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The Macroeconomic, Industrial and Distributional Effects of Removing Tariffs in Bangladesh

by

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ABSTRACT

This paper examines the economic effects of removing tariffs in Bangladesh using a computable general equilibrium (CGE) modelling approach. The results of the simulations indicate that in the short-run a funded tariff cut with fixed real national savings would increase employment slightly and hence would expand GDP. There would be a small economy-wide welfare gain as measured by real consumption. The sectoral results showed that export-oriented industries would experience an expansion in output and employment. There also would be positive effects on the suppliers to these industries. Lightly-protected industries, which rely heavily on imported intermediate inputs, are projected to show robust expansion as they would benefit from a cost reduction. However, highly-protected, import-competing industries would suffer a contraction in output and employment as they would face increased competition from imports due to the removal of tariffs. The simulation results also indicate that there would have some noticeable effects on the distribution of real consumption between different household groups. Overall, urban households would experience an expansion in real consumption and rural households would suffer a contraction as a consequence of the funded tariff cut with fixed real national savings.

Key words: CGE model, trade liberalisation, income distribution, Bangladesh.

JEL classification codes: C68, F13, O15

LIST OF ABBREVIATIONS

APC	Average Propensity to Consume
BOTE	Back-of-the-envelope
CES	Constant Elasticity of Substitution
CET	Constant Elasticity of Transformation
CGE	Computable General Equilibrium
CIRDAP	Centre on Intergraded Rural Development for Asia and the Pacific
CPI	Consumer Price Index
EPZ	Export Processing Zone
GDP	Gross Domestic Product
GEMPACK	General Equilibrium Modelling PACKage
GOB	Government of Bangladesh
GOS	Gross Operating Surplus
HS	Harmonised System
IO	Input Output
LES	Linear Expenditure System
NIP	New Industrial Policy (of 1982)
QR	Quantitative Restriction
RHS	Right Hand Side
RIP	Revised Industrial Policy (of 1986)
RMG	Readymade Garments
ROR	Rate of Return (on investment)
SAM	Social Accounting Matrix
SAP	Structural Adjustment Programme
TCF	Textile, Footwear and Clothing
USITC	United States International Trade Commission
WCO	World Customs Organization

NOTES

(i)	BAORANI refers to CGE model of Bangladesh
(ii)	ORANI refers to Australian CGE model
(iii)	Taka (Tk.) refers to Bangladeshi currency (exchange rate was US$ 1 = Tk. 50.31 in 1999-2000, GOB: 2003c).

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1. INTRODUCTION

There is support for the view that trade liberalisation, or decline in protection, leads to faster economic growth and poverty reduction in poor countries (Dollar and Kraay, 2001; World Bank, 2002). On the other hand, there are also studies that express pessimism and find little evidence to support a link between trade liberalisation and economic growth (Grossman and Helpman, 1991; and Rodriguez and Rodrik, 2000). Yanikkaya (2002) examines the relationship between import duties and growth for 80 developed and developing countries including Bangladesh over the period of 1970–1997 and shows that trade barriers in the form of tariffs can actually be beneficial for economic growth, especially for developing countries. The trade reform in Bangladesh has been widely analysed in different studies (Ahammad, 1995; CIRDAP, 2000; Lewis, 1990; Mujeri and Khondker, 2002; and Noman, 2002). They all conclude that trade reform in Bangladesh would expand its economy. Yet there are other studies that argue the opposite, namely that domestic trade reform in Bangladesh would contract the economy (Annabi et al., 2006; Chowdhury, 1989; Khan, 2000 & 1996; Khondker and Raihan, 2004; and Salim, 1998).

In view of the above paradoxical findings, it may be worthwhile to re-examine the relationship between trade liberalisation and economic performance in the context of Bangladesh, where trade policies were dramatically liberalised in the early 1990s. The main objective of this paper, therefore, is to examine the economic effects of removing tariffs in Bangladesh using a large-scale comparative-static computable general equilibrium (CGE) model. CGE models, because of their computational rigour and extensive analytical capability, have become a popular policy-analysis technique in the examination of the economy-wide effects of policy changes. Over the last two decades, CGE models have been applied increasingly to the problems of trade and investment policy, tax policy, structural adjustment and agricultural policy in both developed and developing countries[1].

[1] Major review articles of CGE models and applications include Shoven and Whalley (1984), Pereira and Shoven (1988) and Powell and Lawson (1990). For major reviews of CGE models used in development policy analysis, see Decaluwe and Martens (1988), de Melo (1988) and Bandara (1991).

