiment which extends the value-added tax (EVAT) to the service sector with a revenue neutral VAT rate of 3.5 percent depicts that the pattern of tax incidence of domestic VAT and import VAT would still remain progressive. However, in contrast to the previous two scenarios the combined incidence of the VAT system is higher for the self-employed household groups compared with the employee household groups. For instance, the combined incidence of the EVAT system is 1.69 times higher for the self-employed household group compared with the self-employed low income household group. The corresponding estimates for the self-employed household group under the VAT and pre-VAT scenarios are 1.23 and 1.31 respectively. On the other hand, the combined incidence of the EVAT system is 1.48 times higher for the employee household group compared with 1.84 and 1.95 observed under the VAT and pre-VAT scenarios.

A review of collection of value-added tax at domestic and import stage under alternative VAT scenarios indicates that despite the reduction of value-added tax rate from 7 percent rate to 3.5 percent, the collection of VAT at the domestic stage is much higher under the EVAT scenario compared with the VAT scenario. This is because the revenue from the service sector is large enough to compensate for the fall in the revenue from the domestic manufacturing base. On the other hand, the collection of VAT at import stage is somewhat smaller under the EVAT scenario than the VAT scenario due to the reduction in value-added tax rate. In this case, the revenue from the augmented import stage VAT base (i.e. services) is not large enough to cover the loss in revenue due to the reduction in the value-added tax rate.

Again, as the incidence effects of excise duties and tariffs are not affected and remain progressive, the progressivity in the combined incidence of VAT leads to a progressive indirect tax structure. The incidence of the indirect tax system with extension of VAT to the service sector would still be 1.44 times higher for the self-employed high income household compared with the self-employed low income household. Analogously, the overall indirect tax incidence would be 1.65 times higher for the employee high income household compared with the employee low income household. Unlike the base and the VAT scenario, tax incidence of the self-employed middle income household group is less than self-employed high income household depicting a clear progressive pattern of tax incidence for the self-employed household group.

4.4.3 General equilibrium approach and major findings

This section reports the incidence of the indirect tax system under alternative value added tax scenarios using the multi-sector and multi-household computable general equilibrium model developed in chapter 3. The CGE model allows for the effects of relative price changes and the consequent secondary effects on resource allocation, production, consumption, revenue, the tax incidence of the indirect taxes and on economic welfare. Since the tax incidence estimation under the general equilibrium approach takes into account all the secondary but important effects of allocation of resource and economic welfare, the estimates of tax incidence are expected to be different from the estimates observed under the simple approach.

Estimates of indirect tax incidence are reported in Table 4.3. It reports the incidence of indirect tax system under VAT and extended VAT scenarios.

Table 4.3. Indirect Tax Incidence in Bangladesh Under Alternative VAT Scenarios: CGE Approach (as percent of consumption)

HH Groups	Excise Duty (1a)	Domestic VAT (2a)	Import VAT (2b)	Total VAT 2=(2a+2b)	Tariff (3)	Total (1a+2+3)
			The VAT Scenario			
Self-employed	0.436	1.740	0.989	2.729	3.090	6.255
Low Income	0.389	1.416	0.815	2.231	2.539	5.159
Middle Income	0.377	2.058	1.118	3.176	3.513	7.066
High Income	0.543	1.746	1.034	2.780	3.218	6.541
Employee	0.444	1.856	1.004	2.860	3.172	6.477
Low Income	0.392	1.274	0.648	1.921	2.100	4.414
Middle Income	0.358	1.998	1.091	3.089	3.440	6.887
High Income	0.583	2.296	1.273	3.570	3.977	8.130
			The EVAT Scenario			
Self-employed	0.352	2.168	0.564	2.732	3.133	6.217
Low Income	0.326	1.675	0.458	2.133	2.562	5.021
Middle Income	0.321	1.848	0.602	2.451	3.551	6.323
High Income	0.409	2.982	0.632	3.614	3.284	7.307
Employee	0.363	2.184	0.569	2.753	3.218	6.333
Low Income	0.304	2.020	0.397	2.416	2.121	4.841
Middle Income	0.313	1.656	0.579	2.235	3.477	6.026
High Income	0.472	2.875	0.732	3.607	4.055	8.133

A comparison of the revenue-neutral VAT scenario under simple and CGE approach reveals that the combined incidence of VAT system appears to be slightly more progressive under the CGE estimates compared with the simple approach. For the self-employed household group, the degree of progressivity of combined VAT system is 1.25 compared with the degree of progressivity of 1.23 observed under the simple approach. Analogously for the employee household group, the corresponding CGE estimate is 1.86 compared with 1.84 obtained under the simple approach.

The estimates of CGE approach not only depict a higher degree of progressivity of the VAT system but also reveal a higher degree of progressivity for tariffs with the introduction of the value-added tax. For the self-employed household group, the degree of progressivity of tariffs is 1.27 under CGE approach compared with the degree of progressivity of 1.26 observed under the simple approach. Similarly, for the employee household group the corresponding CGE estimate is 1.90 compared with 1.88 obtained under the simple approach.

The estimated high degree of progressivity of tariffs (which accounts for 40 percent of indirect tax in Bangladesh), along with the progressivity of the domestic and import stage value-added tax, resulted in a more progressive structure of indirect tax system than was observed in the simple approach. For example, the estimated indirect tax incidence for the self-employed low income household is 5.159 percent compared with 6.541 percent for the self-employed high income household in the CGE estimation, implying a degree of progressivity of 1.27 compared with 1.26 under the simple approach. For the employee household group, the estimated tax incidence for the low and high income household groups are 4.414 percent and 8.130 percent respectively. This estimate implies a higher degree of progressivity of 1.84 under the CGE approach compared with 1.82 under the simple approach.

When value-added tax is extended to the service sector at a revenue-neutral 3.5 percent rate, the pattern of combined incidence of domestic and import stage VAT still remains progressive. In contrast to the previous two scenarios (i.e. pre-VAT and VAT scenarios) the combined incidence of the VAT system is, however, higher for the self-employed household groups compared to the employee household groups. For instance, the combined incidence of the EVAT system is 1.69 times higher for the self-employed household group compared with the self-employed low income household group. On the other hand, the combined incidence of the EVAT system is 1.49 times higher for the employee household group.

On the other hand, the degree of progressivity of the overall indirect tax system is 1.46 for the self-employed household group compared to the degree of progressivity of 1.68 for the employee household group thereby reversing the incidence pattern of combined EVAT system. This result again reflects the relative strength of the tariff system in dictating the incidence pattern of the overall indirect tax system.

A comparison of the revenue-neutral alternative VAT scenarios under simple and CGE approaches reveals that the patterns of indirect tax incidence are not significantly different under the two approaches. Under the VAT scenario, for the self-employed household group the degree of progressivity of the indirect tax system is 1.27 in the CGE estimation compared with 1.26 under the simple approach. For the employee household group, the estimated degree of progressivity is 1.84 under the CGE approach compared with 1.82 under the simple approach. Similarly in the case of the extended VAT scenario, for the self-employed household group the degree of progressitivity of the indirect tax system is 1.46 in the CGE estimation compared with 1.44 under the simple approach. For the employee household group, the corresponding estimates are 1.68 under the CGE approach compared with 1.65 under the simple approach.

The apparent similarity in the incidence estimates obtained in the simple and CGE approaches may be attributable to two factors.

(i) A review of the results of CGE model suggests that the overall production and consumption effects are small under the two VAT scenarios. Moreover, the redistributive effects of tax reforms also appear to be small.

(ii) Any policy reform is likely to change the sectoral as well as general price level and these changes in prices may have some effects on the distribution of consumption expenditure and tax payments of different household groups. In particular, large changes in the prices of non-taxed primary agricultural products significantly affect the consumption pattern of household groups even though they might be paying almost the same amount of tax as before, thereby influencing the degree of the progressivity or regressivity of the tax system. It is observed that in the two VAT scenarios the rise in the general price level is low. The increases in the general price levels are 0.45 and 0.85 percent in the VAT and EVAT scenarios. Analogously the rise in the prices of primary agricultural and forestry products are also small. The prices of subsistence agricultural products and forestry products increased by 0.70 and 1.50 percent respectively in the VAT scenario. While in the EVAT scenario, the respective rise in the prices of subsistence agricultural products and forestry products are 0.86 and 1.74 percent.

Therefore, changes in the distribution of consumption expenditure and tax payments across the six household groups are not significantly different from the patterns observed under the simple approach and hence the estimates of the CGE approach are not significantly different from the estimates of the simple approach.

4.4.4 Some qualifications of the results

(1) Possible consequences of the introduction of imperfectly competitive behaviour into tax theory are not yet well recognised. Since such an well established theoretical framework is not yet available, almost all tax policy analyses assume perfect competition in markets and constant returns to scale in production. Therefore, no attempt has been made in this study to include features of imperfect competition and increasing returns to scale.

(2) One surprising finding of this exercise is that there are no significant differences in the indirect tax incidence estimates observed between the simple and CGE approaches. This revelation, although surprising is also observed in other studies. In particular, Ferh et al (1994) observed similar close approximations between the first

round calculations and the general equilibrium estimations. They developed a computable general equilibrium model to evaluate the welfare and revenue effects of different VAT proposals for EU member states. They concluded that " after having finished our work we still believe in the virtues of CGE analysis, but also regard rough-and-ready first round calculations much more favourably than before. The disturbing fact is that in most cases first round calculations proved to be reasonable approximations for general equilibrium quantifications."

(3) Analogously, Mansur and Khondker (1991) used an heuristic, an input-output and a CGE approach to examine the revenue and price effects of the VAT system in Bangladesh. Although the findings of the CGE model were somewhat robust, the findings were not significantly different from those observed under the heuristic and input-output approaches.

(4) Another important observation is that the introduction of revenue-neutral uniform VAT is likely to make the overall indirect tax system less progressive than the degree of progessivity observed under the pre-VAT scenario although the impact is small. It is also observed that the combined incidence effect of the domestic and import stage VAT is expected be small under the VAT system compared with the combined incidence effect of excise and sales tax system. Similar small consequences of various fiscal reforms have been reported by Pleskovic (1989) for Egypt. To examine the incidence of various fiscal reforms on urban and rural households, Pleskovic used a CGE model based on a modified Harberger (1962) model and a Social Accounting Matrix (SAM). The model was applied to 1979 SAM data for Egypt to analyse the redistributive effects of four hypothetical policies involving indirect taxes and subsidies. Neutrality of the government budget was maintained in each case by adjusting taxes and transfers. One of the major conclusions of the paper was that the distributional effects were small when existing indirect taxes were replaced by a uniform sales tax.

(5) It is difficult to check the validity of our results due to a lack of comparable studies or evidence on the incidence pattern of the VAT system in Bangladesh. The redistributive effects of a new tax system are best captured by comprehensive expenditure surveys such as the Household Expenditure Survey (HES). The last HES was conducted in 1988/89. The next HES survey is therefore expected to provide some evidence on the redistributive effects of the value-added tax system in Bangladesh.

However, Chowdhury (1993) reported some redistributive effects of a revenue-neutral value-added tax experiment for Bangladesh on the basis of changes in the consumption expenditure of four household groups.

He used a CGE model based on 1984/85 data to evaluate the efficiency and welfare effects of various hypothetical tax reforms. One of the tax reform policies relates to the introduction of value-added tax in place of excise tax. A uniform and revenue-neutral rate of 2.8 percent value-added tax was levied on domestic production activities in place of the excise duty[21]. The results of his VAT experiments are presented in Appendix Table A.4.1 while our results of consumption and production effects are shown in Appendix Table A.4.2. He reported that both production and consumption effects were negative. Gross domestic product and total consumption declined by 2.6 percent and 0.67 percent respectively. On the other hand, in contrast to his findings, both production and consumption effects are observed to be positive in our experiments. It is noted that GDP and total consumption increased by 1.04 and 1.25 percent in the first experiment (i.e. VAT experiment), while in the second (or EVAT) experiment the corresponding changes are 0.81 and 0.62 percent.

[21] To perform the VAT experiment, he adjusted the data set instead of modelling the specific features of the VAT system. In his experiments, taxes were added to value-added, before intermediate inputs were added. He argued that " since a model can be considered as an interpretation of observed data and is based on both data and the underlying behavioural assumption, we have to adjust the data for the changing assumption of the new tax system".

A review of the performance of the economy of Bangladesh during the post-VAT years appears to support our findings of favourable production and consumption effects, despite the introduction of a uniform rate of value-added tax. GDP and consumption growth for selected fiscal years are presented in Appendix Table A.4.3. It is observed that the overall production and consumption effects are favourable in the post-VAT years (i.e. 1992 and 1993). Moreover the manufacturing sector which is directly influenced by the VAT, showed favourable growth performances during the post-VAT years.

However the results of our CGE model are significantly different from the results reported by Chowdhury and thereby tend to refute his claim that a VAT system would be detrimental to overall production and consumption in Bangladesh. Our model has also possibly produced improved estimates of the redistributive effects of the VAT system in Bangladesh. It could be conjectured that any CGE model where policy reforms are carefully and explicitly specified and designed should generate more satisfactory outcomes than the models where policy reforms are not well specified.

4.5 Conclusion

In this chapter the incidence patterns of indirect tax system have been examined when excise tax on domestic manufacturing activities and sales tax on imports are replaced by a revenue-neutral uniform rate of value-added tax. Two different approaches are employed to analyse the incidence pattern; a simple approach and a CGE approach.

With the introduction of a revenue-neutral 7 percent VAT, the overall indirect tax incidence appears to be less progressive than the pre-VAT system, although the impact is small. That is the VAT system would still remain progressive notwithstanding the use of a single rate, with zero rate applied only to exports. Similarly, the VAT system would still remain progressive when VAT is extended to the service sector.

One surprising finding of this exercise is that there are no significant differences in the indirect tax incidence estimates observed under the simple and CGE approach. It is observed that in the two experiments, the incidence calculations under the simple approach are close to the general equilibrium estimates. According to these results it appears that simple calculations are a reasonable approximation of the CGE quantifications. It is relevant to note that since all the secondary but important effects are considered in a CGE model, it tend to produce more reliable and robust estimates than the estimates generated by the simple or input-output approaches. Thus it is important to use CGE models to derive reliable and robust estimates and thereby check the validity of estimates generated by the simple or input-output approaches.

The results of our CGE model refuted some of the previous claims that a uniform rate of value-added tax would be detrimental to growth and welfare in Bangladesh. We believe the satisfactory outcomes provided by our model is due to careful and explicit modelling of specific features of the value-added tax system for Bangladesh.

Appendix to chapter four

Table A.4.1. Summary Results of Chowdhury's Value-Added Tax Experiments, (million taka)

Household Groups	Base Level of Consumption	New Level of Consumption
Household One	92101.17	90538.01
Household Two	89531.67	88188.69
Household Three	67532.42	67593.19
Household Four	47205.25	47960.53
Total	296279.51	294280.42
GDP	319122.00	310824.00

Note: Households are divided into four groups according to their income levels with household one is the poorest and household four is the richest household.

Table A.4.2. Consumption and Production Effects of VAT System in Bangladesh (million taka)

Household	Base Level of	New Level of Consumption	
Groups	Consumption	VAT Scenario	EVAT Scenario
Self-employed	356689	362521	359625
Low Income	90137	90584	90308
Middle Income	159228	161500	159820
High Income	107324	110437	109497
Employee	251029	252786	251846
Low Income	123468	124020	123603
Middle Income	87212	87904	87584
High Income	40349	40862	40656
Total	607717	615306	611467
GDP	659598	666463	664911

Table A.4.3. Gross Domestic Product and Consumption Growth for Selected Fiscal Years, (percent)

	FY91	FY92	FY93
GDP Growth Rate	3.4	4.2	4.5
Agriculture	1.6	2.2	1.9
Manufacturing	2.4	7.3	8.0
Construction & Utilities	7.0	6.8	6.7
Services	4.6	4.8	5.4
Consumption Growth Rate	1.9	2.5	3.3
Private	1.9	2.1	3.2
Public	1.6	4.8	3.7

Note: In constant FY85 prices.
Source: Statistical Year book of Bangladesh, 1991.

Chapter Five

Foreign Competition, Industrial Concentration and Profitability in Manufacturing Sectors in Bangladesh

5.1 Introduction

Empirical research on industrial organisation has provided useful insights into the relationship between industrial structure and performance both for developed and developing economies. Most studies have confirmed the hypothesised relationship between market structure and profitability by finding a significant association between profitability and industrial concentration. In recent years there is a growing consensus among economists that, along with concentration, the extent of foreign competition significantly influences the performance of domestic industries. This leads to a number of industrial organisation studies incorporating a foreign competition variable. The incorporation of foreign competition variable has been achieved in different ways. Some studies (Esposito and Esposito, 1971; Pagoulatos and Sorensen, 1976) treated the market share of imports as an additive influence on domestic profitability. In other studies (Jacquemin et al, 1980; Pugel, 1980; and Turner, 1980) the influence of import competition on profitability is conditional upon the competitive structure of domestic sellers as foreign and domestic sellers together represent the supply side of the market. Accordingly, in such studies, market shares of imports are used interactively with domestic concentration to test their joint influence on profitability. There is now ample evidence for developed countries that foreign competition variables exerted a strong impact on the domestic profitability (see Nakao Appendix Table A1). There is relatively little evidence for developing countries. So far no study has been undertaken to examine the relation between profitability and market structure variables in the manufacturing sector of Bangladesh.

The purpose of this chapter is to provide some empirical evidence on the relation between industrial structure and profitability in the manufacturing sector of Bangladesh and to assess the importance of foreign and domestic factors on industry profitability. This study incorporates some improvements over previous studies by using two alternative measures of concentration and two foreign competition variables to examine the robustness of the findings. However, this study does not consider the endogenous estimation of key explanatory variables such as concentration measures (Jacquemin et al, 1980; and Geroski, 1982) and the market share of imports (Geroski, 1982; and Marvel, 1980). Estimation of such variables requires additional variables such as minimum efficient scale, degree of diversification, industry demand elasticity, elasticity of supply of firms, average hourly earnings of skilled and unskilled workers, and a geographic dispersion index. Since such variables or close proxies for such variables are not available in Bangladesh, no attempt has been made to estimate concentration measures and market share of imports endogenously in this study.

The plan of the chapter is as follows. Section 5.2 describes the measurement and nature of industrial concentration. Statistical and econometric estimation of the relationship between profitability and measures of concentration is discussed in section 5.3. The effects of alternative foreign competition variables on domestic profitability based on regression analysis are examined in section 5.4. Concluding observations are presented in section 5.5.

5.2 The measurement and nature of industrial concentration

This section describes the unit of measurement employed to construct alternative measures of concentration. The four and five firm concentration ratios and Hirschman-Herfindahl index (HHI) estimated for 1985/86 and 1986/87 are also reported here. The choice of 1985/86 and 1986/87 is governed by the availability of relevant data. No comparable information is available for 1988/89 or any other recent year. The nature and extent of industrial concentration in the major industries in Bangladesh are also discussed.

5.2.1 Construction of concentration indexes

Both the physical units of output and employment by size of firms are used to construct the concentration indices for the year 1986/87. Since employment by size of firms is not available for 1985/86, only the physical units of output are used to construct concentration indices for that year. Similarly, the HHI indexes are constructed only by using the physical units of output by firm size as employment data are not available for 1985/86. The basic data used for the estimation of concentration measures of the different industries is the Directory of Industrial Establishments 1988. This identifies the size of firms by physical units of output and by level of employment[22]. The study covers 28 major industries of Bangladesh[23]. The sample accounted for more than eighty-five percent of output of manufacturing sector in Bangladesh for 1986/87 (see Appendix Table A.5.1 where industries are ranked in order of volume of output).

5.2.1.1 Concentration ratio

The most widely used concentration index is the concentration ratio. This is a partial index as it is based upon only a portion of the total number of firms in a given market.

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[22] The choice of above two units of measurement for construction of concentration indices is, therefore, governed by availability of data on firm size. Among different units of measurement, the appropriate unit of measurement is not immediately obvious. The most commonly used measuring units are (1) value-added, (2) value of shipment, (3) sales, (4) employment, (5) assets and (6) output. Most of these measures are potentially deficient in some respects. Koch (1974) pointed out that measurement of value-added, value of shipment, and sales are susceptible to price inflation and deflation. The employment measure can be seriously compromised by technological change, which alters the capital-to-labour ratio in production, Another potential difficulty with employment measure is the heterogeneity of labour. The asset measure, although not optimal, may be best among the available measures. However, according to Koch " the ideal measure of firm size would rely upon a physical unit of output rather than the possibly biased measurement proposed above (p 127)."

[23] The ready made garment, which is now one of the leading industries in Bangladesh, is not included in the sample since no data are available for the two representative years. In this regard it is important to note that, the ready made garment activities started during this period (mid eighties) in Bangladesh.