The remainder of the paper is organised as follows. Section 2 presents an overview of trade policy reforms in Bangladesh. Then the theoretical structure of the Bangladesh CGE model and the database are briefly described in Section 3. Section 4 provides a description of the simulations that are carried out to investigate the economic effects of trade liberalisation in Bangladesh. The results for macroeconomic variables and for output and employment by sector, as well as the results for household consumption are presented in Section 5. Finally Section 6 provides concluding comments.

2. TRADE POLICY REFORMS IN BANGLADESH: AN OVERVIEW

After gaining independence in 1971, Bangladesh, like other South Asian neighbours, adopted an inward looking import-substitution growth strategy. This was supported by a number of protective and concessionary measures, namely, quantitative restrictions, restricted import licensing, differentiated and high rates of nominal tariffs, an overvalued domestic currency and subsidised loans to traded goods sectors. These distorted incentives led to allocative and productive inefficiencies and created an anti-export bias. As a result, the economy experienced a low growth rate: GDP only grew at an average annual rate of 2.5 percent between 1970 and 1980 (World Bank, 1991). This prompted policy makers to introduce reforms towards a free market economy and export-led industrialisation in the early 1980s. Since then the liberalisation policies adopted by Bangladesh have passed through three phases[2].

The first rigorous effort aimed at reforming the previous import-substitution trade and investment regime was undertaken in the early 1980s with the introduction of the New Industrial Policy of 1982 (NIP-82). The primary objective of NIP-82 was to encourage greater participation of the private sector in the industrialisation of the country. This phase of reform covering the period between 1981-82 to 1985-86 saw a number of important initiatives towards liberalisation of the economy, namely, a move from the positive (allowable commodities) list of import control to a negative (commodities not allowed to be imported) list, reduction in the number of commodities which were not allowed to be imported, expansion of export

[2] A detailed discussion on the trade policy reform in Bangladesh can be found in the World Bank (1996) document: *Bangladesh – Trade Policy Reform for Improving the Incentive Regime*.

performance benefits, and institution of duty drawback facilities to encourage export sectors.

Table 1: Number of 4-digit HS Codes Subject to Quantitative Restrictions (QRs)[3]

Year	Total	Trade reasons			Non-trade reasons
		Banned	Restricted	Mixed	
1985-86	478	275	138	16	49
1986-87	550	252	151	86	61
1987-88	529	257	133	79	60
1988-89	433	165	89	101	78
1989-90	315	135	66	52	62
1990-91	239	93	47	39	60
1991-92	193	78	34	25	56
1992-93	93	13	12	14	54
1993-94	109	7	19	14	69
1995-97	120	5	6	17	92
1997-02	124	5	6	17	96

Source: Data for the year 1985-86 to 1993-94 are from Rahman and Bhattacharya (2000) p. 5 and data for the year 1995-97 and 1997-2002 are from Fontana et al. (2001) p. 25.

The second phase was launched in 1986 to match with the Revised Industrial Policy (RIP-86) and covered the period between 1986-87 and 1990-91. During this phase there was a substantial reduction in quantitative restrictions (QRs)[4] on imports. The total number of QRs came down from 478 to 239 between 1985-86 and 1990-91 (Table 1). Moreover, during this phase, a significant reduction in the anti-export bias was achieved through rationalisation of tariffs as well as through the introduction of a scheme of incentives for export-oriented activities. The export incentives provided include zero-tariff on imported inputs and special support for economic activities in export processing zones (EPZs).

The third phase of the reforms, introduced in 1991-92, was the most comprehensive compared to the reforms of the earlier two phases. This phase, in fact, overlapped with the Structural Adjustment Programme (SAP) which was being implemented in Bangladesh over the same period of time. The SAP brought about important and

[3] The Harmonized Commodity Description and Coding System, or simply "HS Code", is a system for classifying goods in international trade developed by the World Customs Organization (WCO). For details visit its website at <http://www.wcoomd.org/ie/En/en.html>.

[4] Quantitative restrictions (QRs) are specific limits imposed by countries on the quantity or value of goods that can be imported or exported. They can be in the form of a quota, a monopoly or any other quantitative means. In other words, QRs refer to non-tariff measures, which are taken to regulate or prohibit international trade.

profound reforms in trade, investment, fiscal, financial and institutional policies in Bangladesh to achieve a greater openness of the economy. During the 1990s, QRs and average tariff rates were dramatically reduced. For example, the total number of QRs for trade reasons came down from 179 to only 28 between 1990-91 and 1997-02 (Table 1), and the import-weighted average tariff rate was reduced from 23.6 percent in 1992-93 to 9.7 percent in 2001-02 (Table 2).

Table 2: Trend of Average Tariff Rates (percent)

Year	Unweighted average	Import-weighted average
1992-93	47.4	23.6
1993-94	36.0	24.1
1994-95	25.9	20.8
1995-96	22.3	17.0
1996-97	21.5	18.0
1997-98	20.7	16.0
1998-99	20.3	14.1
1999-00	19.5	13.8
2000-01	18.6	15.1
2001-02	17.1	9.7

Source: GOB (2003c) p. 51.

Table 3: Degree of International Openness for Bangladesh, Pakistan, Sri Lanka and India

		1990	1995	2000
Bangladesh	Export propensity	8.3	14.2	17.5
	Import penetration	16.7	20.8	23.0
	Trade ratio	26.7	36.6	42.1
Pakistan	Export propensity	14.8	16.7	16.2
	Import penetration	19.2	18.9	17.9
	Trade ratio	35.1	36.1	34.5
Sri Lanka	Export propensity	30.2	35.6	39.1
	Import penetration	35.3	41.7	44.9
	Trade ratio	68.2	81.6	88.8
India	Export propensity	7.1	11.1	n.a.
	Import penetration	8.4	12.1	n.a.
	Trade ratio	15.7	23.3	19.4

Notes: (i) Export propensity: (Exports of goods and services)/GDP*100.

(ii) Import penetration: (Imports of goods and services)/(GDP plus trade surplus or minus trade deficit)*100.

(iii) Trade ratio: (Exports of goods and services + imports of goods and services)/GDP*100.

(iv) n.a. refers to not available.

Source: GOB (2003c) p. 55.

Table 3 shows the changes in the degree of international openness of Bangladesh, Pakistan, Sri Lanka and India during 1990-2000. It may be noted that in 1990 Sri Lanka was the most open economy according to the three measurements of international openness, namely, export propensity, import penetration and trade ratio, Pakistan was the second, Bangladesh placed third and India was the least open economy. Sri Lanka continued to remain the most open economy in 2000 while Bangladesh moved to the second place. It may further be noted that in Bangladesh, openness took place at a considerably faster rate during 1990-2000 than for its neighbours. As a result, Bangladesh became one of the most open economies in the South Asian region.

3. THEORETICAL STRUCTURE OF THE BANGLADESH CGE MODEL

The theoretical structure of the core CGE model of the Bangladesh economy (called BAORANI[5]) used in this paper is based closely on ORANI, a CGE model of Australian economy (Dixon *et al*., 1982). The main extension of ORANI's theoretical structure for BAORANI is the incorporation of multiple households in the same manner as employed by Horridge *et al.* (1995) for their CGE model of South Africa. A complete description including the theoretical structure of the BAORANI model is provided in Hoque (2006). BAORANI, like ORANI, is a single country comparative-static CGE model. It consists of 86 industries, 94 commodities and three primary factors of production: labour, capital and land. Its main characteristics are listed below:

Production structure

Producers are assumed to be price takers who choose their inputs to minimise the cost of producing any given level of output subject to a constant return to scale nested Leontief/constant elasticity of substitution (CES) production functions. CES functions allow substitution between: imported and domestic inputs; labour, capital and land; and occupations. Production functions are assumed to be weakly separable. No substitution is allowed between primary factors and intermediate inputs or between intermediate inputs of different classes. Substitution between imported and domestic

[5] The name of the model is inclusive of the Australian model 'ORANI' to which is added 'BA' for Bangladesh. It is a coincidence that the title of the new model also is the name of the researcher's home village.

inputs is modelled using Armington elasticities i.e. the Armington (1969) assumption that imports are imperfect substitutes for domestic supplies is adopted. Each industry is allowed to produce a mixture of all commodities which are combined according to a constant elasticity of transformation (CET) function. Labour is disaggregated into eight groups according to gender and level of education (for type of labour see Appendix B). Appendix A illustrates the structure of production.

Investment demands

Investors are assumed to be price takers who minimise the cost of creating units of physical capital subject to nested CES production functions. Aggregate investment is normally exogenous, but its industrial composition depends on the relative rates of return across industries.

Household demands

The representative household is assumed to maximise a nested Klein-Rubin/CES utility function (Klein and Rubin, 1947-1948) subject to its aggregate budget constraints. Substitution is allowed between commodities and between sources of commodities using a nested Linear Expenditure System (LES)-CES demand system. Household sector is disaggregated into nine groups in accordance with the following criteria: (i) regional differences, i.e. urban and rural households; (ii) educational level of the head of the household; and (iii) access to productive forms of material wealth particularly, agricultural land (for type of household see Appendix C).

Export demands

Export demands are modelled by dividing all commodities into two groups: traditional and non-traditional. For an individual traditional export commodity, foreign demand is inversely related to that commodity's price and for the remaining collective non-traditional export commodities; foreign demand is inversely related to the average price of all collective export commodities.

Government demands

The level and composition of government consumption is exogenously determined.