It is defined as the proportion of industry output (or any other unit) accounted for by the k largest firms, where k is an arbitrary number. Thus $C_k = \sum_{i=1}^{k} x_i/x = \sum_{i=1}^{k} s_i$. Whereas when k is 4, we have the four firm concentration ratio which depicts the share of industry accounted for by the largest four firms. The overwhelming reason for its popularity is pragmatism. It requires only partial information to show the extent of concentration in a given market. Davies (1989) argued that the concentration ratio is a reasonable measure since large values indicate more dominance for the leading firms. Hart and Clarke (1980) also provided a pragmatic defence and added that it is a more immediately understandable index of concentration than some of the other available measures. Nevertheless there is unease with the concentration ratio because it has little to commend it theoretically[24].

5.2.1.2 Hirschman-Herfindahl index

The Hirschman-Herfindahl index (1964) is the sum of squares of the relative sizes of the firms in the market, where the relative firm sizes are expressed as a percent of the total size of the market. That is

$$HHI = \sum_{i=1}^{n} (x_i/x)^2 = \sum_{i=1}^{n} s_i^2 = \frac{1+v^2}{N}.$$

Thus, the index depends both on market share inequality (as measured by v^2) and on number of firms, N. It takes some value between 0 and 1, with larger values indicating higher concentration. The main attraction of HHI index is that it has a background in oligopoly theory as it measures changes in market shares. Yet the index has some defects: (i) it is too sensitive to firm numbers, in the sense that entry

[24] To construct the concentration ratio, it is assumed that numbers of firm colluding in all industries are the same. In that case it is reasonable to argue that why the size of the colluding group should be the same in all industries. In fact it is quite unlikely that this type of pricing behaviour is common for all industries in the first place (Davies 1989, p 127). The main problem of this measure is that it does not describe the entire number and size distribution of firms, only a slice of it. That is it emphasises inequalities between top k firms and the rest of the industry at the expense of all else.

of relatively small firms will lead to non-trivial reductions in HHI, indicating a significant reduction in concentration which is not really justified (Hart, 1975; and Hart and Clarke, 1980)[25]; and (ii) it is arbitrary. Squaring the market shares has no inherent superiority over raising them power of 1.5, 1.8 or any other number. Each number implies a distinctive weighting among large and small market shares. To pick a single power (2.0) without serious evaluation may not be a good scientific method (Shepherd, 1986).

5.2.2 Nature and extent of industrial concentration

Table 5.1 shows the estimated four and five firm concentration ratios of the 28 major industries for the years' 1985/86 and 1986/87. Although the choice of four and five firm concentration ratios is necessarily arbitrary, their choice may be supported by their wide and perhaps accepted use in industrial organisation studies to depict and compare the extent of concentration in and between particular industries. It is notable that the extent of industrial concentration is high for both of the representative years. The average four-firm output concentration ratios are 68 and 69 percent for 1985/86 and 1986/87 respectively. The average five-firm output concentration ratios are 72 and 73 percent for 1985/86 and 1986/87 respectively. Since employment data are not available for 1985/86, employment concentration ratios are calculated only for 1986/87. The average levels of four and five firm employment concentration ratios are somewhat lower than corresponding average output concentration ratios. The four and five firm employment concentration ratios are 61 and 66 percent respectively. It therefore appears that the extent of competition is weak in most of the industries in Bangladesh.

[25] Davies (1979), however, showed that other popular indexes are even more sensitive to small-scale entry.

Table 5.1. Measures of Concentration in Major Industries in Bangladesh

Industry	Output Based				Employment Based	
	Year 1985/86		Year 1986/87		Year 1986/87	
	CR_4	CR_5	CR_4	CR_5	CR_4	CR_5
1. Jute Textiles	26.40	30.00	31.00	36.70	37.80	43.40
2. Rice Milling	58.90	62.10	58.10	62.00	36.50	43.06
3. Edible Oils	40.00	55.90	48.40	64.10	25.90	30.20
4. Bakery	45.90	49.90	41.00	45.20	41.50	44.90
5. Beverage	98.00	98.40	99.40	99.80	97.60	98.90
6. Leather Products	87.70	88.40	88.50	88.90	81.70	84.00
7. Fertiliser	95.60	98.90	90.70	99.00	74.10	88.20
8. Pharmaceuticals	35.00	38.50	49.80	53.60	21.90	24.90
9. Cement	100.0	100.0	100.0	100.0	100.0	100.0
10. Glass	65.50	78.80	78.90	81.70	69.40	77.30
11. BPCI Sheet	98.30	98.60	99.70	99.70	67.50	68.30
12. Electric Product	81.90	84.80	77.30	80.50	54.70	61.80
13. Battery	91.10	91.70	98.50	99.40	79.50	81.10
14. Machinery	57.00	60.30	49.80	52.30	34.10	36.90
15. Sewing Machine	90.60	100.0	99.50	100.0	88.20	100.0
16. Petroleum Product	100.0	100.0	100.0	100.0	100.0	100.0
17. Steel Rerolling	26.60	31.20	31.10	35.80	17.40	20.30
18. Hand loom	13.70	16.50	13.50	16.40	16.10	18.90
19. Cutlery	95.60	100.0	84.70	90.90	81.60	91.90
20. Sugar	40.40	48.36	40.00	48.80	38.20	44.90
21. Tobacco Product	73.10	75.50	57.70	60.13	77.90	86.20
22. Rubber Products	58.40	65.40	70.35	79.75	64.00	73.30
23. Tanning-Finishing	58.90	59.10	52.20	58.10	-	-
24. Textiles	52.40	60.50	52.40	59.10	-	-
25. Aluminium product	92.60	95.35	89.40	93.25	81.90	86.70
26. Light Engineering	62.90	66.80	57.20	61.85	37.61	41.30
27. Vehicle-Ship Bldg	89.90	90.20	79.00	85.18	80.68	83.45
Mean Concentration	68.37	72.37	68.58	72.55	60.85	65.81
Standard Deviation	26.15	24.38	25.26	23.92	26.53	27.22

Note: '-' Indicate non availability of employment data for those industries.

The estimated values of HHI for the 28 industries for 1985/86 and 1986/87 are also reported in Table 5.2. It is evident from Table 5.2 that the values of HHI are high in those industries where levels of four and five firm concentration ratios are also observed to be high. These industries are beverage, leather products, cement, bp and ci sheet, sewing machine, and petroleum products, etc. This result indicates that there are inequalities among the leading firms of these industries. On the other hand industries with high concentration ratios but low HHI are fertiliser, tobacco products and aluminium products. Therefore these industries are composed of relatively equal sized firms, which generated relatively lower values of HHI. It is also evident that the extent of inequalities among firms are quite low in industries such as jute textiles, rice milling, edible oils, bakery, pharmaceuticals, glass, sugar, steel rerolling and hand loom, all of which have HHI below 0.10.

Table 5.2. Hirschman-Herfindahl Indexes in Major Industries in Bangladesh

Industry	Year 1985/86	Year 1986/87
1. Jute Textiles	0.0475	0.0465
2. Rice Milling	0.0108	0.0139
3. Edible Oils	0.0398	0.0797
4. Bakery	0.0621	0.0597
5. Beverage	0.4671	0.4109
6. Leather Products	0.6745	0.3818
7. Fertiliser	0.3293	0.2510
8. Pharmaceuticals	0.0600	0.1296
9. Cement	0.5403	0.5197
10. Glass	0.0975	0.1171
11. BPCI Sheet	0.6258	0.5621
12. Electric Products	0.1924	0.1604
13. Battery	0.3725	0.2675
14. Machinery	0.1215	0.1295
15. Sewing machine	0.9087	0.9261
16. Petroleum Products	0.9257	0.9257
17. Steel Rerolling	0.0347	0.0407
18. Hand loom	0.0635	0.0200
19. Cutlery	0.3297	0.3270
20. Sugar	0.0769	0.0760
21. Tobacco Products	0.2597	0.3555
22. Rubber Products	0.2195	0.2235
23. Tanning & Finishing	0.0650	0.0533
24. Textiles	0.2564	0.2544
25. Aluminium Products	0.2959	0.3016
26. Light Engineering	0.1689	0.1414
27. Vehicle-Ship Building	0.3288	0.3379
28. Industrial chemical	0.2317	0.2788

5.3 Relationship between profitability and measures of concentration: statistical and econometric analysis

5.3.1 Measurement of profitability

There exists much controversy regarding the most appropriate measure of profitability. Among different measures of profit, two most widely accepted measures are the price-cost margins and rate of return on assets or equity. A major problem with rate of return measure of profitability arises from lack of comparable data on assets classified by suitably disaggregated industry (Clarke, 1985). This measure has been used in U.S. studies of profitability and market structure, especially before 1970s.

As an alternative measure of profitability, the price-cost margin has been used in a number of studies to test the relationship between profitability and concentration (Collins and Preston, 1968; Khalilzadeh, 1974; Amjad, 1978; Pagoulatos and Sorensen, 1976; Jacquemin, 1980; Pugel, 1980; and Turner, 1980). In most studies this is measured as value added at factor cost minus wages and salaries, depreciation and other overhead costs divided by total revenue, and hence is an approximation to the ratio of gross profits and overheads to sales[26]. The use of price-cost margin as a measure of profit rates has been criticised on the ground that it is profit rate on the firm's sales, not on firm's invested capital or asset (Benishay, 1967). While on the same ground price-cost margin has been regarded as a superior measure of profit. Weiss (1974) pointed out that 'rates of return on sales may indeed be conceptually superior to returns on equity or assets, since two firms with the same degree of monopoly power would not have the same rates of return on equity if the capital they needed per dollar of sales differed'. We, therefore, decided to use industry price-cost margin as a measure of profitability. The price-cost margins are calculated by subtracting costs from gross sales. The Census of Manufacturing Industries (CMI) data for 1985/86 and 1986/87 are used to calculate the price-cost margins as:

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26 "Alternatively, it can be viewed not as an index of profitability at all but rather as an approximation to an index of market power. Following Lerner (1934), we may argue that an appropriate index of monopoly power of a firm is $(p_i - c_i)/p_i$ where p_i is its price and c_i its marginal cost. Taking a weighted average of such Lerner indices, with revenue weights, we have $PCM = \sum_{i=1}^{n}(p_i - c_i)x_i / \sum_{i=1}^{n} p_i x_i$ (1) where x_i is output and PCM is the industry price-cost margin. The measured price-cost margin is only an approximation to (1) except in the case where average costs are constant and hence equal to the marginal costs, c_i. If this approximation can be taken to be reasonably accurate, however, then the price-cost margin offers a reasonable direct measure of monopoly power (Clarke 1985, 106)".

$$PCM_i = \frac{(Q_i - EC_i - IC_i - NIC_i)}{Q_i} \qquad (5.1)$$

where, Q_i is the value of output excluding indirect taxes. EC_i denotes employment cost which includes wage and salaries. IC_i refers to intermediate cost. This is composed of the cost of raw material and fuel and electricity. NIC_i depicts non-industrial cost which consists of depreciation, rent, interest, advertisement and other overhead costs. These classifications of costs are obtained directly from the Census of Manufacturing Industries of Bangladesh[27].

The data set used for statistical and econometric analysis for the representative years and averages of the two years are shown in Appendix Table A.5.2, A.5.3 and A.5.4 respectively.

5.3.2 Correlation analysis of price-cost margins and measures of concentration

This section reports the relationship between industry price-cost margins and alternative measures of concentration with the aid of simple and rank correlation methods[28]. Table 5.3 presents the results of simple correlation between price-cost margins and four-firm concentration ratio and HHI. It is observed from Table 5.3 that simple correlation between profitability and four-firm concentration are quite high and are significant at better than one percent levels in all the three representative years. When HHI is used as a measure of concentration, the simple correlation coefficients fell from high levels to moderate levels. As a consequence the level significance of

[27] The price-cost margins exclude fixed costs such as the cost of capital machinery and buildings etc. By excluding fixed costs this measure responds to the criticism that differences across industries of this measure could be due to variations in capital-output ratio alone (Benishay, 1967 and Ornstein, 1975).

[28] The pioneering work on profits and concentration was done by Bain (1951). In his sample of 42 US industries, the simple linear correlation coefficient between profitability and concentration were r= 0.33, which is significant at less than 5 per cent level. Since there are some arguments that price-cost margins may not generate the precise measure of profit, it may be preferable to use rank correlation coefficient to examine the relationship between profitability and concentration.

correlation coefficients reduced from 1 percent level or better to 13 percent level or better.

Table 5.3. Results of Correlation Between Price-Cost Margin and Measures of Concentration

a. Simple Correlation between Price-Cost Margin and Four-Firm Concentration Ratio		
1985/86	1986/87	Av: 1985/86 & 1986/87
0.5728	0.5767	0.6073
P=0.001	P=0.001	P=0.001
b. Simple Correlation between Price-Cost Margin and Hirschman-Herfindahl Index		
1985/86	1986/87	Av: 1985/86 & 1986/87
0.4292	0.3092	0.3934
P=0.011	P=0.061	P=0.013

Note: P refers to probability values associated with correlation coefficients.
The significance of the coefficients is tested using a one-tailed test.

The results of the rank correlations between price-cost margins and alternative measures of concentration are provided in Table 5.4. The rank correlations between profitability and four-firm concentration are quite high and are similar to the levels observed in the simple correlation case. The rank correlation coefficients are significant at better than one percent levels in all the three cases. On the other hand, the rank correlation between price-cost margins and HHI are higher than the simple correlation between price-cost margins and HHI. As a result the significance level of the rank correlation coefficients increased to 7 percent level in this case from 13 percent level in simple case.

Table 5.4. Results of Rank Correlation Between Price-Cost Margin and Measures of Concentration

a. Rank Correlation between Price-Cost Margin and Four-Firm concentration Ratio

1985/86	1986/87	Av: 1985/86 & 1986/87
0.5678	0.5497	0.5880
P=0.001	P=0.001	P=0.001

b. Rank Correlation between Price-Cost Margin and Hirschman-Herfindahl Index

1985/86	1986/87	Av: 1985/86 & 1986/87
0.5794	0.4570	0.5077
P=0.001	P=0.007	P=0.001

Note: P refers to probability values associated with correlation coefficients. The significance of the coefficients is tested using a one-tailed test.

5.3.3 Econometric estimation of profitability and market structure variable

The estimation procedure used to analyse the relationship between profitability and market structure variable is the ordinary least square method (OLS)[29]. The relationships between price-cost margins and concentration measures are tested both in linear and log-linear form. The models also incorporate a capital-output ratio variable to examine the extent to which the absolute capital requirements, captured by high capital-output ratio, would constitute entry barriers and further strengthen the relationship between price-cost margin and concentration. The capital-output ratio is calculated by dividing the book value of fixed assets by the value of production. The information on values of fixed assets and the values of production are obtained from the CMI reports for each of the respective years.

29 The results obtained from the ordinary least square methods are efficient as there is no significant contemporaneous correlation between the independent variables. It is noted that with cross-section data the constancy of variance of the error term may be violated leading to the problem of heteoscedasticity. In such a situation, the estimates will be inefficient but unbiased. Thus Whites test was carried out to check whether there are problems of heteroscedasticity in the data. The results of this test suggest no evidence of heteroscedasticity. Moreover the examination of the pattern of outliers also suggests non-existence of heteroscedasticity.

Following two equations are used to test the relationship between price-cost margins and concentration ratio.

$$(\text{PCM})_i = c + a_1(CR_4)_i + a_2(K/O)_i + u \qquad (5.2)$$

$$\text{Log}\,(\text{PCM})_i = c + a_1 \log(CR_4)_i + a_2 \log(K/O)_i + u \qquad (5.3)$$

Where $(\text{PCM})_i$ = Estimated price-cost margin in the ith industry.
$(CR_4)_i$ = Four-firm concentration ratio in ith industry.
$(K/O)_i$ = Capital-output ratio of the ith industry.
u = Error-term.

5.3.3.1 Results of regression analysis

The results of the regression analysis of linear form are given in Table 5.5 for the individual years as well as for the average of the two years. An examination of the Table 5.5 indicates that the explanatory variables (i.e. concentration ratio and capital-output ratio) display the expected signs. However, the estimated coefficients are significant only for the concentration ratio. In particular, the regression coefficient of the concentration ratio is significant at less than the 1 percent level for the three representative years.

The regression coefficient of the capital-output ratio is not significant for any of the two years or for the average of the two years. It, therefore, appears that the capital intensity of the industry, as reflected in the capital-output ratio, is not significantly related to the price-cost margin. The low correlation between capital-output ratio and concentration (simple correlation coefficient, r, is between 0.25 to 0.35 for different years) obviates the need to regress price-cost margin with capital-output ratio alone.

The results of the regression analysis of log-linear form are also presented in Table 5.5 for the individual years as well as for the average of the two years. Again, the estimated coefficients are significant (at less than the 1 percent level) only for the concentration variable with the expected positive sign for all the representative years. It is also observed that the regression coefficient of the capital-output ratio is not significant for any of the two years or for the average of the two years. Thus the use of the log-linear form does not significantly alter the results or enhance the explanatory power of the model.

Table 5.5. Results of Regressions with Price-Cost Margin as Dependent Variable in 28 Industries, Linear and Log-linear form

Dependent Variable	Concentration Ratio (CR_4)	Capital-Output Ratio (K/O)	Concentration Ratio Log (CR_4)	Capital-Output Ratio Log (K/O)	Constant Term	R^2	$\overline{R}^2$
			Year 1985/86				
2. PCM	0.207[a] (3.012)	1.989 (0.829)	–	–	3.792	0.346	0.294
3. Log PCM	–	–	0.700[a] (3.493)	0.050 (0.434)	0.042	0.376	0.327
			Year 1986/87				
2. PCM	0.203[a] (3.247)	1.397 (0.763)	–	–	4.494	0.348	0.296
3. Log PCM	–	–	0.677[a] (3.563)	0.065 (0.677)	0.081	0.367	0.316
			Average: 2 Years				
2. PCM	0.213[a] (3.370)	1.494 (0.751)	–	–	3.398	0.383	0.333
3. Log PCM	–	–	0.691[a] (4.070)	0.043 (0.464)	0.025	0.437	0.392

Notes: Figures in parentheses are t-ratios. The significance of the coefficients is tested using a one-tailed test.
a: significant at the 1 per cent level.

The relationship between price-cost margins and concentration using an alternative measure of concentration namely as HHI is also tested. The motivation for this is to check the robustness of the outcome observed with four-firm concentration ratio as the measure of concentration. The results of the regression analysis with HHI as a measure of concentration depict that the signs of the regression coefficients of the explanatory variables are positive in all cases, conforming to theoretical expectations. There is, however, a difference in the significance level of the regression coefficients of concentration variable in this model compared to the equation 5.2. In particular, the significance levels of the regression coefficient of the concentration variable when measured by the HHI index reduced from 1 percent level to 10 percent level or better. It is also observed that when HHI is used as a measure of concentration the regression coefficient of the capital-output ratio is significant at 10 percent level or better for the 1985/86 and for the average of the two years.

The use of log-linear framework greatly enhances the significance levels of the HHI variable to 1 percent or better from 10 percent or better levels observed in linear case. This result of log-linear framework also indicates that the capita-output ratio is significant at 10 percent level or better for the average of the two years only. Regression analysis between price-cost margins and Hirschman-Herfindahl index is elaborated in Appendix A.1.

The results of these models support the theoretical and empirical observations that price-cost margins are significantly related to concentration levels in Bangladesh, whichever of the two concentration measures is selected. The results also reveal that capital intensity of the industry as reflected in the capital-output ratio is not significantly related to the price-cost margin, even when different measures of concentration are used. Amjad (1978) and Sharwani (1976) also found significant association between profitability and concentration for large scale manufacturing sectors in Pakistan. Their studies, however, were confined only to the manufacturing sectors of the western province and did not include the manufacturing sectors of the eastern province which is now known as Bangladesh.

5.4 Import penetration: impact of foreign competition on price-cost margins

In this section, the impacts of foreign and domestic factors on domestic profitability are examined in an integrated framework. Two measures of import penetration or foreign competition are used to estimate the relationship between domestic profitability and foreign competition. These two measures are the shares of imports in total domestic supply and the effective rates of tariff.

5.4.1 Import shares

While it is conventional to characterise firms in highly concentrated industries as those having significant market power, this inference can be altered in the context of industries facing substantial degrees of actual import competition. High levels of imports may reduce the ability of domestic firms to maintain prices above the long-run average cost of production. Furthermore, modern oligopoly theory reveals that potential (import) competition through the threat of entry, foreign entry, may also compel domestic firms to set prices close to the competitive levels (Pagoulatos and Sorensen, 1976). Esposito and Esposito (1971) pointed out that foreign producers may often more easily overcome entry impediments faced by the domestic and foreign entrants and, thereby, may exert the strongest influence upon the pricing decision of the domestic firms. It is thus expected that, ceteris paribus, profits margins are lower in industries where actual and potential import competition is higher.