Prices

Zero-pure-profit conditions and constant returns to scale imply that basic values of outputs are functions only of input prices. Basic prices of imports are the landed-duty-paid domestic currency prices. Purchasers' prices are the sum of basic prices, sales taxes, and trade and transport margins.

Market clearing

Commodity markets are assumed to be cleared. A common short-run assumption that real wage rates are fixed with labour in excess supply is adopted.

Identities defining macro variables

The model includes a number of identities defining macroeconomic variables (e.g. GDP, the trade balance, price indexes) as explicit aggregates of their microeconomic components.

The model is solved using the GEMPACK (General Equilibrium Modelling PACKage) software, developed by the Centre of Policy Studies and the Impact Project, Monash University (Harrison and Pearson, 1996). A CGE database for the model is constructed using information from the 2000 input output (IO) tables and from the 1993-94 and 2000 Social Accounting Matrix (SAM) for Bangladesh[6]. The elasticity estimates used in the model are assigned on the basis of literature reviews.

4. DETAILS OF THE SIMULATIONS

4.1 Closures

A set of three simulation experiments, removing all tariffs for the fiscal year 1999-2000, are carried out to assess the short-run economic impact of tariff removal on macroeconomic indicators, sectoral output and employment, as well as the impact on household consumption in Bangladesh. The base-year (1999-2000) and simulation-experiment values of the tariff rates for the all 94 commodities are presented in Table E.1 located in Appendix E. The features of the closures specific to individual simulation are given in Table 4. The key assumptions common to all simulations are:

[6] Both 2000 IO tables and 2000 SAM for Bangladesh are supplied by the Sustainable Human Development Unit, Planning Commission, Ministry of Planning, Government of Bangladesh, Dhaka (GOB, 2003a and 2003b) and the 1993-94 SAM is from Fontana and Wobst (2001).

- the simulation relates to the short run - current capital stocks in each industry are held fixed, with rates of return to capital adjusting endogenously;
- real wage rates (CPI-deflated) are held fixed, with employment adjusting in each industry;
- real domestic absorption is endogenous – real household consumption moves with real disposable income, real private investment links to current profits, and real government demands are held fixed;
- the ratio of nominal trade balance and nominal GDP is endogenous;
- the policy has no effect on technology and consumer preferences; and
- finally, the nominal exchange rate is the numeraire.

Table 4: Simulation Specific Features of Closures

Simulation	Description
Simulation 1 (unfunded)	All tax rates are exogenous (no constraint on government borrowing); APC (average propensity to consume) is exogenous; and Real national saving is endogenous.
Simulation 2 (funded)	Across-the-board adjustment in tax rates to maintain government budget neutrality (no change in government borrowing); APC (average propensity to consume) is exogenous; and Real national saving is endogenous.
Simulation 3 (funded)	Across-the-board adjustment in tax rates to maintain government budget neutrality (no change in government borrowing); APC (average propensity to consume) is endogenous; and Real national saving is exogenous.

The constraints that our choice of assumptions place on the economy are important in determining relative price changes and therefore the responses of agents to the effects of removing tariffs in Bangladesh. Figures 1, 2 and 3 present schematic representation of the short-run macroeconomic environment for simulations 1, 2 and 3 respectively. In these figures, exogenous variables are depicted in rectangles and endogenous variables are depicted in ovals. The arrows indicate direction of causation between variables. In the first figure (Figure 1), on the supply-side of the macro economy, we have exogenised the capital stock, technology and the real wage. On the demand-side, real government expenditure is held fixed, leaving aggregate real private

consumption, investment and trade balance as endogenous in the national income identity. Note that we have assumed real private consumption is linked to real disposable income for each household type. We also assume real private investment in each industry is a function of current profits (net rate of return).