In line with many other empirical models, as a quantitative measure of actual import competition the current shares of imports (M/DS) in total domestic supply (DS) is included in the model. The total domestic supply consists of output plus net imports. The data for imports and exports are obtained from the Bangladesh Trade Statistics. The corresponding output values are obtained from the Census of Manufacturing Industries for the respective years. Both of these reports are published annually by the Bangladesh Bureau of Statistics. The sectoral classification used in these two reports are also same.

The conjecture is that the higher the import shares the greater is the degree of actual import competition, so it is expected that this variable (i.e. import shares) should exert negative influence on profit margins.

5.4.2 Effective rates of tariff

The use of import shares to proxy import penetration although a widely accepted variable, may not be the most desirable variable. In effect, the model should be using levels of competing imports by sectors as opposed to total import shares by sectors. However, due to the paucity of published data on levels of competing imports, most researchers have assumed that sectoral competing imports and sectoral total imports are the same and hence they used import shares to capture the extent of foreign competition. This approach may, however, be inappropriate in models for developing countries where large parts of imports are financed by project aid. The goods that are imported under projects are usually exempt from tariff and other payments and are not allowed to be traded in the domestic market along with domestic products and commercial imports. Therefore, imports financed by project aid can be classified as non-competitive imports. In Bangladesh, on average 40 to 45 percent of imports are financed by project aid (The World Bank, 1993). In particular the shares of imports financed by project aid were 39 and 48 percent in 1985/86 and 1986/87 respectively.

On the other hand it appears that some parts of the commercial imports are non-competitive as well. For example, in the case of the petroleum sector almost all the imports are crude petroleum products which are used in the domestic refineries to produce refined petroleum products. Crude and refined petroleum products are different commodities and hence, they are complementary rather than competitive products. However, unlike the petroleum sector, differences between non-competitive and competitive imports are not readily apparent for other sectors. Therefore, it is not possible to generate sectoral estimates of competitive imports without resorting to value judgement.

One accepted alternative is to use effective tariff rates to portray the strength or extent of foreign competition (Bloch 1974, and Hitiris 1978). Tariff rates, which directly affect the prices of imported goods in the domestic market, have significant influence on the behaviour of domestic firms. In effect, high rates of tariffs restrict the flow of imports by raising the market prices of imported goods and thereby allow the domestic counterpart to reap above normal profits in the domestic market. High levels of tariffs coupled with low levels of imports may induce the domestic firms to maintain prices above the long-run average cost of production. It is thus expected that, ceteris paribus, profit margins are higher in industries where effective tariff rates are high.

Theoretical support for this can be drawn from Nakao (1986) who used a generalised model of collusive oligopoly under threat of foreign competition to examine the relation between the profitability of domestic firms, shares of imports, and international trade barriers. He argued that the barriers to international trade are associated positively with the total profits of the domestic oligopolists and negatively with the shares of imports; the reduction in the international trade barriers decreases the total profits of collusive oligopoly in the domestic market, and increases the shares of imports. Therefore, in addition to import shares, effective rates of tariff can be used as an alternative variable to capture the strength of foreign competition. The data on effective tariff rates are obtained from the National Board of Revenue (NBR). The National Board of Revenue uses the same sectoral classification as the Bangladesh Trade Statistics. Therefore the sector classification of the NBR and CMI are also same.

The following two equations are used to test the relationship between price-cost margins and the degree of foreign competition:

$$(\mathrm{PCM})_i = \mathrm{c} + a_1(CR_4)_i + a_2(K/O)_i - a_3(M)_i + \mathrm{u} \qquad (5.4)$$

$$(\mathrm{PCM})_i = \mathrm{c} + a_1(CR_4)_i + a_2(K/O)_i + a_3(TR)_i + \mathrm{u} \qquad (5.5)$$

Where $(PCM)_i$ = Estimated price-cost margin in the ith industry.
$(CR_4)_i$ = Four-firm concentration ratio in ith industry.
$(K/O)_i$ = Capital-output ratio of the ith industry.
$(M)_i$ = Import penetration i.e. imports as a percentage of total domestic supply. The total domestic supply is estimated as DS= Output+ Imports -Exports.
$(TR)_i$ = Effective rates of tariff in the ith industry.
u = Error-term.

5.4.3 Results of regression analysis

The results of the regression analysis with foreign competition variables such as import shares and effective rates of tariff are presented in Table 5.6 below. In all cases the coefficients for the import shares have negative signs, and they are statistically significant at less than 5 percent level. The results of the regression analysis with effective rates of tariff capturing the extent of import penetration indicate that the coefficients of the tariff variables have the expected signs, and are statistically significant at less than 1 percent level except for the year 1986/87. The tariff coefficient is significant at less than 2.5 percent for the year 1986/87. This result suggests that the regression coefficients of tariff rates are more statistically significant than the of import shares coefficient. The coefficients of the concentration ratio variable are significant at 1 per cent level or better in both models. The regression coefficients of the capital-output ratio are not significant in any of the three cases when import share is used as a proxy for import competition. However, the capital-output ratio turns out to be significant at 10 percent level in the model with effective tariff rates. It is also observed that values of both the R^2, $\overline{R}^2$ are higher in these models (i.e. model 5.4 and 5.5) compared to the previous models. Thus more of the variation of price-cost margins is explained by models 5.4 and 5.5.

These results not only indicate that the import competition plays a major role in affecting profitability in domestic industries, but also supports the observations that price-cost margins are higher in those industries where concentration levels are high and import shares are low or effective tariff rates are high (Nakao, 1980).

Table 5.6. Results of Regression Analysis: Impact of Imports and Tariff Rates on Industry Profits

Dependent Variable	Concentration Ratio (CR_4)	Capital-Output Ratio (K/O)	Import Share (M)	Tariff Rates (TR)	Constant Term	R^2	$\bar{R}^2$
				Year 1985/86			
4. PCM	0.209[a] (3.176)	2.354 (1.021)	-0.101[c] (1.812)	–	7.224	0.425	0.355
5. PCM	0.184[a] (2.899)	3.878[d] (1.678)	–	0.072[a] (2.492)	0.025	0.481	0.416
				Year 1986/87			
4. PCM	0.204[a] (3.440)	2.137 (1.204)	-0.097[c] (1.961)	–	7.550	0.438	0.368
5. PCM	0.199[a] (3.478)	2.745[d] (1.555)	–	0.074[b] (2.416)	0.215	0.475	0.410
				Average: 2 Years			
4. PCM	0.215[a] (3.615)	1.973 (1.043)	-0.099[c] (2.012)	–	7.163	0.472	0.406
5. PCM	0.198[a] (3.453)	2.996[d] (1.585)	–	0.071[a] (2.568)	0.151	0.516	0.455

Notes: Figures in parentheses are t-ratios. The significance of the coefficients is tested using a one-tail test.
a: significant at the 1 per cent level.
b: significant at the 2.5 per cent level.
c: significant at the 5 per cent level.
d: significant at the 10 per cent level.

The influence of foreign competition on price-cost margins with an alternative measure of concentration such as HHI is also examined. In all the three cases the coefficients of the import share variable have the expected negative signs, and they are statistically significant at 10 percent level or better. The results of the regression analysis with effective rates of tariff depict that the tariff coefficients have the expected signs, and are statistically significant at less 2.5 percent level except for the year 1986/87. the tariff coefficient is significant at less 5 percent level for the year 1986/87. This result thereby supports previous findings that the regression coefficients of tariff rates are more statistically significant than import shares coefficients. Regression analysis between price-cost margins, import competition and Hirschman-Herfindahl index is elaborated in Appendix A.2.

Furthermore, the effect of foreign competition on domestic profitability is also examined by using dummy variables for competing imports. It is assumed that the dummy variable for competing imports of the ith industry (i.e. $MD_i = 0$) is zero where import shares are less than 20 percent of domestic supply, and in all other cases it is one (i.e. $MD_i = 1$). It is observed that when we use dummy variables for competing imports, divided the industries into two different categories-those where imports are less than 20 percent and those with more- the results are almost similar to the model where import share was used as a measure of import competition. These results are elaborated in Appendix A.3.

These results, thus, support the earlier findings that the import competition exerts strong influence on the profitability of domestic industries. It is also observed that price-cost margins are higher in those industries where concentration levels are high and import shares are low or effective tariff rates are high.

5.5 Conclusion

In this chapter the impact of market structure variables on profitability in the 28 major manufacturing sectors in Bangladesh for the years' 1985/86 and 1986/87 has been examined. The sample covered over eighty-five percent of the manufacturing sector. The main results are: (i) On the basis of high levels of concentration it appears that the extent of competition is weak in most of the industries in Bangladesh. (ii) The simple correlation between profitability and four-firm concentration ratios are high but when HHI is used as a measure of concentration, the simple correlation coefficients fell from high levels to moderate levels. (iii) The rank correlation coefficients between profitability and four-firm concentration ratios are also high and are similar to the levels observed in the case of the simple correlations measure. However, the rank correlation between price-cost margins and HHI are higher than the simple correlation between price-cost margins and HHI and are significant at much higher level of significance. (iv) When price-cost margins are used as an indicator of profitability, concentration is an important factor explaining differences in profitability among different industries. This result is robust even when alternative measures of concentration are used. (v) In most of the cases it is observed that profitability is not significantly related to the capital-output ratio. (vi) The foreign competition variables play a major role in affecting profitability in domestic industries. The result also supports the observation that price-cost margins are higher in those industries where concentration levels are high and import shares are low or effective tariff rates are high.

In this study, no attempt has also been made to examine the extent of concentration in other sectors such as agriculture and services since relevant information is not available in Bangladesh. The general perception, however, is that the extent of concentration in those sectors is significantly lower then the extent of concentration observed for the manufacturing sector. For instance, the financial services (i.e. banks and insurance) sector has a four-firm concentration ratio of 48 percent in 1986/87 which is substantially lower than the average four-firm concentration ratio observed for the manufacturing sector.

Finally, it is important to note that these findings may be viewed with caution since no adjustment has been made to capture informal activities. Although it would be desirable to include informal activities in a model of an underdeveloped country like Bangladesh, lack of data prevented us from making any adjustment. No information is available regarding the extent of informal sector activities in Bangladesh. However, in line with the findings of comparable developing countries, it is believed that the extent of overall informal sector activities could be around 15 percent of GDP. On the other hand, it is also believed that informal activities are more concentrated in sectors other than the manufacturing sector of the economy.

Appendix to chapter five

Table A.5.1. Industry Output as a percentage of total Manufacturing Output

Industry	Industry Output as a % of Total Industry Output	Cumulative Percentage
Jute Textiles	16.15	
Textiles	10.33	26.48
Petroleum Products	9.49	35.97
Tobacco Products	7.77	43.74
Leather Products	4.98	48.72
Fertiliser	4.78	53.50
Rice Milling	4.61	58.11
Pharmaceuticals	4.25	62.36
Sugar	3.50	65.86
Edible Oils	3.40	69.26
Tanning & Finishing	2.28	71.54
BPCI Sheet	2.23	73.77
Hand loom	2.14	75.91
Steel Rerolling	1.69	77.60
Light Engineering	1.12	78.72
Aluminium Products	0.86	79.58
Vehicle & Ship Building	0.86	80.44
Industrial chemical	0.83	81.27
Battery	0.81	82.08
Cement	0.71	82.79
Machinery	0.70	83.49
Bakery	0.42	83.91
Electric Products	0.42	84.33
Beverage	0.37	84.70
Glass	0.32	85.02
Rubber Products	0.22	85.24
Cutlery	0.02	85.26
Sewing Machine	0.01	85.27

Table A.5.2. Data Set for Statistical and Regression Analysis, 1985/86

Industry	Price-Cost Margin (PCM)	Concen-tratio ratio (CR4)	Capital-Output ratio (K/O)	Hirschman-Herfindahl Index (HHI)	Import Share (M)	Tariff Rates (TR)
1. Jute Textiles	6.40	26.40	1.20	0.4750	0.00	0.00
2. Rice Milling	5.40	58.90	0.29	0.0108	65.25	2.50
3. Edible Oils	6.40	40.00	0.17	0.0398	88.99	45.77
4. Bakery	11.30	45.90	0.25	0.0621	3.89	150.00
5. Beverage	47.60	98.00	0.57	0.4671	14.30	192.40
6. Leather Products	23.30	87.70	0.19	0.6746	0.65	125.00
7. Fertiliser	27.70	95.60	3.18	0.3293	29.14	0.00
8. Pharmaceuticals	20.40	35.00	0.27	0.0600	22.13	16.93
9. Cement	42.70	100.00	2.68	0.5403	62.40	16.73
10. Glass	24.30	65.50	0.91	0.0975	29.95	60.47
11. BPCI Sheet	23.50	98.30	0.49	0.6258	20.18	50.50
12. Electric Products	25.60	81.90	0.54	0.1924	40.66	14.59
13. Battery	21.20	91.10	0.17	0.3725	11.38	40.93
14. Machinery	23.60	57.00	0.54	0.1215	69.63	33.08
15. Sewing machine	19.70	90.60	0.20	0.9087	28.12	70.10
16. Petroleum Products	18.70	100.00	0.67	0.9257	63.56	6.10
17. Steel Rerolling	4.50	26.60	0.20	0.0347	87.21	20.00
18. Hand loom	10.40	13.70	0.19	0.0635	0.00	0.00
19. Cutlery	18.00	95.60	0.28	0.3297	54.30	83.70
20. Sugar	10.00	40.40	0.30	0.0769	27.04	49.20
21. Tobacco Products	29.80	73.18	0.27	0.2597	0.51	198.10
22. Rubber Products	29.00	58.40	0.31	0.2195	52.25	69.95
23. Tanning & Finishing	22.60	58.90	0.12	0.0650	0.00	0.00
24. Textiles	17.40	52.40	0.51	0.2564	37.83	67.52
25. Aluminium Products	12.80	92.60	0.38	0.2959	51.33	38.50
26. Light Engineering	11.80	62.90	0.28	0.1689	86.14	10.00
27. Vehicle & Ship Building	14.00	89.90	1.63	0.3288	73.77	53.79
28. Industrial Chemical	11.90	80.90	1.38	0.2317	33.88	51.38

Table A.5.3. Data Set for Statistical and Regression Analysis, 1986/87

Industry	Price-Cost Margin (PCM)	Concen-tratio ratio (CR4)	Capital-Output ratio (K/O)	Hirschman-Herfindahl Index (HHI)	Import Share (M)	Tariff Rates (TR)
1. Jute Textiles	9.70	31.00	1.29	0.0465	0.00	0.00
2. Rice Milling	12.50	58.10	0.48	0.0139	89.13	2.50
3. Edible Oils	8.60	48.40	0.17	0.0797	61.69	33.39
4. Bakery	21.90	41.00	0.31	0.0597	1.90	150.00
5. Beverage	36.40	99.40	0.47	0.4109	19.15	139.36
6. Leather Products	30.80	88.50	0.17	0.3818	0.56	75.00
7. Fertiliser	19.90	90.70	3.27	0.2510	23.09	0.00
8. Pharmaceuticals	17.00	49.80	0.27	0.1296	24.29	10.56
9. Cement	41.00	100.00	3.28	0.5197	64.00	20.48
10. Glass	34.00	78.90	0.72	0.1171	25.54	56.10
11. BPCI Sheet	11.60	99.70	0.34	0.5621	37.18	35.00
12. Electric Products	25.60	77.30	0.54	0.1604	45.45	43.45
13. Battery	25.40	98.50	0.13	0.2675	7.00	41.93
14. Machinery	18.90	49.80	1.33	0.1215	67.87	26.53
15. Sewing machine	13.30	99.50	0.16	0.9261	25.11	62.50
16. Petroleum Products	25.30	100.00	0.65	0.9257	57.97	8.63
17. Steel Rerolling	10.60	31.10	0.26	0.0407	88.00	22.40
18. Hand loom	7.50	13.50	0.19	0.0200	0.00	0.00
19. Cutlery	20.30	84.70	0.33	0.3270	32.84	59.30
20. Sugar	5.00	40.00	0.40	0.0760	24.05	60.32
21. Tobacco Products	24.70	57.70	0.17	0.3555	1.064	200.00
22. Rubber Products	31.30	70.35	0.35	0.2235	24.54	43.61
23. Tanning & Finishing	18.20	52.20	0.17	0.0533	0.00	0.00
24. Textiles	17.30	52.40	0.49	0.2544	51.54	43.38
25. Aluminium Products	16.10	89.40	0.22	0.3016	64.49	40.75
26. Light Engineering	5.40	57.20	0.33	0.1414	85.00	5.00
27. Vehicle & Ship Building	14.40	79.00	2.14	0.3379	88.76	36.82
28. Industrial chemical	22.12	82.00	1.47	0.2788	36.45	32.24

Table A.5.4. Data Set for Statistical and Regression Analysis, Average of Two Years

Industry	Price-Cost Margin (PCM)	Concen-tratio ratio (CR4)	Capital-Output ratio (K/O)	*Hirschman*-Herfindahl Index (HHI)	Import Share (M)	Tariff Rates (TR)
1. Jute Textiles	8.10	28.70	1.25	0.0470	0.00	0.00
2. Rice Milling	9.00	58.50	0.39	0.0124	77.19	2.50
3. Edible Oils	7.50	44.40	0.17	0.0598	75.34	39.58
4. Bakery	16.60	43.40	0.28	0.0609	2.90	150.00
5. Beverage	42.00	98.70	0.63	0.4390	16.73	165.80
6. Leather Products	27.10	88.10	0.18	0.5282	0.60	99.50
7. Fertiliser	23.80	39.20	3.23	.02902	26.12	0.00
8. Pharmaceuticals	18.70	42.40	0.27	0.0948	23.21	13.75
9. Cement	42.20	100.00	2.98	0.0530	63.20	18.61
10. Glass	29.20	72.20	0.72	0.1073	27.75	58.29
11. BPCI Sheet	17.60	99.00	0.42	0.5940	28.68	42.50
12. Electric Products	28.10	79.60	0.55	0.1764	43.06	42.52
13. Battery	23.30	94.80	0.15	0.3200	9.19	41.43
14. Machinery	21.20	53.40	0.44	0.1255	68.75	29.81
15. Sewing machine	16.50	90.60	0.81	0.9175	26.62	66.30
16. Petroleum Products	22.00	100.00	0.66	0.9257	60.77	7.37
17. Steel Rerolling	7.60	28.90	0.23	0.0377	87.61	21.20
18. Hand loom	8.90	13.60	0.19	0.0418	0.00	0.00
19. Cutlery	19.20	90.20	0.31	0.3284	43.57	71.50
20. Sugar	7.50	40.60	0.35	0.0765	25.55	54.76
21. Tobacco Products	27.30	65.40	0.22	0.3076	1.07	199.10
22. Rubber Products	30.20	64.40	0.33	0.2215	38.40	56.78
23. Tanning & Finishing	20.40	55.55	0.15	0.0592	0.00	0.00
24. Textiles	17.40	52.40	0.50	0.2554	44.69	55.45
25. Aluminium Products	14.50	91.00	0.30	0.2988	57.91	39.75
26. Light Engineering	8.60	60.10	0.31	0.1552	58.57	7.50
27. Vehicle & Ship Building	14.20	84.50	1.89	0.3334	81.27	45.31
28. Industrial chemical	17.00	81.80	1.43	0.2553	35.16	41.81

A.1 Regression analysis between profitability and Hirschman-Herfindahl index

The relationship between price-cost margins and Hirschman-Herfindahl index as an alternative measure of concentration is also tested. The modified models with HHI take the following forms.

$$(PCM)_i = c + a_1(HHI)_i + a_2(K/O)_i + u \quad (A.5.2)$$

$$\text{Log } (PCM)_i = c + a_1 \log(HHI)_i + a_2 \log(K/O)_i + u \quad (A.5.3)$$

Where $(PCM)_i$ = Estimated price-cost margin in the ith industry.
$(HHI)_i$ = Hirschman-Herfindhal Index of the ith industry.
$(K/O)_i$ = Capital-output ratio of the ith industry.
u = Error-term.

The results of the regression analysis of linear form are shown in Table A.5.5 for the individual years as well as for the average of the two years. The signs of the regression coefficients of the explanatory variables are positive in all cases, conforming the theoretical expectations. The significance levels of the regression coefficient of the concentration level when measured by HHI index reduced from 1 percent level to 10 percent level or better compared with models where concentration ratio is used as a measure of concentration. The regression coefficient of the capital-output ratio is not significant for any of the two years or for the average of the two years when concentration ratio is used as a measure of concentration. However, when HHI is used as a measure of concentration the regression coefficient of the capital-output ratio is significant at 10 percent level or better for the 1985/86 and for the average of the two years. Table A.5.5 also reports the results of the regression analysis of log-linear form. The use of log-linear framework greatly enhances the significance levels of HHI variable to 1 percent or better from 10 percent or better levels observed in linear case. This result of log-linear framework also depicts that the capita-output ratio is significant at 10 percent level or better for the average of the two years only.

Table A.5.5. Ordinary Least Square Regression Equations Explaining Price-Cost Margin in 28 Industries, Linear and Log-linear form

Dependent Variable	Herfindahl Index (HHI)	Capital-Output Ratio (K/O)	Herfindahl Index Log (HHI)	Capital-Output Ratio Log (K/O)	Constant Term	R^2	$\overline{R}^2$
			Year 1985/86				
A.2. PCM	15.778[b] (2.226)	3.769[d] (1.559)	-	-	12.441	0.257	0.197
A.3. Log PCM	-	-	0.362[a] (4.519)	0.051 (0.492)	3.486	0.498	0.448
			Year 1986/87				
A.2. PCM	11.281[d] (1.540)	2.616 (1.292)	-	-	14.602	0.153	0.086
A.3. Log PCM	-	-	0.238[a] (2.655)	0.089 (0.852)	3.332	0.255	0.195
			Average: 2 Years				
A.2. PCM	9.554[d] (1.329)	3.975[c] (1.822)	-	-	14.404	0.161	0.094
A.3. Log PCM	-	-	0.232[a] (2.836)	0.139[d] (1.380)	3.391	0.292	0.237

Notes: Figures in parentheses are t-ratios. The significance of the coefficients is tested using a one-tail test.
a: significant at the 1 per cent level.
b: significant at the 2.5 per cent level.
c: significant at the 5 per cent level.
d: significant at the 10 per cent level.

A.2 Regression analysis between profitability, import competition and HHI

The influence of foreign competition on price-cost margins with Hirschman-Herfindahl index is also examined. Inclusion of HHI in place of four-firm concentration ratio modifies the models in the following forms.

$$(PCM)_i = c + a_1(HHI)_i + a_2(K/O)_i - a_3(M)_i + u \quad (A.5.4)$$

$$(PCM)_i = c + a_1(HHI)_i + a_2(K/O)_i + a_3(TR)_i + u \quad (A.5.5)$$

Where $(PCM)_i$ = Estimated price-cost margin in the ith industry.
$(HHI)_i$ = Herfindhal Index of the ith industry.
$(K/O)_i$ = Capital-output ratio of the ith industry.
$(M)_i$ = Import penetration i.e. imports as a percentage of total domestic supply. The total domestic supply is estimated as DS=Output+ Imports -Exports
$(TR)_i$ = Effective rates of tariff in the ith industry.

u = Error-term.

The results of the regression analysis with the modified models are presented in Table A.5.6. In all cases the coefficients of the import share variable have the expected negative signs, and they are statistically significant at 10 percent level or better. The results of the regression analysis with effective rates of tariff depict that tariff coefficients also have the expected signs, and are statistically significant at less 2.5 percent level except for the year 1986/87. Tariff coefficient is significant at less 5 percent for the year 1986/87. The coefficients of the HHI are significant but at lower levels of significance of 10 percent or better in both the models. Contrary to our previous findings, the capital-output ratios turn out to be significant in all cases. The results thus suggest that capital intensity may influence price-cost margin when an alternative measure of concentration is adopted. The levels of significance are relatively stronger in models where HHI is combined with the effective rates of tariff.

Table A5.6. Results of Regression Analysis: Impact of Foreign Competition Variables on Profitability

Dependent Variable	Herfindahl Index (HHI)	Capital-Output Ratio (K/O)	Import Share (M)	Tariff Rates (TR)	Constant Term	R^2	$\overline{R}^2$
				Year 1985/86			
A.4. PCM	15.053^b (2.165)	4.148^c (1.744)	-0.089^d (1.457)	-	15.736	0.317	0.232
A.5. PCM	13.328^c (2.028)	5.550^b (2.379)	-	0.075^b (2.412)	7.581	0.402	0.327
				Year 1986/87			
A.4. PCM	11.358^d (1.606)	3.355^d (1.679)	-0.097^d (1.679)	-	17.671	0.242	0.147
A.5. PCM	9.824^d (1.409)	3.395^c (1.938)	-	0.072^c (1.972)	10.580	0.271	0.180
				Average: 2 Years			
A.4. PCM	8.820^d (1.552)	4.424^b (2.060)	-0.090^d (1.513)	-	17.677	0.235	0.139
A.5. PCM	7.797^d (1.671)	5.384^a (2.560)	-	0.076^b (2.311)	9.843	0.314	0.228

Notes: Figures in parentheses are t-ratios. The significance of the coefficients is tested using a one-tail test.
a: significant at the 1 per cent level.
b: significant at the 2.5 per cent level.
c: significant at the 5 per cent level.
d: significant at the 10 per cent level.

A.5.3 Regression analysis with dummy variable for competing imports

In this section the results of the effects of import competition is examined using a dummy variable for competing imports. Inclusion of dummy variable for competing imports modifies the model in the following forms:

$$(PCM)_i = c + a_1(CR_4)_i + a_2(K/O)_i - a_3(MD)_i + u \qquad (A.5.6)$$

Where $(PCM)_i$ = Estimated price-cost margin in the ith industry.
$(CR_4)_i$ = Four-firm concentration ratio in ith industry.
$(K/O)_i$ = Capital-output ratio of the ith industry.
$(MD)_i$ = Dummy variable for competing imports i.e. $MD_i = 0$ when imports are less than 20percent of domestic supply and otherwise $MD_i = 1$.
u = Error-term.

The results of the regression analysis are presented in Table A.5.7. It is observed that when we use dummy variable for competing imports the results are not significantly different from the results observed in model where import shares are used as a measure of foreign competition. The sign of import variable is negative in all cases as the model predicts and is statistically significant in all the three cases.

Table A.5.7. Regression Results: Impact of Dummy Variable for Imports on Industry Profits

Dependent Variable	Concentration Ratio (CR_4)	Capital-Output Ratio (K/O)	Dummy for Imports (MD)	Constant Term	R^2	$\bar{R}^2$
			Year 1985/86			
A.6. PCM	0.217[a] (3.268)	2.792 (1.186)	-6.310[c] (1.737)	7.102	0.419	0.347
			Year 1986/87			
A.6. PCM	0.223[a] (3.769)	2.236 (1.275)	-7.038[c] (2.161)	7.562	0.454	0.385
			Average: 2 Years			
A.6. PCM	0.227[a] (3.774)	2.176 (1.138)	-6.330[c] (1.987)	7.030	0.470	0.404

Notes: Figures in parentheses are t-ratios. The significance of the coefficients is tested using a one-tail test.
a: significant at the 1 per cent level.
b: significant at the 2.5 per cent level.
c: significant at the 5 per cent level.

Chapter Six

A Computable General Equilibrium Model for the Bangladesh Economy: Competitive and Non-competitive Variants

6.1 Introduction

In this chapter, an alternative model of the Bangladesh economy is developed to analyse the effects of tariff reforms on resource allocation and income distribution under both competitive and non-competitive assumptions. The model explicitly incorporates features of imperfect competition and increasing returns to scale. A review of the literature reveals that imperfectly competitive behaviour and increasing returns to scale has been modelled in different ways. In one approach (e.g. Cox and Harris, 1985) the industry rationalisation effects of trade reforms are discussed. In this type of model the firm's perceived demand elasticity is treated as constant in the short run. Other market structure variables such as the number of firms, marginal cost (or unit variable cost) and profits are determined endogenously. Increasing returns to scale are assumed to stem from the fixed cost part of the total cost. Fixed cost is usually calculated using available econometric estimates of the minimum efficient scale of production and cost saving achievable. The latter parameter depicts the decline in cost that would result if a firm were to expand its output from the actual level to the efficient scale of production. Additional gains from trade reforms appear to come from industry rationalisation effects, that is the exit of inefficient firms, and a reduction in unrealised scale economies. In other types of model (e.g. Devarajan and Rodrik, 1991) the pro-competitive effects of trade reforms are explained. In this type of model all the market structure variables, including the firm's perceived demand elasticity, are endogenous. The market structure variables that characterise imperfect competition are marginal costs, the number of domestic firms, the excess profit condition and the market demand elasticity for domestic goods. Increasing returns to scale are also assumed to stem from the fixed cost part of the total cost.

The fixed cost is composed of labour and capital costs in the same proportion as in total value added. However, the calibration of increasing returns to scale is achieved in an ad hoc fashion due to lack of relevant estimates (i.e. minimum efficient scale etc.).

Here a Devarajan and Rodrik-type model is developed to examine the effects of tariff liberalisation in Bangladesh. The reasons for pursuing the Devarajan and Rodrik approach are that: (i) the model can accommodate both the pro-competitive effect and industry rationalisation effect; (ii) the model allows for calculations of welfare and resource allocation effects under imperfect competition with and without scale economies; (iii) it also shows an alternative way to calibrate increasing returns to scale when relevant estimates such as minimum efficient scale and the level of fixed costs etc. which would be required to specify increasing returns to scale in line with Cox and Harris, are not available.

The present model incorporates market structure variables to characterise imperfect competition. These are marginal costs, the number of firms in each industry, the excess profit condition and the market demand elasticity for the domestic goods. In calibrating these variables we have tried to remain close to actual and observed data such as: profit rates; differential rental rates for capital etc. The income distribution effects which are generally ignored in most imperfect competition models, are also captured here. The original equilibrium of the model is expected to replicate the economy of Bangladesh for 1988/89 set out in the SAM data base. The chapter is set out in the following way. In section 6.2 a competitive variant of the model is presented. Section 6.3 incorporates the market structure variables to capture non-competitive behaviour. In section 6.4, calibration with increasing returns to scale is discussed. Concluding observations are presented in section 6.5.

6.2 A computable general equilibrium model for Bangladesh economy: the competitive case

This section presents the equations of a CGE model assuming perfect competition and constant returns to scale. In each sector, the output is produced by capital, labour and intermediate inputs which are used in fixed proportions to output. The primary factors capital and different types of labours make up the sectoral value added. In this version of the model, the factor market is separated into a market for capital and a market for labour. Accordingly, separate labour and capital market clearing conditions are specified in the model. The labour market clearing condition requires equality between labour demand and fixed labour supply with wage rates as the equilibrating variable. Similarly the capital market clearing condition requires equality of capital demand and supply. In this case the equilibrating variable is the rental rates. Apart from the specification of production structure and separation of factor market, the specification of this model is similar to that specified in chapter 3. The equations, variables and parameters of this model are presented in Table 6.1. The presentation is brief because the model specification is similar to that already discussed and elaborated in chapter three.

Table 6.1 Equations of the CGE Model: Competitive Variant

Prices

6.1 $PM_i = \overline{PWM_i} \cdot ER \cdot (1 + tm_i + st_i)$

6.2 $PE_i = PWE_i \cdot ER$

6.3 $P_i = \dfrac{PD_i \cdot D_i + PM_i \cdot M_i}{Q_i}$

6.4 $PV_i = PD_i - \sum_j \tau_{ji} \cdot P_j - td_i$

6.5 $PK_i = \sum_j K_{ji} \cdot P_j$

6.6 $PX_i = \dfrac{PD_i \cdot D_i + PE_i \cdot E_i}{X_i}$

Production and Supply

6.7 $X_i = A_i \prod_l LD_{il}^{\alpha_{il}} \cdot K_i^{\alpha_{ki}}$

6.8 $W_l \cdot \varpi_{il} = PV_i \cdot \alpha_{il} \dfrac{\partial X_i}{\partial LD_{il}}$

6.9 $INT_{ij} = \tau_{ji} \cdot X_j$

6.10 $R_i = PV_i \cdot \alpha_{ki} \cdot \dfrac{\partial X_i}{\partial K_i}$

Exports and Imports

6.11 $X_i = AT_i \cdot [\gamma_i \cdot E_i^{\phi i} + (1 - \gamma_i) \cdot D_i^{\phi i}]^{1/\phi i}$

6.12 $E_i = D_i \cdot [\dfrac{PE_i \cdot (1 - \gamma_i)}{PD_i \cdot \gamma_i}]^{\psi i}$

6.13 $E_i = E_i^0 \cdot [\dfrac{PWE_i}{\overline{PWSE_i}}]^{\eta_i}$

6.14 $Q_i = AQ_i \cdot [\delta_i \cdot M_i^{-\rho_i} + (1 - \delta_i) \cdot D_i^{-\rho_i}]^{-1/\rho_i}$

6.15 $M_i = D_i \cdot [\dfrac{PD_i \cdot \delta_i}{PM_i \cdot (1 - \delta_i)}]^{\sigma_i}$

Incomes

6.16 $Y_l = \prod_i W_l \cdot \varpi_{il} \cdot LD_{il}$

6.17 $YL_h = \sum_l \Phi_{hl} \cdot Y_l$

6.18 $Y_h = [YL_h + YK_h + \overline{RM_h} \cdot ER + \overline{DV_h} + \overline{GTR_h} + \overline{NHTR_h}] \cdot (1 - th_h - s_h)$

6.19 $YKG = \zeta_k \cdot Y_k$.

6.20 $Y_k = \sum_i R_i \cdot K_i$

6.21 $YK_h = \Phi_{hk} \cdot Y_k$

6.22 $YG = \sum_h th_h \cdot Y_h + \sum_i td_i \cdot X_i \cdot PX_i + tc \cdot YC + \sum_i tm_i \cdot \overline{PWM_i} \cdot M_i \cdot ER + \sum_i st_i \cdot \overline{PWM_i} \cdot M_i \cdot ER + YKG$

6.23 $YC = \chi_k \cdot Y_k$

Final Demand

6.24 $CD_{ih} = \varphi_{ih} + (\beta_{ih}/P_i) \cdot (Y_h - \sum_{i=1}^{14} \varphi_{ih} \cdot P_i)$

6.25 $INT_i = \sum_j INT_{ij}$

6.26 $PK_i \cdot DK_i = \xi_i \cdot I$

6.27 $\overline{GD_i} = \beta_i^g \cdot \overline{GTOT}$

6.28 $ID_i = \sum_j \kappa_{ij} \cdot DK_j$

Savings

6.29 $SH_h = s_h \cdot Y_h$

6.30 $SC = YC - \sum_h \overline{DV_h} - t_c \cdot YC$

6.31 $SG = YG - \sum_i \overline{GD_i} - \sum_h \overline{GTR_h}$

6.32 $S = \sum_h SH_h + SG + SC + SF \cdot \overline{ER}$

Equilibrium Conditions

6.33 $\sum_i LD_{il} = LS_l$

6.34 $Q_i = INT_i + \sum_h CD_{ih} + GD_i + ID_i$

6.35 $\sum_i K_i = KS$

6.36 $\sum_i \overline{PWM_i} \cdot M_i = \sum_i PWE_i \cdot E_i + \sum_h \overline{RM_h} + SF$

6.37 $I = S = \sum_h SH_h + SG + SC + FS \cdot \overline{ER}$

Table 6.1 Variables and Parameters of the CGE Model

Variables			
CD_{hi}	Household demand for good i	R_i	Returns to capital in sector i
D_i	Domestic sales of domestic output	$\overline{RM_h}$	Remittances
DK_i	Investment by sector of destinations	S	Total savings
$\overline{DV_h}$	Dividend payments to households	SH_h	Household savings
E_i	Exports from sector i.	SG	Government savings
ER	Nominal exchange rate.	SC	Corporate savings
$\overline{GD_i}$	Government final demand	SF	Foreign savings
$\overline{GTR_h}$	Government transfers to households	Q_i	Composite goods supply
I	Investment	$\overline{NHTR_h}$	Net transfers among households
ID_i	Final demand for investment goods	$_l$	Average wage of labour category l
INT_i	Intermediate demand	X_i	Domestic output,
K_i	Capital demand	YC	Corporation income
LD_{il}	Labour demand	Y_l	Labour income
M_i	Imports	Y_k	Capital income
PD_i	Domestic sales price	YL_h	Household income from labour
PE_i	Domestic price of exports	YK_h	Household income from capital
PK_i	Composite price of capital	YKG	Government income from capital
PM_i	Domestic price of imports	YG	Government income
PWE_i	World price of exports	Y_h	Household income
Parameters			
A_i	Production function shift parameter	Φ_{hk}	Capital to household matrix
α_{il}	Share parameters for labour	ζ_f	Government income from capital
α_k	Share parameters for capital	χ_f	Corporation income from capital
ϖ_{il}	Sector-specific parameter	β_i^g	Government expenditure shares
τ_{ij}	Input-output coefficients.	β_{hi}	Household expenditure shares
tm_i	Tariff rates on imports	ξ_i	Investment destination shares
st_i	Sales tax rates on imports	κ_{ij}:	Capital composition matrix
td_i	Indirect tax rates	t_c	Corporate tax rate
AQ_i	CES function share parameter	th_h	Household income tax rate
δ_i	CES function shift parameter	s_h	Household savings rate
σ_i	Elasticity of substitution.	$\overline{GTOT}$	Real government expenditure
AT_i	CET function shift parameters	E_i^0	Export demand shift parameter
γ_i	CET function share parameters	η_i	Price elasticity of export demand
ψ_i	Elasticity of transformation	$\overline{PWM_i}$	World price of imports
Φ_{hl}	Labour to household matrix	$\overline{PWSE_i}$	World price of export substitutes

6.3 Model variant with non-competitive behaviour

In this section, the specification of various market structure variables is discussed. In particular, this involves the estimation of: marginal costs; the number of firms in each industry; the excess profit condition and the market demand elasticity for domestic goods. This information is essential in order to simulate the effects of trade liberalisation in Bangladesh in the presence of non-competitive structure. Since econometric estimates of market structure variables such as marginal cost and the market demand elasticities are not available for the manufacturing sectors in Bangladesh, a calibration procedure is used to estimate them. We proceed in the following the steps:

(1) The 14 production sectors are first sub-divided into competitive and non-competitive sectors on the basis of their degree of concentration. It was evident from chapter five that the concentration ratios are quite high in major industries in Bangladesh as measured by the four-firm concentration ratio. It was observed that the average four-firm concentration ratios are 68 and 69 percent for 1985/86 and 1986/87 respectively. It was also observed that the estimated concentration ratios are rather low for the jute sector. On the other hand, this ratio was not computed for the ready made garment sector due to a paucity of data. However, casual observation suggests that the ready made garment industry is composed of a large number of roughly equal-sized firms. Therefore, the scope of collusion between firms appears to be small and the industry may be characterised as being competitive. Accordingly, the garments sector is treated as competitive. With the exception of the garments sector, the other seven manufacturing sectors are treated as non-competitive. Evidence of concentration is not available for the agricultural, construction, service and trade and transport sector but in line with other studies, these sectors are assumed to behave in a competitive manner.

(2) On the import side, it is assumed that world prices are unaffected by developments in the economy of Bangladesh. However, since domestic and imported commodities within a sector are assumed to be imperfect substitutes, domestic firms retain some market power in the domestic market in the non-competitive industries.

(3) Marginal cost is derived from the solution of the minimisation of total cost subject to a given output level (see Appendix A.1). For sector i this yields:

$$MC_i = \frac{1}{A_i}\prod_{l=1}^{7}(\varpi_{il}\cdot W_l/\alpha_{li})^{\alpha_{li}}\cdot(R_i/\alpha_{ki})^{\alpha_{ki}}+\sum_j \tau_{ji}\cdot P_j \tag{6.38}$$

(4) The market demand elasticity for the domestic goods is calculated using the information from the Armington specification. According to Armington, each composite good is defined as a CES aggregate of domestically produced goods and imported goods. Domestically produced goods within a composite good are treated as perfect substitutes for each other. The market demand elasticity is calculated as the percentage change in domestic demand for the domestic goods in response to a unit percentage change in the price of domestic goods, i.e. PD, while keeping all domestic expenditure on the relevant composite goods constant. The calculated market demand elasticity takes the following form (the derivation is shown in Appendix A.2) :

$$\varepsilon_i = -\sigma_i + (1-\sigma_i)\cdot\frac{\delta_i^{\sigma_i}\cdot PD_i^{(1-\sigma_i)}}{(1-\delta_i)^{\sigma_i}\cdot PM_i^{(1-\sigma_i)}+\delta_i^{\sigma_i}\cdot PD_i^{(1-\sigma_i)}} \tag{6.39}$$

where, σ_i and δ_i are the Armington elasticity and the share parameter for sector i respectively. This elasticity specification implies that the market demand elasticity ε_i will change under any policy reform since it changes with PD_i and PM_i. Equation (6.39) also shows that ε_i increases in absolute value whenever the relative price of imports (i.e. PM_i/PD_i) falls. It implies that the domestic firms will behave more competitively as a consequence of trade liberalisation (since a direct consequence of trade liberalisation is a fall in the relative price of imports). The inverse relationship between market demand elasticity and the relative price of imports is depicted by the following equation:

$$\frac{\partial \varepsilon_i}{\partial \frac{PM_i}{PD_i}} = (1-\sigma_i)\cdot\frac{-(1-\sigma_i)\cdot(1-\delta_i/\delta_i)^{\sigma_i}\cdot(PM_i/PD_i)^{-\sigma_i}}{\left[(1-\delta_i/\delta_i)^{\sigma_i}\cdot(PM_i/PD_i)^{1-\sigma_i}+1\right]^2} < 0 \qquad (6.39a)$$

Contrary to this elasticity specification, in some models (e.g. Cox-Harris, 1985 and Gunasekera and Tyres, 1988) the firms perceived demand elasticity is assumed constant in the short-run. The elasticity of aggregate sectoral demand is also endogenous in de Melo and Holst (1990).