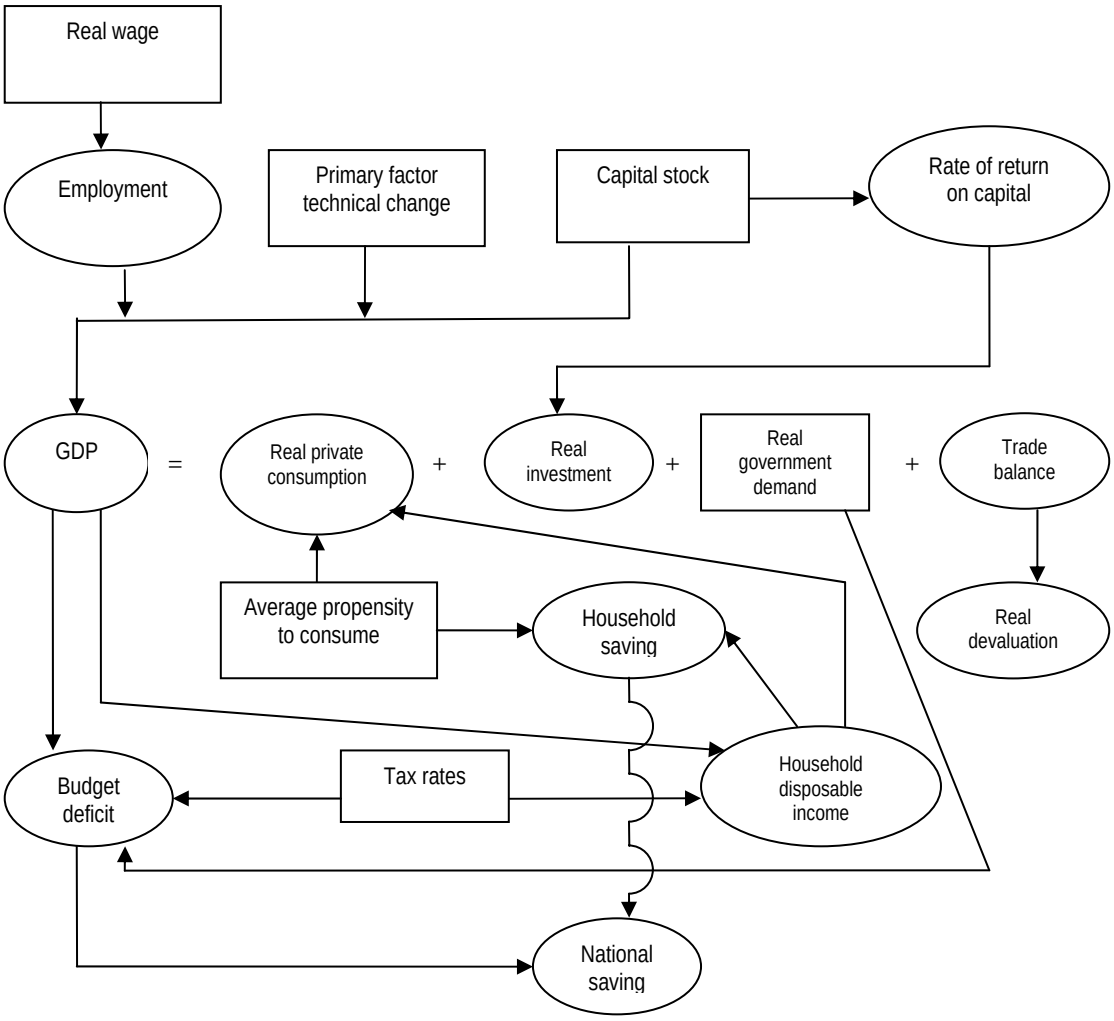


Figure 1: Schematic Representation of the Macroeconomic Environment for Simulation 1

Figure 2 presents a schematic representation of the short-run macroeconomic environment for simulation 2. This figure differs from Figure 1 in the following ways. While the government budget deficit was shown in an oval in Figure 1, it is shown in a rectangle in Figure 2. This indicates a switch from endogenous treatment of the budget deficit in simulation 1 to exogenous treatment in simulation 2. Moreover, tax rates are endogenous in Figure 2 compared to exogenous in Figure 1.

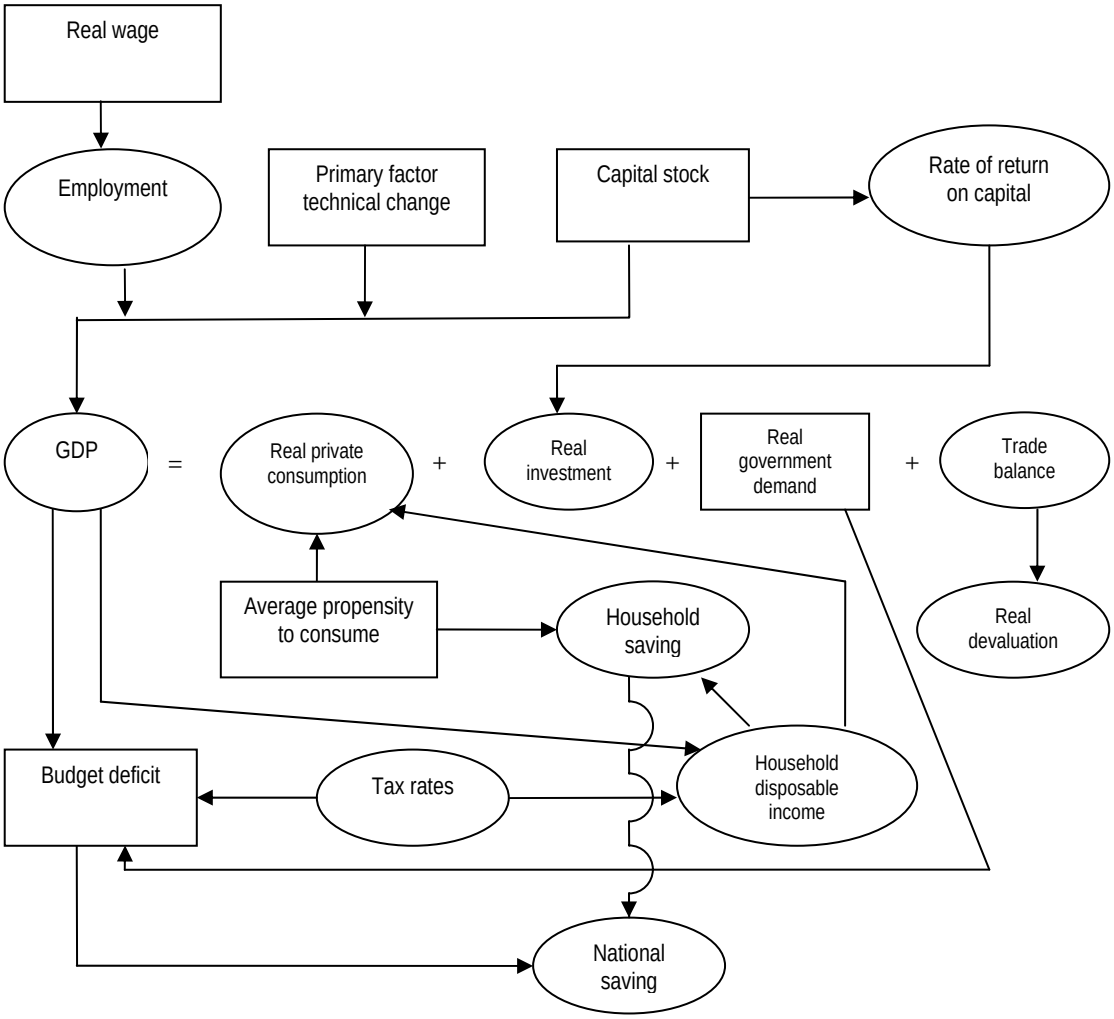


Figure 2: Schematic Representation of the Macroeconomic Environment for Simulation 2

The schematic representation of the short-run macroeconomic environment for simulation 3 is presented in Figure 3. Like previous two figures, in this figure, on the supply-side of the macro-economy we have exogenised the capital stock, technology and the real wage. On the demand-side, real government expenditure is held fixed, leaving aggregate real private consumption, investment and trade balance as endogenous in the national income identity. Figure 3, however, differs from that of Figures 1 and 2 in a number of ways. One of the key distinctions is that while average propensity to consume (APC) is endogenous in Figure 3, it is held fixed in Figures 1 and 2. Correspondingly national saving is exogenous in Figure 3 whereas it is endogenous in the other two figures. By assuming the real national savings constant, we are allowing Bangladeshis to hold the same amount of capital or in other words

forcing them to buy the same amount of capital before and after the policy change. Accordingly, we assume that any change in investment is due to foreign investment. Because in this simulation the Bangladeshis will own the same amount of capital in the future with the policy as without the policy, we can interpret the deviation in consumption in this simulation as the welfare effect of the policy.