(5) No data are available for the number of domestic firms for the manufacturing sectors. In the absence of such information, the number of domestic firms is endogenously calculated in this model. The Lerner symmetry condition is used to derive the number of domestic firms (see Appendix A.3). The Lerner condition states that:

$$\frac{PD_i\cdot(1-td_i)-MC_i}{PD_i\cdot(1-td_i)} = \frac{-1}{N_i\cdot\varepsilon_i} \qquad (6.40)$$

It is assumed that the non-competitive firms behave in a Cournot-Nash fashion. Under this hypothesis, the firm's perceived demand elasticity for domestic sales is $N_i\cdot\varepsilon_i$, where N_i is the number of firms in sector i (see Appendix A.4 for further discussion on the firm's perceived demand elasticity). Further manipulation of equation (6.40) yields the number of domestic firms:

$$N_i = \frac{PD_i\cdot(1-td_i)}{\varepsilon_i\cdot\left[PD_i\cdot(1-td_i)-MC_i\right]} \qquad (6.41)$$

For export sales, the Lerner symmetry condition takes the following form:

$$\frac{PE_i \cdot (1-td_i) - MC_i}{PE_i \cdot (1-td_i)} = \frac{-1}{N_i \cdot \eta_i} \tag{6.42}$$

where η_i is the price elasticity of export demand. The export demand elasticities are exogenous and are different from the endogenously determined market demand elasticities. It is observed that the right hand side and the left hand side of equation 6.42 are conceptually different because the number of firms is already derived, and export demand elasticities are exogenous. However, the two sides of equation 6.42 should be equal and the equality between two sides is not attained unless either η_i or PE_i are allowed to adjust. To satisfy the equality condition PE_i is allowed to adjust while keeping η_i constant. In this case PE_i will be marginally less than unity. Alternatively, export demand elasticities, η_is may be allowed to adjust setting PE_i equal to unity. In this case, η_i would always be equal to ε_i and therefore the developments in the domestic economy would directly influence the world market which appears to be a highly unrealistic assumption.

(6) The level of excess profits is an important dimension of imperfect competition. The level of excess profits is defined to be those profits above the normal amount necessary to keep entrepreneurial resources committed (Richardson, 1989). The excess profit function for the non-competitive sector i is specified as:

$$\pi_i = [PX_i \cdot (1-td_i) - AC_i] \cdot (N_i \cdot XF_i) \tag{6.43}$$

where, XF_i is the output per firm. No information is available regarding the amount of excess profits in the non-competitive sectors. In previous studies, part of the return from capital has been treated as pure or excess profits. To generate the amount of excess profits, sectoral rental rates of capital (R_i) observed in the SAM are reduced by 30 percent across all sectors, so that the total excess profits amount to 15 percent of total corporate capital income. The 15 percent profit rate is chosen to be approximately equal to the average price-cost margins of 15.2 percent observed for the manufacturing sector in Bangladesh for 1988/89. This rate is also closely commensurate with the average price-cost margins estimated for 1985/86 and 1986/87. This implies that in the non-competitive variant the sectoral rental rates (R_i) are different for each of the 14 sectors but are less than the sectoral rental rates observed in the SAM data base. Therefore, in the non-competitive sectors any excess of revenues over wage, capital and intermediate costs is treated as excess profits. While in the competitive sector, this excess revenue is denoted as if it is a return to specific factors, although no sector-specific factor is used in the model.

It is relevant to note that, de Melo and Holst (1990) also used the information of observed price-cost margin to specify an excess profit rate of 10 percent in their model for Korea. On the other hand Devarajan and Rodrik (1991) assumed a uniform five percent rental rate for capital for all sectors to generate the amount of excess profits.

(7) The first order conditions (for labour and capital) for non-competitive sectors are modified to capture the effects of imperfect competition, while the first order conditions for the competitive sectors remain as before. The first order conditions for non-competitive sectors are re-specified as:

$$W_l \cdot \varpi_{il} = (MC_i - \sum_j \tau_{ji} \cdot P_j) \cdot \alpha_{il} \frac{\partial X_i}{\partial LD_{il}} \tag{6.44}$$

or $W_l \cdot \varpi_{il} \cdot LD_i = X_i \cdot (MC_i - \sum_j \tau_{ji} \cdot P_j) \cdot \alpha_{il}$

$$R_i = (MC_i - \sum_j \tau_{ji} \cdot P_j) \cdot \alpha_{ki} \cdot \frac{\partial X_i}{\partial K_i} \tag{6.45}$$

or $R_i \cdot K_i = X_i \cdot (MC_i - \sum_j \tau_{ji} \cdot P_j) \cdot \alpha_{ki}$

(8) In the non-competitive variant, since the gross return to capital is now decomposed into returns to capital; excess profits; and returns to sector-specific factor, the distribution of capital income among institutions needs to be re-specified.

Equation (6.20) is re-specified to show to income from capital and profits:

$$Y_k = \sum_i (R_i \cdot K_i + \pi_i) \tag{6.46}$$

The following equation is used to derive income from the sector-specific factor:

$$Y_s = \sum_i (PV_i \cdot X_i + \pi_i) - Y_k - \sum_l Y_l \tag{6.47}$$

To distribute incomes from capital and sector-specific factors among institutions, the same capital factor to institution allocation matrix is used, so that an institution's income from these factors exactly conforms to the institution's income from capital observed in the SAM data base.

Household income from capital is thus specified as:

$$YK_h = \Phi_{hk} \cdot Y_k \tag{6.48}$$

The distribution of income from the sector-specific factor is specified as:

$$YS_h = \Phi_{hs} \cdot Y_s \tag{6.49}$$

where, YS_h, Φ_{hs} and Y_s are the household's income from sector-specific factors, the sector-specific factor to households allocation matrix and the income from the specific factor respectively. Finally, household disposable income equation is re-specified as:

$$Y_h = \left[YL_h + YK_h + YS_h + \overline{RM_h} \cdot ER + \overline{DV_h} + \overline{GTR_h} + \overline{NHTR_h} \right] \cdot (1 - th_h - s_h) \tag{6.50}$$

(9) The government income equation is modified to show the income from the specific factor. The modified income equation has the form:

$$YG = \sum_h th_h \cdot Y_h + \sum_i tm_i \cdot \overline{PWM_i} \cdot M_i \cdot ER + \sum_i st_i \cdot \overline{PWM_i} \cdot M_i \cdot ER$$
$$+ \sum_i td_i \cdot X_i \cdot PX_i + tc \cdot YC + YKG + YSG \qquad (6.51)$$

where, YSG shows government's income from sector-specific factor. This is estimated as $YSG = \zeta_s \cdot Y_s$.

(10) Analogously corporations income is represented by the following modified equation:

$$YC = YKC + YSC \qquad (6.52)$$

where, YKC and YSC denote corporation's income from capital and sector-specific factor respectively. These are computed as $YKC = \chi_k \cdot Y_k$ and $YSC = \chi_s \cdot Y_s$ respectively.

The results of the calibration procedure are provided in Table 6.2. Table 6.2 shows the calibrated values of the relevant variables. The calibration procedure generates the base year of values of domestic output, the number of domestic firms, marginal cost and the amounts of excess profits that are consistent with the assumptions and observed data for Bangladesh for 1988/89.

Table 6.2. Calibration of Market Structure Variables

Non-competitive Sectors	Number of firms	Marginal Cost (taka)	Industry Profits (million taka)	Output per Firm (million taka)
Food & Tobacco	91	0.843	310	370
Clothing	9	0.896	1330	1530
Chemical	22	0.889	520	600
Cement	10	0.892	1790	2030
Machinery	20	0.907	540	670
Other Industries	18	0.915	700	820
Energy	30	0.766	420	570

Note: Number of firms is rounded to a whole number

6.4 Calibration with imperfect competition and increasing returns to scale

To incorporate increasing returns to scale, in most models the total cost is separated into fixed and variable cost components. The increasing returns to scale is then assumed to stem from the fixed cost part of the total cost. The problem is to ascertain the split between fixed and variable costs. In Cox-Harris type models fixed cost is calculated using available econometric estimates of the minimum efficient scale of production and cost saving achievable (cost disadvantage ratio). It shows the decline in cost when a firm increases its output from the actual level to the efficient level. Such a specification requires information on minimum efficient scale and the cost disadvantage ratio. Such estimates are not available for Bangladesh nor it is possible to estimate them as the required information is not available. Furthermore, the extent of fixed cost by major industry groups is also not available. In the absence of such essential information, an alternative approach (in line with Devarajan and Rodrik, 1991) has been adopted to specify increasing returns to scale based on the following assumptions.

(i) Like other models, increasing returns are assumed to stem from the fixed cost element of the total cost. It is also assumed that the fixed cost consists of labour and capital costs in the same proportion as in total value added.

(ii) Scale elasticity which depicts the extent of unrealised scale economies is defined as a ratio of the average and marginal cost (i.e. $\theta_i = AC_i/MC_i$). A uniform scale elasticity of 10 percent is assumed for all non-competitive sectors. This implies that average cost is assumed to be 10 percent higher than the marginal cost for each non-competitive sector. This parameterizes the degree of increasing returns to scale in the benchmark equilibrium. However, the scale elasticity is only fixed initially and it varies across simulation outcomes as firm output, factor costs and input prices change.

A similar approach has also been used by de Melo and Holst (1990) and Devarajan and Rodrik (1991). There is, however, some controversy as to how important and symmetric these scale effects are within given industries. Accordingly, some models such as Harrison et al (1995) and Francois et al (1994) adopted differential scale elasticity values for different sectors. In Harrison et al, the elasticity values ranged from 3 percent for food-beverage-tobacco products to 13 percent for processed rice. In Francois et al, where the values are 'best guessed', the range was between 5 percent and 15 percent.

The scale elasticity is then used to calculate the fixed cost from:

$$FC_i = (AC_i - MC_i)\cdot X_i \tag{6.53}$$

or $FC_i = MC_i \cdot (AC_i / MC_i - 1)\cdot X_i$ (6.54)

or $FC_i = MC_i \cdot (\theta_i - 1)\cdot X_i$ (6.55)

where, FC_i denotes total fixed cost in sector i.

Given FC_i, the fixed amount of labour and capital inputs can then be estimated as:

$$\overline{LD}_{il} = \frac{\alpha_{il} \cdot FC_i}{W_l \cdot \varpi_{il}} \tag{6.56}$$

$$\overline{K}_i = \frac{\alpha_{ki} \cdot FC_i}{R_i} \tag{6.57}$$

The production function is modified to incorporate the fixed amount of labour and capital inputs. The modified production function takes the following form:

$$X_i = A_i \prod_l (LD_{il} - \overline{LD}_{il})^{\alpha_{il}} \cdot (K_i - \overline{K}_i)^{\alpha_{ki}} \tag{6.7*}$$

The first order conditions (for labour and capital) for non-competitive sectors are also modified, while the first order conditions for the competitive sectors remain as before. The first order conditions for non-competitive sectors are specified as:

$$W_l \cdot \varpi_{il} = (MC_i - \sum_j \tau_{ji} \cdot P_j) \cdot \alpha_{il} \frac{\partial X_i}{\partial LD_{il}} \quad \text{where } LD_{il} = (LD_{il} - \overline{LD}_{il}) \qquad (6.44^*)$$

$$\text{or } W_l \cdot \varpi_{il} \cdot (LD_i - \overline{LD}_{il}) = X_i \cdot (MC_i - \sum_j \tau_{ji} \cdot P_j) \cdot \alpha_{il}$$

$$R_i = (MC_i - \sum_j \tau_{ji} \cdot P_j) \cdot \alpha_{ki} \cdot \frac{\partial X_i}{\partial K_i} \quad \text{where } K_i = (K_i - \overline{K}_i) \qquad (6.45^*)$$

$$\text{or } R_i \cdot (K_i - \overline{K}_i) = X_i \cdot (MC_i - \sum_j \tau_{ji} \cdot P_j) \cdot \alpha_{ki}$$

The calibration results with increasing returns to scale are presented in Table 6.3. The calibration procedure generates the base year of value of domestic output, the number of domestic firms, marginal cost, and the amounts of excess profits that are consistent with the assumptions and observed data for Bangladesh for 1988/89. Notice that the numbers of firms are significantly smaller in this case since marginal costs are lower in the presence of fixed cost.

Table 6.3. Calibration Results with Increasing Returns to Scale

Non-competitive Sectors	Number of firms	Marginal Cost (taka)	Industry Profits (million taka)	Output per Firm (million taka)
Food & Tobacco	9	0.766	310	3590
Clothing	5	0.814	1330	2860
Chemical	7	0.808	520	1890
Cement	5	0.808	1790	3840
Machinery	6	0.823	540	2010
Other Industries	7	0.831	700	2270
Energy	8	0.695	420	2120

Note: Number of firms is rounded to a whole number

6.5 Conclusion

In this chapter an alternative model of the Bangladesh economy is developed to examine the effects of tariff liberalisation on resource allocation and income distribution under both competitive and non-competitive assumptions. The present model incorporates market structure variables to characterise imperfect competition. These are marginal costs, the number of domestic firms in each industry, the excess profit condition and the market demand elasticity for domestic goods. Since econometric estimates of these market structure variables are not available in Bangladesh, a calibration procedure is used to quantify them. The model also incorporates features of increasing returns to scale. As in many other models, increasing returns are assumed to stem from the fixed cost component of the total cost. A uniform scale elasticity of 10 percent is assumed for all non-competitive sectors. This parameterizes the degree of increasing returns to scale in the benchmark equilibrium.

Appendix to chapter six

A.1. Derivation of the marginal cost function

The marginal cost function is derived from cost minimisation subject to the Cobb-Douglas production function. The generalised form of the Cobb-Douglas production function is specified as:

$$X = A \cdot L^{\alpha} \cdot K^{(1-\alpha)} \tag{A.1.1}$$

Assuming that $A = 1$, the Cobb-Douglas production function takes the form

$$X = L^{\alpha} \cdot K^{(1-\alpha)} \tag{A.1.2}$$

The cost minimisation problem specifies minimisation of

$$C = W \cdot L + R \cdot K \tag{A.1.3}$$

subject to $X = L^{\alpha} \cdot K^{(1-\alpha)}$ (A.1.4)

The lagrange of the problem is then

$$H = W \cdot L + R \cdot K + \lambda \cdot \left[X - L^{\alpha} \cdot K^{(1-\alpha)} \right] \tag{A.1.5}$$

The first order conditions are

$$\frac{\partial H}{\partial L} = W - \lambda \cdot \left[\alpha \cdot L^{\alpha-1} \cdot K^{1-\alpha} \right] \tag{A.1.6}$$

$$\frac{\partial H}{\partial K} = R - \lambda \cdot \left[(1-\alpha) \cdot L^{\alpha} \cdot K^{-\alpha} \right] \tag{A.1.7}$$

$$\frac{\partial H}{\partial \lambda} = X - L^{\alpha} \cdot K^{(1-\alpha)} \tag{A.1.8}$$

Manipulation of the first order conditions gives

$$\lambda = \frac{W \cdot L}{\alpha \cdot X} = \frac{R \cdot K}{(1-\alpha) \cdot X} \tag{A.1.9}$$

$$L = \frac{R}{W} \cdot \frac{\alpha}{(1-\alpha)} \cdot K \tag{A.1.10}$$

$$K = \frac{W}{R} \cdot \frac{(1-\alpha)}{-\alpha} \cdot L \qquad \text{(A.1.11)}$$

Substitution of equation A.1.10 and A.1.11 for L and K in the production function yields the following conditional factor demand functions

$$L = (W/R)^{\alpha-1} \cdot (1-\alpha/\alpha)^{\alpha-1} \cdot X \qquad \text{(A.1.12)}$$

$$K = (R/W)^{-\alpha} \cdot (\alpha/1-\alpha)^{-\alpha} \cdot X \qquad \text{(A.1.13)}$$

Substitution of conditional factor demand functions in the cost function yields

$$C = W \cdot L + R \cdot K = W \cdot X \cdot W^{\alpha-1} \cdot R^{1-\alpha} \cdot (1-\alpha)^{\alpha-1} \cdot \alpha^{1-\alpha} + R \cdot X \cdot R^{-\alpha} \cdot W^{\alpha} \cdot \alpha^{-\alpha} \cdot (1-\alpha)^{\alpha} \qquad \text{(A.1.14)}$$

or $C = X \cdot W^{\alpha} \cdot R^{(1-\alpha)} \cdot (1-\alpha)^{\alpha} \cdot \alpha^{-\alpha} \cdot (\alpha/1-\alpha+1)$ (A.1.15)

or $C = X \cdot W^{\alpha} \cdot R^{(1-\alpha)} \cdot (1-\alpha)^{\alpha} \cdot \alpha^{-\alpha} \cdot (1/1-\alpha)$ (A.1.16)

or $C = X \cdot W^{\alpha} \cdot R^{(1-\alpha)} \cdot (1-\alpha)^{\alpha-1} \cdot \alpha^{-\alpha}$ (A.1.17)

The derivative of total cost (C) with respect to output (X) yields the marginal cost

$$MC = \frac{\partial C}{\partial X} = W^{\alpha} \cdot R^{(1-\alpha)} \cdot (1-\alpha)^{\alpha-1} \cdot \alpha^{-\alpha} \qquad \text{(A.1.18)}$$

or $MC = (W/\alpha)^{\alpha} \cdot (R/1-\alpha)^{1-\alpha}$ (A.1.19)

Now setting $\alpha = \alpha_{il}$, $(1-\alpha) = \alpha_{Ki}$, $\quad = \varpi_{il} \cdot W_l$, $R = R_i$ and adding the intermediate cost component, the marginal cost (MC) for sector i can be written as

$$MC_i = \frac{1}{A_i} \prod_{l=1}^{7} (\varpi_{il} \cdot W_l/\alpha_{li})^{\alpha_{li}} \cdot (R_i/\alpha_{ki})^{\alpha_{ki}} + \sum_j \tau_{ji} \cdot P_j \qquad \text{(A.1.20)}$$

A.2. Derivation of the market demand elasticity for domestic goods

The demand elasticity is calculated as the percentage change in domestic demand for the domestic goods in response to a unit percentage change in the domestic price, while holding all domestic expenditures on the relevant composite commodity (i.e. the CES aggregate) fixed.

$$\varepsilon_i = \frac{\partial D_i}{\partial PD_i}\frac{PD_i}{D_i} \quad \text{(A.2.1)}$$

From the Armington specification, the demand for domestic goods D_i is derived as:

$$D_i = \delta_i^{\sigma_i} \cdot Q_i \cdot P_i^{\sigma_i} \cdot PD_i^{-\sigma_i} \quad \text{(A.2.2)}$$

multiplying both sides of equation (2.2) by P_i, we get

$$D_i = \delta_i^{\sigma_i} \cdot P_i \cdot Q_i \cdot P_i^{\sigma_i - 1} \cdot PD_i^{-\sigma_i} \quad \text{(A.2.3)}$$

or $D_i = \delta_i^{\sigma_i} \cdot Y_i \cdot P_i^{\sigma_i - 1} \cdot PD_i^{-\sigma_i}$ where $Y_i = P_i \cdot Q_i$ (A.2.4)

the composite or the unit price P_i is specified as;

$$P_i = \left[(1-\delta_i)^{\sigma_i} \cdot PM_i^{1-\sigma_i} + \delta_i^{\sigma_i} \cdot PD_i^{1-\sigma_i}\right]^{\frac{1}{1-\sigma_i}} \quad \text{(A.2.5)}$$

or $P_i^{\sigma_i - 1} = (1-\delta_i)^{\sigma_i} \cdot PM_i^{1-\sigma_i} + \delta_i^{\sigma_i} \cdot PD_i^{1-\sigma_i}$ (A.2.6)

substitution of equation (A.2.6) for $P_i^{\sigma_i - 1}$ in equation (A.2.4) yields

$$D_i = \delta_i^{\sigma_i} \cdot Y_i \cdot PD_i^{-\sigma_i}\left[(1-\delta_i)^{\sigma_i} \cdot PM_i^{1-\sigma_i} + \delta_i^{\sigma_i} \cdot PD_i^{-\sigma_i}\right] \quad \text{(A.2.7)}$$