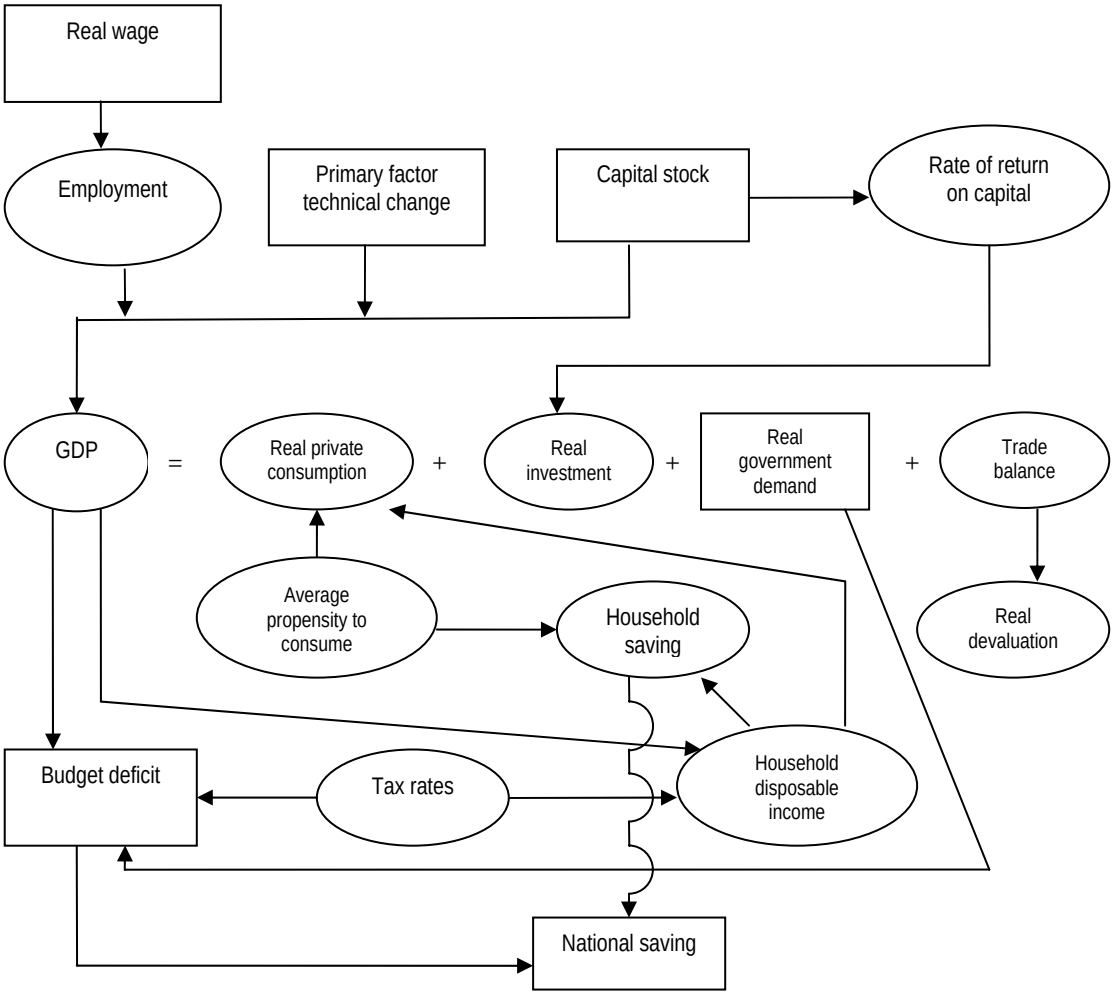


Figure 3: Schematic Representation of the Macroeconomic Environment for Simulation 3

5. SIMULATION RESULTS

5.1 Macroeconomic Effects

The results for key macroeconomic variables from simulations 1, 2 and 3 are shown in Table 5. Before discussing these results, it is important to comment on the way in which the results are presented. The first column of Table 5 is the effects resulting

from the removal of tariffs prior to any adjustment that is made in domestic indirect or direct tax rates to bridge the deficit in government revenue. The second column is the effects of an increase in across-the-board tax rates to maintain neutrality of government revenue. The effects resulting from the real national savings are shown in column 3 of Table 5. The fourth column is merely the sum of first, second and third columns. In the subsequent section, our discussion focuses on the primary effects of removing tariffs (Table 5, column 1). Then we will look at the other effects.

Table 5: Macroeconomic Impact of Removing Tariffs

Main macro variables	Primary effects of removing tariffs (**1**)	Effects of general tax increase (**2**)	Effects of national savings (**3**)	Total effects (**4**)
Real investment expenditure	2.439	-2.937	0.098	-0.400
Real household consumption	2.774	-2.909	0.168	0.033
Real government demands	0	0	0	0
Export volume index	-10.691	15.832	-1.061	4.080
Import volume index	5.493	-3.262	0.145	2.376
Real GDP	0.404	-0.270	-0.019	0.115
Aggregate capital stock	0	0	0	0
GDP price index	6.079	-8.325	0.447	-1.799
GDP at factor cost deflator	7.964	-10.190	0.465	-1.761
Aggregate employment	0.495	-0.392	-0.057	0.046
Investment price index	8.029	-10.810	0.526	-2.255
Consumer price index	5.277	-7.328	0.414	-1.637
Exports price index	0.678	-0.955	0.059	-0.218
Real devaluation	-5.730	8.028	-0.466	1.832
Average capital and land rental	10.094	-12.458	0.505	-1.859
Average nominal wage	5.277	-7.328	0.414	-1.637
Average real wage	0	0	0	0
Terms of trade	0.678	-0.955	0.059	-0.218
Real national saving	-15.254	16.552	-1.298	0
Average propensity to consume	0	0	0.140	0.140
(Nominal BOT)/(nominal GDP)*	-0.019	0.022	-0.002	0.001
Contribution of BOT to real GDP*	-2.228	2.575	-0.167	0.180
Government budget deficit**	-34,691	34,691	0	0

Note: Variables with (* and **) asterisk are in ordinary changes, variable with (**) asterisk in million Taka and all other macro results are percentage changes.