The derivative of D_i with respect to PD_i is:

$$\frac{\partial D_i}{\partial PD_i} = \delta_i^{\sigma_i} \cdot Y_i \cdot \left[-\sigma_i \cdot PD_i^{-\sigma_i - 1} \cdot P_i^{\sigma_i - 1} + PD_i^{-\sigma_i} \cdot (1-\sigma_i) \cdot \delta_i^{\sigma_i} \cdot PD_i^{-\sigma_i}\right] \quad \text{(A.2.8)}$$

division of domestic price PD_i by domestic goods D_i gives

$$\frac{PD_i}{D_i} = \frac{PD_i}{\delta_i^{\sigma_i} \cdot Y_i^{\sigma_i - 1} \cdot PD_i^{-\sigma_i}} \quad \text{(A.2.9)}$$

or $\dfrac{PD_i}{D_i} = \dfrac{1}{\delta_i^{\sigma_i} \cdot Y_i^{\sigma_i - 1} \cdot PD_i^{-\sigma_i - 1}}$ (A.2.10)

substitution of equation (A.2.8) and (A.2.10) in equation (A.2.1) yields the market demand elasticity for the domestic goods

$$\varepsilon_i = \frac{\delta_i^{\sigma_i} \cdot Y_i \cdot \left[-\sigma_i \cdot PD_i^{-\sigma_i - 1} \cdot P_i^{\sigma_i - 1} + PD_i^{-2\sigma_i} \cdot (1-\sigma_i) \cdot \delta_i^{\sigma_i}\right]}{\delta_i^{\sigma_i} \cdot Y_i \cdot P_j^{\sigma_i - 1} \cdot PD_i^{-\sigma_i - 1}} \quad \text{(A.2.11)}$$

$$\text{or } \varepsilon_i = \frac{P_i^{\sigma_i-1} \cdot PD_i^{-(\sigma_i+1)}}{P_i^{\sigma_i-1} \cdot PD_i^{-(\sigma_i+1)}} \cdot \left[-\sigma_i + (1-\sigma_i) \cdot \delta_i^{\sigma_i} \cdot PD_i^{1-\sigma_i} \cdot P_i^{1-\sigma_i}\right] \tag{A.2.12}$$

$$\text{or } \varepsilon_i = -\sigma_i + (1-\sigma_i) \cdot \delta_i^{\sigma_i} \cdot \frac{PD_i^{1-\sigma_i}}{P_i^{\sigma_i-1}} \tag{A.2.13}$$

substitution of equation (A.2.6) for $P_i^{\sigma_i-1}$ in equation (A.2.13) yields

$$\varepsilon_i = -\sigma_i + (1-\sigma_i) \cdot \delta_i^{\sigma_i} \cdot \frac{PD_i^{1-\sigma_i}}{(1-\delta_i)^{\sigma_i} \cdot PM_i^{1-\sigma_i} + \delta_i^{\sigma_i} \cdot PD_i^{1-\sigma_i}} \tag{A.2.14}$$

A.2.1 The responsiveness of the elasticity of demand with respect to the change in the relative price of imports

Further manipulation of equation (A.2.14) yields

$$\varepsilon_i = -\sigma_i + (1-\sigma_i) \cdot \delta_i^{\sigma_i} \cdot \frac{1}{(1-\delta_i)^{\sigma_i} \cdot [PM_i/PD_i]^{1-\sigma_i} + \delta_i^{\sigma_i}} \tag{A.2.15}$$

$$\text{or } \varepsilon_i = -\sigma_i + (1-\sigma_i) \cdot \frac{1}{(1-\delta_i/\delta_i)^{\sigma_i} \cdot [PM_i/PD_i]^{1-\sigma_i} + 1} \tag{A.2.16}$$

derivatives of ε_i with respect to change in the relative price of imports yields

$$\frac{\partial \varepsilon_i}{\partial \frac{PM_i}{PD_i}} = (1-\sigma_i) \cdot \frac{-(1-\sigma_i) \cdot (1-\delta_i/\delta_i)^{\sigma_i} \cdot (PM_i/PD_i)^{-\sigma_i}}{\left[(1-\delta_i/\delta_i)^{\sigma_i} \cdot (PM_i/PD_i)^{1-\sigma_i} + 1\right]^2} < 0 \tag{A.2.17}$$

A.3. Derivation of number of domestic firms

The number of domestic firms in each of the non-competitive sectors is derived from the

'Lerner ' symmetry condition.

$$\frac{PD_i \cdot (1-td_i) - MC_i}{PD_i \cdot (1-td_i)} = \frac{-1}{N_i \cdot \varepsilon_i} \tag{A.3.1}$$

or $$\frac{\varepsilon_i \cdot [PD_i \cdot (1-td_i) - MC_i]}{PD_i \cdot (1-td_i)} = \frac{-1}{N_i} \qquad \text{(A.3.2)}$$

manipulation of equation (A.3.2) gives the number of domestic firms

$$N_i = \frac{PD_i \cdot (1-td_i)}{\varepsilon_i \cdot [PD_i \cdot (1-td_i) - MC_i]} \qquad \text{(A.3.3)}$$

A.4. Relationship between market demand elasticity and firm's perceived demand elasticity

The non-competitive firms are assumed to behave in Cornout-Nash fashion. Under this hypothesis, $N \cdot \varepsilon$ denotes the firm's perceived demand elasticity for domestic sales. Richardson (1989) noted that the market demand elasticityε, would not in general be equal to each firm's perceived demand elasticity, say e. He used an 'imperfection weight' Ψ to depict the relationship market demand elasticity and firm's perceived demand elasticity: $\frac{1}{e} = \Psi \frac{1}{\varepsilon}$. For perfectly competitive firms, $\Psi = 0$; imperfect competition plays no role, and firms are independent. In the case of a monopolist, $\Psi =$; and e=ε. Analogously for a tight collusion of N firms, colluding as if they were one to maximise profits, $\Psi =$ and hence e=ε. For less intense collusion of N firms, Ψ lies between 0 and 1, and each firm's market power depends moderately on that of its rivals. An important intermediate degree of imperfect competition is Cournot competition, in which Ψ equals each firm's share of the overall market ($\Psi = X/N \cdot X = 1/N$, hence $e = N \cdot \varepsilon$). Under Cournot competition each firm optimally decides on its output, taking the output of its rival as given. 'Cournot pricing' involves marking up prices above marginal cost by the reciprocal of $N \cdot \varepsilon$, the product of a firm's market share and the overall market demand elasticity.

Chapter Seven

Results of Tariff Liberalisation under Perfect and Imperfect Competition

7.1 Introduction

Bangladesh has been gradually liberalising her foreign trade regime since the early eighties as an integral part of the structural adjustment programmes. The trade liberalisation strategies have involved a gradual elimination or replacement of non-tariff barriers during the first phase and reduction of tariff rates during the later phase.

The potential benefits of trade liberalisation are well recognised. Until recently, the potential benefits of trade liberalisation have been justified within the paradigm of traditional trade theory based on the "Hecksher-Ohlin-Samuelson" framework. Consequently, most empirical models have assumed that all markets are perfectly competitive and have constant returns to scale in production. Simulations of trade liberalisation with such models have tended to generate rather 'small' welfare gains, often on the order of 1 percent of GNP or less (Cox and Harris, 1985).

The relevance of these results has been questioned on the grounds that the assumptions of perfect competition and absence of scale economies are unrealistic, leading to the omission of potentially important additional sources of welfare gains. In many sectors (as evidence suggests for manufacturing sector), industrial structure is better depicted by a small number of large firms rather than a large number of small firms which individually have no control over market prices. Under such circumstances, trade liberalisation can yield potential additional efficiency gains by reducing the monopoly power of domestic firms (i.e. pro-competitive effects) and rationalisation of domestic industry through exploitation of scale economies.

Venables (1985) states that " the incorporation of industrial organisation characteristics into trade theory has generated new insights into understanding additional sources of potential gains from trade, such as economies of scale, and observed trade flows, in particular the inter industry trade. Furthermore the recognition of the importance of industrial organisation features in international trade has provided a wider framework for the analysis of trade and industrial policies."

Empirical studies have lagged behind the growing theoretical literature. A notable exception to this is the pioneering work by Harris (1984) in which the basic features of 'industrial organisation' entailing imperfect competition, scale economies and product differentiation have been incorporated into a CGE model for Canada. The potential benefits of trade liberalisation were found to be much greater than that yielded by model based on traditional trade theory.

Most case studies have been for developed countries yet, according to de Melo and Holst (1990), it is the developing countries that the influence of market structure variables or industrial organisation features is likely to be greatest. Rodrik (1988) used concentration ratios, among other measures, to compare the extent of monopoly power in the manufacturing sector of the developing and developed countries. He argued that imperfect competition is more pervasive in the manufacturing sector of the developing countries than their counterpart in the developed countries. Some of the studies with 'new' trade theory involving developing countries are Rodrik (1988), Gunasekera and Tyres (1988), Devarajan and Rodrik (1989 and 1991), and de Melo and Holst (1990). The importance of inclusion of market structure variables in the trade policy analysis in the context of a developing country has also been pointed out by Krugman (1986) and Hamilton and Whalley (1987).

On the other hand, Gunasekera and Tyres (1988), claimed that economies of scale, product differentiation and imperfectly competitive market structure may be of limited relevance to developing countries with their small manufacturing sectors. But as they industrialise, these features assume greater significance. Increasingly, the growth in manufacturing exports of developing countries is likely to be linked to markets characterised by entry barriers that typify imperfect competition.

There is now evidence that the manufacturing sector in Bangladesh appears to have imperfectly competitive features as measured by the popular four-firm concentration ratios and Hirschman-Herfindahl index. In particular, it is observed that the average four-firm concentration ratios in 1986 and 1987 are 68 and 69 percent respectively. Even though the concentration ratios on their own cannot show how collusive the behavioural outcomes in particular industries are, these numbers seem broadly indicative of the extent of imperfect competition (Rodrik, 1988). Furthermore, measures of concentration (i.e. concentration ratios and Hirschman-Herfindahl index) are found to be statistically significant determinants of 'profitability'-measured by price-cost margins. Considering the evidence of imperfect competition in the manufacturing sector, it seems reasonable to include features of 'industrial organisation' within trade policy analysis in Bangladesh.

In this chapter a Devarajan-Rodrik type CGE model is applied to assess the resource allocation, welfare and income distribution effects of trade liberalisation in Bangladesh. The decision to use a CGE model is also vindicated by the fact that in recent years these models have been employed to examine various aspects of trade and tax policy alternatives and in particular to address the following questions: (i) whether the incorporation of market structure variables significantly alters the results yielded by the traditional trade models; (ii) whether there is any significant difference in outcome between no entry (of domestic firms) and free entry equilibrium;

(iii) whether there is any additional gain for manufacturing sectors with increasing returns to scale; and (iv) what are the implied income distribution effects of trade liberalisation.

The plan of the chapter is as follows. Section 7.2 reviews the main features of general equilibrium results of trade policy with imperfect competition. Simulation results of tariff liberalisation under different model variants are discussed in section 7.3. Section 7.4 discusses the income distribution effects. Concluding observations are presented in section 7.5.

7.2 Main features of computable general equilibrium research on trade policy with imperfect competition

Almost all trade models with imperfect competition and increasing returns to scale report larger welfare gains from trade liberalisation compared with traditional trade models based on 'Hecksher-Ohlin-Samuelson' framework. The larger welfare gains appear to have been generated from different sources, such as (i) industry rationalisation effects (Cox-Harris, 1985, Gunasekera and Tyres, 1988); and (ii) pro-competitive effects (Devarajan and Rodrik, 1989, 1991). At the sectoral level, the manufacturing sector turns out to be the main beneficiary of trade liberalisation in contrast to the perfect competition models where the manufacturing sector is the major loser.

One common feature observed in most models is the treatment of the manufacturing sector as the non-competitive sector. Other sectors such as agriculture, services, construction and transport are assumed to behave in a competitive manner. This assumption is made perhaps because some evidence on extent of imperfect competition is available for manufacturing sector while for other sectors such evidence is virtually non-existent.

Market structure variables common to most models are marginal (or unit variable) cost, the number of firms, zero and excess profit conditions, and the market demand elasticities. Except for the market demand elasticity, all other variables are usually endogenous. In some models (e.g. Cox-Harris, 1985; Gunasekera and Tyres, 1988) the market demand elasticities are constant in the short run while in Devarajan and Rodrik (1989, 1991) and de Melo and Holst (1990) they are endogenous. In most models, increasing returns to scale are assumed to stem from the fixed cost part of total cost. The fixed cost is composed of both labour and capital costs. The basic assumption is that it takes a minimum amount of labour and capital to start production. The firm's technology is then characterised by indivisibilities. The presence of fixed cost is the result of existence of such indivisibilities.

Even though there is no general theory of price determination in non-competitive industries, most models adhere to the monopolistic competitive pricing rule and the focal pricing rule (e.g. Cox-Harris in the case of Canada). The monopolistic competition pricing rule is based on Lerner mark-up formula which states that each firm sets a mark-up over marginal (or unit variable) costs according to the perceived price elasticity of demand for its products (Delorme and Mensbrugghe, 1989-91). The focal pricing rule is a "tariff-limit" pricing rule where domestic prices are set at the world price plus the tariff[30]. Richardson (1989) states that focal pricing incorporates two features that heighten the importance of imperfect competition for trade policy and lead to an increase in welfare gains. Firstly, all domestic firms implicitly collude among themselves without any competitive deviation to undercut the average price of their rivals. Secondly, all domestic firms also implicitly collude with their foreign

[30] The pricing rule is based on the empirical work of Eastman and Stykolt (1967) who showed that a given industry protected by a tariff, in which domestic consumption is small relative to industry's minimum efficient scale of production, is likely to be characterised both by a high number of firms with suboptimal capacity and excessive product differentialtion.

competitors by setting a price that is essentially equal to the world price plus the import tariff on the foreign competing goods.

Most commentators (e.g. Deardorff, 1986) have argued that the use of focal pricing may have produced large benefits from trade liberalisation, especially when Canadian liberalisation is matched by its trading partners. In that case, trade liberalisation directly reduces the collusive focal price charged by all Canadian firms, rationalising all industries by compelling some firms to exit and incumbent firms to lower mark-up and increase scale by travelling down their average cost curves. In this regard it is relevant to note that Brown and Stern (1988), Wigle (1988) and Markusen and Wigle (1987) all observed smaller welfare effects from very similar trade policy experiments with less or no recourse to focal pricing.

In Delorme and Mensbrugghe (1989-91) monopolistic competition pricing and focal pricing were both used to demonstrate the sensitivity of the simulation results to different assumptions regarding oligopolistic behaviour. The simulation results show significant differences between the results obtained under the two pricing hypotheses. In particular, estimated welfare gains are larger under the monopolistic competition pricing than the focal pricing. This is because the extent of scale economies realised under the monopolistic competition pricing hypothesis (13%) was much higher than the cost savings achieved (7%) under the focal pricing hypothesis. Therefore, this result appears to refute the claim that focal pricing hypothesis tend to produce larger effects through greater realisation economies of scale than monopolistic pricing hypothesis.

Like the traditional trade models, the results of trade liberalisation under 'new trade' models are also sensitive to parameter values used such as scale elasticity, market demand elasticity and profit rates. The sensitivity of welfare gains to parameter values has been demonstrated in de Melo and Holst (1990). They used two alternative scale elasticity rates of 10 and 20 percent and two profit rates of 0 and 10 percent. In the zero profit case, the estimated welfare gains are 2.6 to 5.3 percent of GDP, with cost disadvantage ratios of 10 and 20 percent respectively. On the other hand the estimated welfare gains are much higher in the case of excess profit rate of 10 percent compared with the zero profit case. For instance, in the case of excess profit rate the estimated welfare gains are 4.9 and 10.2 percent of GDP with scale elasticity of 10 and 20 percent respectively. The sensitivity issue has also been discussed by Harrison et al (1995). According to them " the larger the estimated unrealised economies of scale in our model, the more potential gains there are from rationalisation and the more an increasing returns to scale implementation would be expected to produce larger estimated gains from trade liberalisation".

7.3 Simulation results of tariff liberalisation

In the present application to Bangladesh in all experiments the tariff rates on imported products are reduced by 50 percent with an upward adjustment of existing domestic production tax rates, so as to maintain the neutrality of government revenue. Given the narrow direct tax base, and the problem and high administrative cost involved in taxing agricultural surplus in Bangladesh, the economy has to rely on the domestic indirect tax system to raise the additional revenue to maintain revenue neutrality (Mansur and Khondker, 1994, provide some estimates of tax potential in Bangladesh). The results of simulations using different variants of the model are presented in Tables 7.1 to 7.6.

7.3.1 Experiment one: tariff liberalisation under perfect competition

This section reports the results of tariff reduction under perfect competition and constant returns to scale. In this case all sectors are assumed to behave in a competitive manner and production takes place under constant returns to scale.

Factors are fully mobile between sectors and full employment of factors is assured through the equality of factor demand and supply. Finally, the equality of savings and investment closes the model. The results of tariff liberalisation under perfect competition are shown in Table 7.1.

Table 7.1 Results of Tariff Liberalisation under Perfect Competition
(percentage changes)

Sectors	Output	Imports	Exports	Tariff Rates
Subsistence Agriculture	0.98	3.51	1.33	8.52
Commercial Agriculture	3.93	0.35	1.23	8.28
Forestry	1.23			
Food and Tobacco	-1.58	19.87	-1.54	34.23
Clothing	-0.01	12.38	1.82	25.59
Garments	2.41	68.05	2.92	62.97
Chemical	-0.41	13.27	0.57	19.63
Cement	-4.39	1.01	-1.14	23.39
Machinery	-7.46	1.43	-3.40	24.12
Other Industries	-3.72	22.67	-0.81	30.15
Construction	-2.33			
Energy	-4.63	7.48	-4.15	10.98
Services	-0.25	1.01	-0.80	
Trade and Transport	0.11			
All Sectors	-0.23	7.43	1.07	

* Tariff rates refer to the effective tariff rate.

As expected, the reduction in tariff rates leads to a substantial increase in the volume of imports for almost all sectors. The increase in the volume of imports is larger for sectors with higher tariff rates such as garments, other industries, and food and tobacco sector. Other sectors that show moderate growth in the volume of imports are chemical, clothing and energy sectors. An examination of the price indices for imported and domestic goods reveals that the imported to domestic good price ratio has significantly declined to produce a substantial increase in the volume of imported goods. In particular the decline in the price ratio is largest for the garments sector with a corresponding increase in the volume of imported goods for that sector. This pattern can be observed for all other import-augmenting sectors in the Appendix Table A.7.1.

In this same experiment, the overall volume of exports increased by 1.07 percent which is mainly due to an increase in the volume of exports of garments, clothing, chemical, subsistence and commercial agriculture sectors. Apart from garments, clothing and chemical sectors, all other manufacturing sectors show a decline in the volume of exports. The specification of the export demand function implies that, given the elasticity of export demand and other parameters, a fall in the domestic price of exports would lead to an increase in export demand. This relationship appears to hold for the eleven trading sectors (see Appendix Table A.7.2). In particular the domestic price of exports has risen for the six export-contracting sectors while the price fell in other five sectors to produce small increase in exports.

As a result of tariff liberalisation, resources move from heavily protected sectors such as manufacturing sectors to less protected sectors such as subsistence and commercial agriculture, forestry and trade and transport sectors. This movement of resources is expected given the initial levels of protection provided to domestic industries. Protection (such as tariffs and non-tariff barriers) permits domestic industries to operate with value added higher than prevails under the free trade, thereby providing incentives for the movement of resources into protected industries. Thus, when such protection is removed, resources tend to move from protected to less protected sectors. Accordingly, almost all the manufacturing sectors show small to moderate declines in output as protection is reduced. The largest percentage decline in output occurs in the machinery sector, closely followed by the energy sector. The other sectors where output declined are; cement, other industry, food and tobacco, chemical and clothing sector. As a result of such decline, total manufacturing output declines by 1.3 percent in this experiment. Among the less protected sectors, the commercial agriculture sector shows the largest percent increase in output, followed by the forestry and subsistence agriculture sectors.

7.3.2 Experiment two: tariff liberalisation under imperfect competition

In this section the outcomes of tariff liberalisation under imperfect competition and constant returns to scale are presented. Seven manufacturing sectors are characterised as non-competitive while the other seven production sectors are assumed to behave in competitive manner in this scenario. The results of tariff liberalisation for this are presented in Table 7.2.

Table 7.2 Results of Tariff Liberalisation under Imperfect Competition and Constant Returns to Scale (Percentage changes)

Sectors	Output	Imports	Exports	Marginal cost	Profit
Subsistence Agriculture	-0.20	2.43	-0.02		
Commercial Agriculture	0.93	2.03	0.36		
Forestry	5.46				
Food and Tobacco	2.62	18.39	6.11	-3.51	-9.40
Clothing	-1.80	12.21	4.31	-1.62	-0.15
Garments	1.47	69.71	1.67		
Chemical	1.02	14.21	3.99	-2.66	-3.62
Cement	10.18	17.53	4.69	-1.87	-6.45
Machinery	16.47	26.75	5.37	-3.31	-5.11
Other Industries	1.73	28.53	5.29	-3.00	-2.29
Construction	14.29				
Energy	9.65	3.32	19.63	-4.88	-12.81
Services	-0.73	1.41	-1.53		
Trade and Transport	5.35				
All Sector	3.06	15.46	1.33		

Note: In this experiment the excess profits are allowed to adjust, holding number of domestic firms fixed.

As in the previous experiment, a consequence of a reduction in tariff rates is that the volume of imports increases substantially for all the sectors. The largest growth in the volume of imports is observed for the garments sector, followed by other industries, machinery, food and tobacco and the cement sectors. Other sectors that show moderate growth in the volume of imports are the chemical and clothing sectors. Again an examination of the price indices for imported and domestic goods reveals that (Appendix Table A.7.1), the imported to domestic goods price ratios have substantially declined to produce a noticeable increase in the volume of imported goods.

The overall volume of exports increased by 1.33 percent in this experiment. It is noticed that the volume of exports increased in nine out of eleven trading sectors. The other two remaining sectors show small declines in export. Again an examination of the domestic price of exports indicates that the domestic prices of exports have declined in these nine sectors to produce an increase in exports. It is also observed that growth of manufacturing exports is larger compared to the previous case. This is because of moderate output growth of manufacturing sectors in this case.

Striking differences between the two experiments (i.e. one and two) are observed when resource allocation effects are examined. In the competitive case, due to tariff liberalisation resources move from heavily protected sectors to less protected or non protected sectors. In this case tariff liberalisation therefore mainly favours the less protected sectors such as subsistence and commercial agriculture, forestry and trade and transport sectors. On the other hand, the heavily protected manufacturing sector is the major loser. Except for the garments sector, output declined in all other manufacturing sectors. In the non-competitive case, the pattern of resource re-allocation is reversed with the manufacturing sectors turning out to be the main beneficiaries of liberalisation. Almost all the manufacturing sectors show moderate output growth with largest output growth noted for the machinery sector. This sector is closely followed by cement and energy. The expansion of the construction sector is perhaps due to strong inter-industry linkages with the machinery and cement sectors. In particular, total manufacturing output increased by 4.3 percent in this case compared to the previous case where manufacturing output as whole declined by 1.3 percent.

It is interesting to note the simultaneous expansion of output and contraction of excess profits of the manufacturing sectors. It is observed that the excess profits decline in all non-competitive sectors. The reduction of excess profits in these sectors is an expected outcome of intensified import competition. But what explains the growth of the manufacturing sector ? It depends to what extent import competition alters the slope of the domestic firm's demand curve (and hence marginal revenue curve). Outputs of domestic firms increase when import competition sufficiently flattens the demand and marginal revenue curves faced by domestic firms[31]. That is, by allowing flow of imports in the domestic markets tariff liberalisation reduces the market power of domestic firms and compels them to behave competitively-that is, it reduces the gap between prices and marginal cost and expands output. Changes in producer prices are shown in Appendix Table A.7.3.

To understand the mechanism at work it is useful to consider an economy where a domestic monopolist competes with a single foreign firm. The domestic monopolist has a downward sloping demand curve d_o and a marginal revenue curve mr_o. For simplicity, it is assumed that the marginal cost (c) is constant and is equal to the average cost. The domestic monopolist is in equilibrium when the marginal cost curve (c) intersects the marginal revenue curve mr_o. The equilibrium price and quantity demanded are p_o and x_0 respectively. The domestic monopolist realises excess profits equal to the area cp_0ta. The initial equilibrium is denoted by point a in figures 1 and 2.

[31] Almost all trade policy changes market demand curves. But such changes are much more significant for non-competitive behaviour than for perfect cometition, where the demand curves of firm remain invariantly flat (Richardson, 1989). Mere pivoting of the market demand curves around an equilibrium point will alter the perceived elasticities and equlibrium even if no coventional "shift" occurs (Bresnahan, 1987). Changes in tariff rates generally cause the elasticity of market demand to alter and hence change the size of marks-up and price distortions (which are invariant at zero under perfect competition).

Consider the consequences of import tariff liberalisation on the domestic monopolist's price, quantity produced and excess profits. Because of tariff liberalisation the domestic monopolist's demand curve shifts inward. In this regard two cases may be considered[32]:

(i) In the first case, consider a parallel inward shift of the domestic monopolist's demand curve to d_1 from d_o. The corresponding new marginal revenue curve is mr_1 which is also parallel to original marginal revenue curve mr_o. The new equilibrium of the domestic monopolist is defined by point b, at which the new marginal revenue curve mr_1 intersects the marginal cost curve (c). The price is p_1 which is less than the initial price p_o. Analogously, quantity demanded x_1, is less than the initial quantity demanded x_o. The excess profit of the domestic monopolist is also reduced (since $cp_1sb < cp_0ta$). Therefore, the domestic monopolist responds to intensified import competition by shifting its demand curve inward and thereby reducing output, price and profits when such shift does not affect the slope of the demand curve. This situation is illustrated in figure 1.

32 It is impossible to provide definite answers to the question of what are the resource re-allocation effects of tariff reforms under conditions of imperfect competition at any acceptable level of theoretical generality (Rodrik, 1988 p-123). The resource allocation effects of trade liberalisation will depend on (I) the type of trade restriction; (ii) the nature of oligopolistic interactions; and (iii) the ease of entry and exit. While analysing this issue in a partial equilibrium framework Buffie and Spiller (1986) shows that the range of theoretical possibilities are unbounded. Domestic output can increase or decrease, as can the domestic price. Given that the search for theoretical generality is a dead end, an alternative is to carry out numerical simulations under assumptions that seem realistic and reliable (Rodrik, 1988 p124). This is essentially the approach that has been adopted in this study.

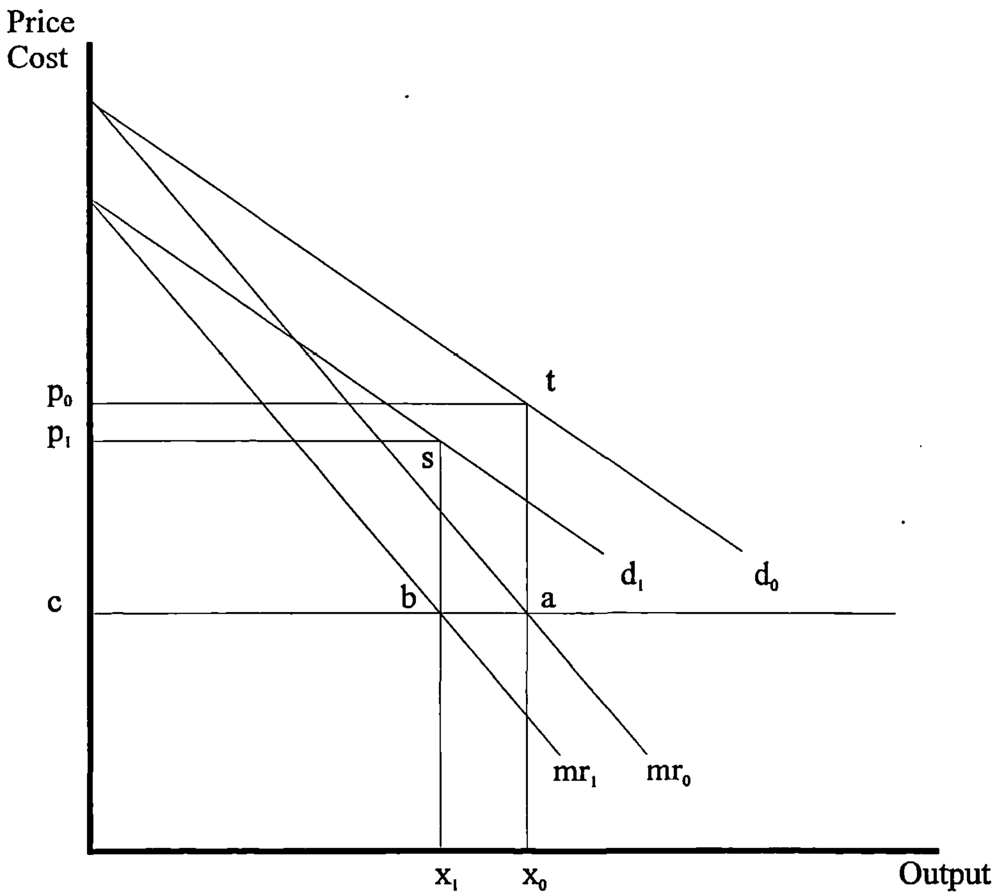

Figure 1: Inward Shift in Monopolist's Demand Curve

(ii) On the other hand, intensified import competition can have a second effect on the demand curve of the domestic monopolist. Beyond shifting the demand curve inward, tariff liberalisation can change its slope and make it flatter. This case is illustrated in figure 2. The new demand curve is d_1 which is more elastic than the demand curve d_o. The corresponding new marginal revenue curve is mr_1. Given the marginal cost (c) of the monopolist, the new equilibrium position is b where the new price p_1 is smaller than the initial price p_o. Contrary to the first case, the quantity produced is larger in this case ($ox_1 > ox_0$). The effect on monopolist's profits is ambiguous. Monopolist's profits may increase or decline in the new equilibrium. It depends on how the tariff liberalisation shifts the demand curve. In figure 2, the shift in the demand curve is drawn so that the profit levels are lower in the new equilibrium. In the initial equilibrium (i.e. at point a) the excess profit of the domestic monopolist is

$$\pi_o = cp_0ta = cp_1va + p_1p_0tv \qquad (7.1)$$

In the new equilibrium (i.e. at point b) the domestic monopolist's excess profit is

$$\pi_1 = cp_1sb = cp_1va + vasb \qquad (7.2)$$

Subtracting (7.1) from (7.2), we find

$$\pi_1 - \pi_0 = [cp_1va + vasb] - [cp_1va + p_1p_0tv] \qquad (7.3)$$

$$\pi_1 - \pi_0 = vasb - p_1p_0tv \qquad (7.4)$$

From figure 2 it is observed that area p_1p_0tv is larger than area $vasb$. Hence it appears that $\pi_1 < \pi_0$. Thus, the domestic monopolist realises less profits in the new equilibrium compared to the initial equilibrium. A similar approach is used by Koutsoyiannis (1979) to show that the level of profits is higher for a discriminating monopolist compared to a simple monopolist.

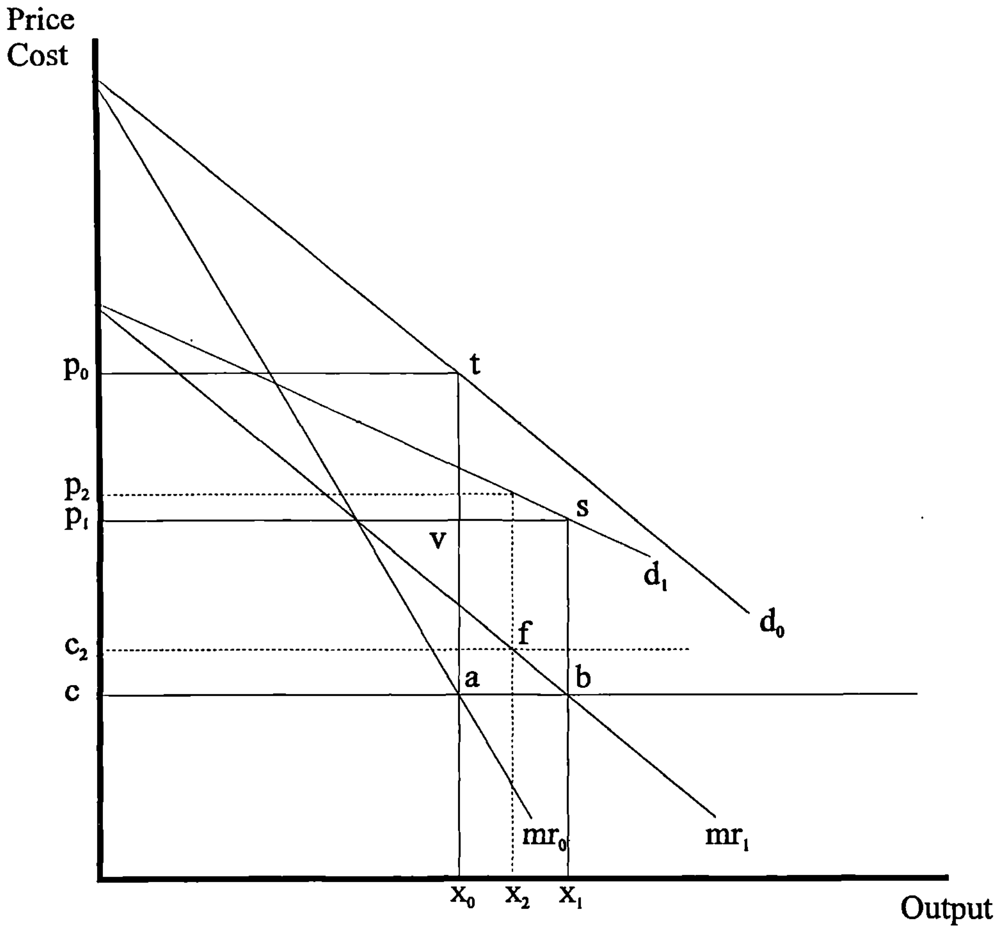

Figure 2: Changes in the Slope of Monopist's Demand Curve

This is what happens in this case as tariff liberalisation renders the demand faced by domestic firms more elastic. Although the demand curve shifts inward due to tariff liberalisation, the change in the slope of the demand curve in the new equilibrium is large enough to offset the deleterious effect on firm's output. Domestic firms now perceive themselves as having less control over their prices, and hence increase output. This is known as the pro-competitive effects of trade liberalisation.

Devarajan and Rodrik (1989, 1991) also reported an expansion of manufacturing output due to the pro-competitive effects of tariff liberalisation. They reported a larger expansion of manufacturing output compared with the present experiment. This may be because: (i) they considered a complete elimination of tariffs, while in our experiments tariff rates are halved, leading to much smaller degree of import competition in our case; (ii) to keep government revenue at the pre-reform level a lump-sum tax was levied on household's income in their experiment, whereas in our case production tax rates are raised. Consequences of higher production taxes on non-competitive firm behaviour are well established in micro-theory (Koutsoyiannis, 1979). Higher production taxes affect the price of composite goods. As a result, the marginal cost curve shifts upward (c_2) to establish a new equilibrium (f) where output is lower ($x_2 < x_1$) and price is higher ($p_2 > p_1$) compared with the equilibrium (i.e. b) in which production taxes are not raised but tariff rates are reduced.

7.3.3 Experiment three: tariff liberalisation under imperfect competition and entry and exits of domestic firms

In this section the consequences of tariff liberalisation are examined when the number of domestic firms in each non-competitive sector is allowed to adjust freely in response to policy changes. The present scenario does not necessarily denote a long-run scenario or outcome because full mobility of labour and capital factors are already allowed in the previous experiments. Instead this scenario depicts a situation where there are no barriers in the industrial structure to prevent entry and exits of firms. However, the accepted terminology in empirical research is to refer this scenario as a long run scenario where all primary factors of production are mobile and domestic firms can enter and exit without impediments. The usual (e.g. Cox and Harris, 1985 and Gunasekera and Tyres, 1988) way to proceed is to set the level of excess profits to zero and then allow the number of domestic firms to adjust endogenously in response to policy reforms. In our case, since the base scenario allows for excess profits, the zero profit condition is not directly comparable to the base scenario. In that case, one would be comparing a long-run equilibrium under free trade with a short-run equilibrium under trade protection.

To overcome this problem, de Melo and Holst (1990) and Devarajan and Rodrik's (1991) approach assumed that the 'observed' level of excess profits describes a long-run solution to start with. Therefore, the level of firm's profits is fixed to the benchmark level of excess profits and then the number of domestic firms are allowed to adjust endogenously in response to policy changes.

Table 7.3 Results of Tariff Liberalisation with Entry and Exit of Domestic firms
(Percentage changes)

Sectors	Output	Imports	Exports	Margi-nal cost	Number of firms
Subsistence Agriculture	-0.30	2.43	0.02		
Commercial Agriculture	1.08	2.64	0.23		
Forestry	4.82				
Food and Tobacco	3.56	18.22	7.61	-4.35	-1.60
Clothing	-1.44	11.99	5.44	-1.97	2.50
Garments	1.61	69.73	1.81		
Chemical	4.51	13.59	9.68	-6.02	-1.52
Cement	9.99	17.54	4.70	-1.72	-1.20
Machinery	17.91	26.45	7.44	-4.60	-3.45
Other Industries	4.35	27.24	10.05	-5.68	-1.53
Construction	14.36				
Energy	10.19	3.68	19.89	-4.98	-3.21
Services	-0.84	1.65	-1.77		
Trade and Transport	6.13				
All Sectors	3.23	15.29	1.44		

Note: In this experiment the number of domestic firm is allowed to adjust, keeping the excess profits fixed.

The results of the tariff liberalisation experiment with entry and exit of domestic firms are presented in Table 7.3. It is observed that these results are not significantly different from the results observed in the second experiment. The changes in the total and sectoral level of imports and exports are also quite similar to the results observed in the previous experiment.. In particular, the increase in total imports (15.29%) is slightly lower in this case in comparison to the increase of 15.45 percent observed in the pervious case. In the case of exports, the total volume of exports increased by 1.44 percent in this case compared with the 1.33 percent increase observed in the previous case.

The pattern of sectoral output change is also similar in the two experiments. As in the previous experiment, except for clothing all manufacturing sectors show moderate growth in output when firms are allowed to exit and enter domestic industries. Moreover, total manufacturing output growth observed in the two experiments is also very close. Total manufacturing output growth is 5.2 percent in this case compared with output growth of 4.3 percent in the previous case.

The apparently similar resource-allocation effects of tariff liberalisation between these two experiments may be due to small entry and exit of domestic firms and observed high sensitivity between firm-level profits and entry and exit of domestic firms. It is noticed that the number of firms declines in all six sectors that experienced a reduction in profits in the previous experiment. It appears that firm-level profits are sensitive to changes in competitive environment generated by exit and entry of domestic firms.

7.3.4 Experiment four: tariff liberalisation with increasing returns to scale

Some results of the tariff liberalisation experiment under increasing returns to scale are reported in Table 7.4. To perform this experiment a uniform scale elasticity of 10 percent is assumed for all non-competitive sectors. However, the scale elasticity changes as relative price, input price and firm output all change with tariff liberalisation. It is expected that the overall welfare gains are enhanced to the extent that scale elasticity is reduced: that is to the extent that firms move down their average cost curves.

Table 7.4 Results of Tariff Liberalisation with Increasing Returns to Scale (Percentage changes)

Sectors	Output	Imports	Exports	Marginal cost	No of Firms	Scale Elasticity
Subsistence Ag.	-1.56	2.92	-2.52			
Commercial Ag.	-1.19	4.35	-0.52			
Forestry	6.53					
Food-Tobacco	3.51	18.60	5.80	-2.33	-3.25	-1.00
Clothing	-1.58	13.96	0.25	0.96	3.45	-1.10
Garments	3.17	69.68	3.46			
Chemical	2.67	15.45	3.53	-1.21	-2.23	-1.00
Cement	26.51	22.94	15.26	-6.92	-3.75	-1.80
Machinery	34.47	40.48	9.45	-4.51	-5.96	-1.70
Other Industries	7.44	32.03	7.52	-3.22	-2.25	-1.10
Construction	24.62					
Energy	14.74	4.22	24.55	-6.99	-4.26	-1.30
Services	0.63	0.22	0.58			
Trade-Transport	7.44					
All Sectors	5.19	20.43	2.98			

Changes in the total and sectoral level of imports and exports are higher in this scenario compared with the previous experiment. In particular, growth of total imports (20.43 %) is much higher in this experiment in comparison to total import increase of 15.29 percent observed in the pervious experiment. In the case of exports, total volume of exports increased by 2.98 percent compared with 1.44 percent increase previously.

The most significant difference is the much larger expansion of output of the manufacturing sectors. Almost all the manufacturing sectors show a much larger output growth. The largest output growth is observed for the machinery sector which expands by 34 percent (previously 18 %). The cement sector expands by 27 percent (previously 10 %). The increases in output of the construction and energy sectors are 25 and 15 percent respectively in this experiment, whereas previously the corresponding output increases for construction and energy sectors are 14 and 10 percent. On the other hand, the other industry sector expands by 7 percent compared to an output expansion of 4 percent previously. The output expansions of food and tobacco and chemical sectors are not significantly different from the previous experiment. Total manufacturing output as whole expands by 9.1 percent (previously 5.2 percent). Clearly the larger expansion of the machinery, cement, energy and other industry sectors is due to moderate reduction in unrealised scale economies in these sectors. This is reflected by the decline of the scale elasticity (θ) in these sectors. The fall in scale elasticity implies a reduction in unit cost as the scale of production increased.

Devarajan and Rodrik (1991) reported a doubling of manufacturing output for intermediate goods and the food processing sector with 3 to 4 percent reduction in unrealised scale economies respectively. The output expansion of cement and basic metal sector was very large (109%) due to large (12%) reduction in unrealised economies of scale.

The exit rates of domestic firms are larger in this experiment compared to the previous experiments; perhaps the moderate benefits from scale economies now compel more inefficient firms to leave the industry. The exit rates of domestic firms are, however, moderate at around 2-6 percent. On the other hand, the entry rate in the other remaining sector is also moderate (3.5%). These rates are similar to the exit rates reported by Devarajan and Rodrik (1991) in the case of Cameroon. Our estimates of exit of domestic firms are significantly smaller than the exit of domestic firms reported by Gunasekera and Tyres (1988). They reported high exit rates of 25-47 percent for domestic firms in the case of Korea in response to trade liberalisation[33].

7.4 Welfare and income distribution effects of tariff liberalisation

The concept of efficiency or welfare is the starting point for any policy analysis. Unlike a pure theoretical approach where only an ordinal measure of alternative states are examined, in applied policy analysis some measures of welfare are employed to compare movement from one state to another.

Therefore, in applied policy analysis, generally some monetary representations of individual utility functions are used. This is defined as the amount of money required to attain a level of utility at a reference price vector. This is termed as money metric, and its value is derived from the expenditure function. The expenditure function which is the inverse of the indirect utility function is a vital tool for welfare analysis and allows 'measurement of utility'. Since the value of expenditure function depends on the set of prices used, there are different money metrics one can use. The most

[33] No estimates are available for entry and exit of domestic firms in the manufacturing sectors of Bangladesh. Tybout (1989) and Roberts (1988) reported some estimates of net exit rates for Chile and Columbia, albeit in the absence of policy shocks. On average the net exit rates were around -3 and 6 percent per year in three- digit industries in Chile and Columbia respectively.

widely used ones are compensating variation (CV) and equivalent variation (EV). These are generally used because they have easy interpretation in terms of the compensated demand curves. In the EV approach, the idea is to measure in money terms, how much income needs to be given up to the consumer at the 'pre-policy change' level of prices (P_0) in order to enable him to enjoy the utility level which arises after the policy change is effected ('post-policy change level of utility'). The CV comes from the opposite direction. It measures the change in 'post-policy change' level of prices (P_1) that brings the consumer to the 'pre-policy change' level of utility.

In a many consumer economy, the use of aggregate EV or CV as a measure of welfare changes, although avoiding any explicit Social Welfare Function (SWF), has an implicit SWF because of the adding up approach. Boadway and Bruce (1984) showed that there are some well-known problems in interpreting the aggregate EVs or CVs and one needs to be careful in interpreting the result of such measures. Social ordering requires more data and judgement than does household ordering and it may not be possible to measure changes in welfare simply on the basis of household orderings of social status drawn from their market behaviour[34]. When EV is used as a measure of welfare, it is implicitly assumed that aggregate market behaviour is generated by a single household whose preferences coincide with the social ordering[35].

[34] Social ordering requires more information than household preference orderings as its information base. It also requires some degree of household welfare comparability and measurability. It will also require a method for aggregating individual welfare. Thus the social ordering requires information on comparability, measurability of household welfare as well as a method for aggregating household welfare. On the other hand, household orderings are based on their market behaviour i.e household's income and market prices.

[35] The aggregate EV 'measures' utilities by the money matric and simply adds the utilities together, assuming the constancy of the marginal utility of income. The aggregate EV is like a classical utilitarian social welfare function applied to individuals with constant marginal utility of income. Thus pure redistributive changes do not affect it (Boadway and Bruce, 1984).

7.4.1 Income distribution effects and changes in gross domestic product

Since there are some problems in interpreting aggregate EV or CV as a satisfactory measure of welfare, changes in gross domestic product are used as an index to compare outcomes between different equilibria. Distributional consequences are captured through the changes in income levels of the household groups, changes in factor income and factor returns. Although each household group generates income from different sources, only factor incomes are allowed to change and all other sources of household incomes are held constant in different experiments. Since all factors are perfectly mobile between sectors, changes in welfare between equilibria can be traced through relative factor returns. Therefore, to evaluate the effect of tariff liberalisation on the functional distribution of income (i.e. returns to factors), it should be noted that in the supply side, the changes in the factor returns affect the distribution of factor income between sectors. Given the households' endowment of labour and capital, these shifts in factor income then determine the distribution of income among households. Table 7.5 reports the changes in income of household groups and the gross domestic product in each of the four experiments.

Table 7.5 Percentage Change in Households Income and Gross Domestic Product

Household	Experiments			
Groups	One	Two	Three	Four
Self-employed				
Low Income	-0.05	1.48	1.49	2.76
Middle Income	-0.69	1.41	1.42	2.70
High Income	-1.17	1.43	1.46	2.84
Employee				
Low Income	-0.03	1.49	1.51	2.78
Middle Income	-0.70	1.41	1.42	2.70
High Income	-1.14	1.37	1.41	2.73
GDP	-0.72	1.62	1.65	3.10

It is observed from the Table 7.5 that in the *first experiment*, changes in income are negative for all household groups and GDP growth is negative in this case.

The decline in income is, however, larger for the high income household groups compared with low income household groups. It is noted in the SAM data base that high income household groups generate relatively more income from capital, while labour income accrues relatively more to the low income household groups. Therefore, when capital income changes are larger than the labour income changes, the income of high income household groups changes more than the income of low income household groups. It is observed from Table 7.6 that fall in capital income is taka 3.94 billion which is larger than the labour income decline of taka 0.70 billion. This explains why the fall in income is larger for the high income household groups compared with the low income household groups.

Contrary to the first experiment, income increased for all household groups in the *second experiment* because of positive GDP growth observed in this case. Again the distribution of income appears to favour the low income households under both the self-employed and employee household groups. For example, in the self-employed household group the income increase of low income household is 1.03 times higher than the income increase of high income household. For the employee household group, the income increase of low income household is 1.09 times higher compared with the income rise of the high income household. This degree of progressivity in household's income is a direct consequence of the large increase in labour income (i.e. taka 5.80 billion) in comparison to a moderate increase in capital income (i.e. taka 4.60 billion).

The distribution of income also appears to favour the low income households in the *third experiment*. There is, however, no significant difference in the degree of progressitivity observed between this and the second experiment. This is because the increases in labour and capital income are not significantly different in this case compared with the previous case and hence the degree of progressivity in income distribution is also similar in this case compared with the previous case.

The income increase of all household groups is much more pronounced in the *fourth experiment*. Income increases of all household groups are almost doubled because of relatively large GDP growth in this case compared with the previous two experiments. The income distribution effects are, however, mixed. The distribution of income appears to favour the high income household group in the self-employed household category but in the employee household group the distribution of income favours the low income household group. In contrast to the previous two experiments, the capital income increase is higher in the case. Increase in capital income is taka 10.66 billion and the labour income increase is taka 9.32 billion. Relatively higher capital income increase may explain why the distribution of income favours the self-employed household group.

It is observed that gross domestic product increased when imperfect competition is introduced. This is because resources are pulled away from low factor return (i.e. wages and rental rates) sectors to relatively high factor return sectors. The GDP growth is similar between second and third experiments because the resource allocation patterns are the same. The increase in gross domestic product is much higher with the incorporation of increasing returns to scale. The additional gain emanated from a reduction in unrealised economies of scale. At this point it is relevant to note that almost all trade models reported magnified welfare gains from trade liberalisation when imperfect competition and increasing returns to scale are introduced.

Table 7.6 Changes in Factor Income and Factor Returns

Factor Classification	Experiments One	Two	Three	Four
	Changes in Factor Returns (in %)			
Administrative	-2.88	0.99	0.88	0.64
Service	-2.55	-0.89	-0.93	-0.62
Ag-HL	1.67	1.46	1.67	2.42
Ag-FLSF	1.78	1.31	1.48	2.15
Ag-FLLF	1.74	1.40	1.58	2.34
WSK	-3.32	3.99	3.38	7.68
WSS	-3.24	4.69	3.80	7.99
WUSK	-3.12	4.51	3.55	8.09
Capital	-1.36	1.56	1.65	3.68
	Changes in Factor Income (in billion taka)			
Labour	-0.70	5.80	5.82	9.32
Capital	-3.94	4.60	4.72	10.66

Note: Ag-HL, Ag-FLSF and Ag-FLLF means agricultural hired labour, family labour in small firms and family labour in large firms respectively. Similarly WSK, WSS and WUSK stand for skilled, semi-skilled and unskilled workers respectively.

7.5 Conclusion

In this chapter, alternative computable general equilibrium models have been used to assess the resource allocation, welfare and income distribution effects of tariff liberalisation in Bangladesh. It has been observed that the results of tariff liberalisation are sensitive to the way the model is specified. The main conclusions are:

(i) In the competitive and constant returns to scale model variant, resources moved from heavily protected sector (e.g. manufacturing sector) to less protected sectors as a result of tariff liberalisation. This movement in resources is expected given the initial levels of protection provided to the domestic industries. Protection permits domestic industries to operate with value added higher than that prevails under the free trade thereby providing incentives for the movement of resources into protected industries.

Thus, when such protection is removed, resources tend to move from protected to less protected sectors.

(ii) When imperfect competition is introduced, the pattern of the resource allocation is reversed with heavily protected manufacturing sectors turning out to be the main beneficiary of liberalisation. Almost all the manufacturing sectors show moderate output growth compared with competitive case. The expansion of manufacturing output is due the pro-competitive effects of tariff liberalisation.

(iii) The pattern of sectoral output change is similar between the no-entry experiment (i.e. experiment two) and the free entry experiment (i.e. experiment three). As in the experiment with no entry and exit of domestic firms, all manufacturing sectors show moderate growth in output when firms are allowed to exit and enter domestic industries. The apparently similar resource-allocations effects of tariff liberalisation between these two experiments may be due to small entry and exit of domestic firms and observed high sensitivity between firm-level profits and entry and exit of domestic firms.

(iv) Almost all the manufacturing sectors show much larger output growth with the incorporation of increasing returns to scale. In particular, the increase in output is almost doubled for the machinery, cement and energy sectors. This magnification comes from a reduction in unrealised scale economies in these sectors.

(v) The distribution of income appears to favour the low income households in the first three experiments. The income distribution effects are mixed in the fourth experiment. In this case, the distribution of income appears to favour the high income household group in the self-employed household category but in the employee household category the distribution of income favours the low income household group. It appears that the progressivity and regressivity in income distribution of household groups depend on the relative change of the capital and labour income.

Appendix to chapter seven

Table A7.1 Base and New Level of Relative Price of Imported and Domestic Goods

Sectors	Base Case	Experiments			
	PM_i/PD_i	One	Two	Three	Four
Subsistence Agriculture	1.000	0.983	0.980	0.980	0.964
Commercial Agriculture	1.000	0.998	0.992	0.989	0.978
Forestry	1.000	1.000	1.000	1.000	1.000
Food and Tobacco	1.000	0.845	0.888	0.896	0.884
Clothing	1.000	0.910	0.905	0.912	0.877
Garments	1.000	0.676	0.671	0.672	0.680
Chemical	1.000	0.894	0.903	0.934	0.899
Cement	1.000	0.948	0.945	0.946	0.978
Machinery	1.000	0.919	0.932	0.944	0.954
Other Industries	1.000	0.825	0.834	0.859	0.844
Construction	1.000	1.000	1.000	1.000	1.000
Energy	1.000	0.901	0.925	0.935	0.912
Services	1.000	0.985	0.984	0.981	0.978
Trade and Transport	1.000	1.000	1.000	1.000	1.000

Table A.7.2 Base and New Level of Domestic Price of Exports

Sectors	Base Case	Experiments			
		One	Two	Three	Four
Subsistence Agriculture	1.000	0.997	1.000	1.000	1.004
Commercial Agriculture	1.000	0.998	0.999	0.999	1.002
Forestry	1.000	1.000	1.000	1.000	1.000
Food and Tobacco	1.000	1.011	0.961	0.953	0.955
Clothing	1.000	0.992	0.956	0.950	0.973
Garments	1.000	0.985	0.990	0.989	0.979
Chemical	1.000	0.999	0.969	0.938	0.964
Cement	1.000	1.010	0.952	0.952	0.889
Machinery	1.000	1.025	0.961	0.950	0.932
Other Industries	1.000	1.007	0.960	0.934	0.940
Construction	1.000	1.000	1.000	1.000	1.000
Energy	1.000	1.030	0.874	0.873	0.848
Services	1.000	1.007	1.010	1.011	0.996
Trade and Transport	1.000	1.000	1.000	1.000	1.000

Table A.7.3 Percentage Changes in Producer Price

Sectors	Experiments			
	One	Two	Three	Four
Subsistence Agriculture	-0.63	0.01	-0.01	1.68
Commercial Agriculture	-0.59	0.36	0.63	1.60
Forestry	-1.34	2.45	4.07	11.47
Food and Tobacco	0.95	-1.60	-2.34	-4.24
Clothing	-2.49	-1.16	-1.48	-0.77
Garments	-2.16	-1.17	-1.26	-2.31
Chemical	-1.17	-1.66	-4.82	-2.27
Cement	-2.05	-2.72	-2.03	-10.04
Machinery	-1.41	-3.10	-4.23	-7.05
Other Industries	-1.77	-2.44	-5.01	-4.86
Construction	-3.27	1.17	1.35	1.70
Energy	2.25	-3.27	-5.85	-14.56
Services	0.97	-1.60	-1.86	-0.32
Trade and Transport	-2.11	-7.62	-8.50	-6.73

Chapter Eight

Summary and Conclusion

8.1 Areas for improvements and extensions

Different variants of the computable general equilibrium models developed in this study are calibrated to Bangladesh economic data for 1988/89. The economy of Bangladesh is numerically specified within the framework of a social accounting matrix. It shows the major macroeconomic relations in a detailed framework and provides a consistent macroeconomic data set for policy modelling. Every effort has been made to use best available information to compile the social accounting matrix. However, it appears that the procedures used to distribute labour income and unincorporated capital income among the six household groups may not be the most appropriate methods.

The available information on percentage of earners by four major factors and the 16 HES income groups and the derived estimates of number of earners by factors are used to distribute labour income by the six household groups. A more desirable approach would be to use the direct estimates of labour income by the HES income groups or the household groups. However this information is not available for all the eight labour factors. Therefore, the above procedure is adopted to derive labour by the six household groups. Similarly, the procedure used to distribute unincorporated capital income among the six household groups may not be the most appropriate one. Again a more desirable method would be to use the direct estimates of capital income by the HES income groups or the household groups. However this information is not available in Bangladesh. Due to lack of such data, average monthly incomes of each household by the HES income groups are used to perform this distribution.

More research needs to be undertaken to improve this aspect of the SAM by generating direct estimates of labour and capital income by the HES income groups. One potential area for extension of the present SAM is the disaggregation of the consolidated capital account. In the present SAM one consolidated capital account is specified to capture the flow of savings and investment by institutions and sectors. To show the flow-of-funds between different financial institutions the consolidated capital account needs to be presented in more detail. Specifically the consolidated capital account transactions may be disaggregated between the major capital account institutions. These are non-financial enterprises, central bank, other monetary institutions, other credit institutions, insurance companies, government, local authorities, households, and rest of the world. The disaggregated capital account will show the consolidated balance between total savings and total investment, with sectoral exposition of the flow-of-funds. The accounts will depict how savings are allocated to investment within the sector and how the difference will be transferred to other sector directly or through the intermediation of financial institutions. The disaggregated capital account will show the financial transactions between institutions, accumulation and formation of capital and their linkages with rest of the economy. This information will be particularly useful to analyse the economy wide effects of financial sector reforms.

The parameter estimates used to specify the computable general equilibrium models such as the substitution elasticities between factors, elasticities of substitution between imported and domestic goods are not the actual estimates for Bangladesh. Ideally, these parameters should be estimated econometrically. However, such estimates are not available for Bangladesh nor it was possible to estimates these key parameters econometrically within the purview of the present study. Thus these parameters are obtained from available literature to calibrate the models. This is one area where more research may be conducted to estimate them econometrically.

The specification of market structure variables and increasing returns to scale involves estimation of marginal costs, the number of domestic firms in each industry, the market demand elasticity for the domestic goods and scale elasticity for the non-competitive sectors. It is desirable to use econometrically estimated values of these variables and parameters. Again no such estimates are available in Bangladesh nor it was possible to estimates these variables and parameters econometrically due to paucity of relevant data. Therefore, a calibration procedure is used to estimate them. This is another area where research may be undertaken to estimate some of the above market structure variables such as marginal cost, the market demand elasticities and the scale elasticities.

The core CGE model is static, with economywide capital stock fixed exogenously. Within the single period, the model does generate savings, investment, and the demand for capital goods. The capital goods are installed during the period, so the investment simply denotes a demand category with no effects on supply in the model. Hence, heterogeneity of capital is of limited importance in the static model, since its only effect will emerge through its impact on the sectoral structure on investment final demand. In a longer term and in dynamic models, the heterogeneity and endogeneity of investment and capital can be very important and may have different affects compared with models where they are treated to be fixed and exogenous. Thus this is another area where research may undertaken to make investment and capital endogenous and to quantify their impact compared to a static specification.

8.2 Achievements and summary of major findings

An important achievement of this study is the compilation of a social accounting matrix for Bangladesh for 1988/89. Such a framework is particularly useful for a country like Bangladesh with conflicting data sources. The compilation exercise integrates different data sources in a detailed framework to show the major macroeconomic relations in Bangladesh and provide a consistent macroeconomic data set for policy modelling. The methodology and statistical procedures used to compile the SAM are also discussed in detail. This exercise thus provides a useful framework to generate and extend future social accounting matrices in Bangladesh.

Government of Bangladesh introduced a consumption-type and destination principle based value added tax in 1991. It is generally argued that a single rate VAT with zero rate limited only to exports would be regressive. Thus another purpose of the study is to examine the distributional consequence of the VAT system that has been adopted in Bangladesh.

Analysis of incidence of the indirect tax system is based on two approaches: a simple approach and a computable general approach. One surprising finding of this exercise is that there are no significant differences in the indirect tax incidence estimates observed between the simple and CGE approaches. Both approaches indicate that because of exemptions on subsistence agricultural products, and because of the progressive structure of the tariffs, the overall indirect tax system would continue to remain progressive even after the introduction of a single rate VAT.

Another important observation is that the introduction of revenue-neutral uniform VAT is likely to make the overall indirect tax system less progressive than the degree of progessivity observed under the pre-VAT system although the impact is small.

It is also observed that the results of our CGE model are significantly different from the results reported by Chowdhury and thereby tend to refute his claims that a VAT system would be detrimental to overall production and consumption in Bangladesh.

The relation between market structure variables and the profitability in manufacturing sector of Bangladesh is also examined in this study. The purpose of this exercise is to provide some empirical evidence on the relation between industrial structure and profitability and to assess the importance of foreign and domestic factors on industry profitability.

The results of this exercise support the theoretical and empirical observations that profitability are significantly related to the concentration levels in manufacturing sector in Bangladesh. Another important finding is that foreign competition variables play a significant role in affecting profitability in domestic industries. The result also supports the observations that the profitability are higher in those industries where concentration levels are high and imports shares are low and effective tariff rates are high.

As mentioned earlier, one of the objectives of this study is to examine resource allocation, welfare and income distribution effects of tariff liberalisation in Bangladesh within the paradigm of both the traditional and new trade theories. Towards this end an alternative model of the Bangladesh economy is developed to analyse the effects of tariff liberalisation on resource allocation and income distribution under both competitive and non-competitive assumptions.

It has been observed that the results of tariff liberalisation are sensitive to the way the model is specified. It is observed that in the competitive and constant returns to scale model variant, resources moved from the heavily protected sectors (e.g. manufacturing sectors) to less protected sectors as a result of tariff liberalisation. This movement of resources is expected given the initial levels of protection provided to the domestic industries. Protection permits domestic industries to operate with value added higher than that prevails under free trade thereby providing incentives for the movement of resources to protected industries. Thus, when such protection is removed, resources tend to move from protected to less protected sectors.

When imperfect competition is introduced heavily protected manufacturing sectors turning out to be the main beneficiary of liberalisation. Almost all the manufacturing sectors show moderate output growth when imperfect competition is introduced. Expansion of manufacturing output appears to come from the pro-competitive effects of tariff liberalisation. That is, by allowing flow of imports in the domestic markets tariff liberalisation reduced market power of domestic firms and compels them to behave competitively. That is, it reduces gap between prices and the marginal cost and expands output.

It is also interesting to note that almost all the manufacturing sectors show much larger output growth with the incorporation of increasing returns to scale. The larger expansion of output of manufacturing sectors is due to a reduction in unrealised scale economies. This is reflected in a decline of the scale elasticity in these sectors. The fall in scale elasticity implies a reduction in unit cost as the scale of production increased.

The income distribution effects of tariff liberalisation are also examined. The distributional consequences are captured through the changes in income levels of the six household groups. The distribution of income appears to favour low income households. It also appears that the progressivity and regressivity in income distribution of household groups depend on the relative change of capital and labour income.

The results of the present study cannot be called definitive because of the use of parameters values that are obtained from the available literature and because of inevitable divergence between the situational reality and the ways models are specified. However, studies of the present kind can provide useful and important insights for policy analysis and provide broad guidelines for actual policy-making in developing counties like Bangladesh.

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