5.2 Macroeconomic Effects of Removing Tariffs: Unfunded

The first column in Table 5 shows the primary effects resulting from the removal of tariffs without maintaining neutrality of government revenue. As an aid to understanding the macroeconomic results (GDP, aggregate capital stock and

aggregate employment) we develop a small back-of-the-envelope (bote) model. A more detailed back-of-the-envelope explanation of economy-wide tariff cut results is supplied in Appendix F. From the supply-side of the macro-economy GDP identity is

$$GDP = A * F(K, L) \tag{0.1}$$

where A is technological-change variable (a 10 percent increase in A means that a given level of output can be produced with 10 percent less capital and labour). We assume that labour earns the value of its marginal product so that

$$W = A * \frac{\partial F}{\partial L}\left(\frac{K}{L}\right) * P_g , \tag{0.2}$$

or

$$A * \frac{\partial F}{\partial L}\left(\frac{K}{L}\right) = \frac{W}{P_g} \tag{0.3}$$

where W is the wage rate and P_g is the GDP price deflator. We assume that the only difference between consumer prices and basic prices are taxes so that

$$P_c = P_g * T \tag{0.4}$$

where P_c is the consumer price index and T is the power of tax (the power of a tax is one plus the *ad valorem* rate). From equations (0.3) and (0.4) we obtain

$$A * \frac{\partial F}{\partial L}\left(\frac{K}{L}\right) = \frac{W}{P_c} * T \tag{0.5}$$

Now our simulation involves removal of tariffs i.e. a lowering of T. With no change in the real wage rate $\left(\frac{W}{P_c}\right)$ and the technological variable A, it follows from the equation (0.5) that a lowering of T implies a fall in $\partial F/\partial L$. Since $\partial F/\partial L$ is an increasing function of K/L, with K fixed, a fall in $\partial F/\partial L$ requires an increase in L. Hence, from our bote model combined with our assumptions of no changes in technology, capital stock and real wage rate we would expect an increase in the aggregate level of employment (L) and consequently an increase in GDP.

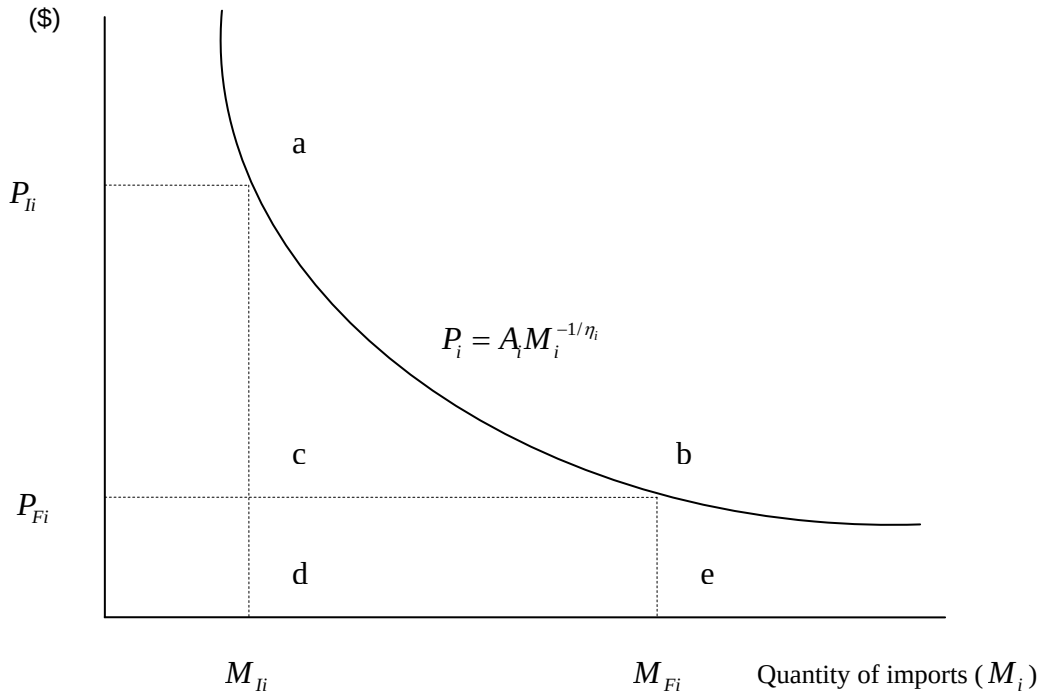


Figure 4: Efficiency Gain from Removal of Tariffs on Commodity i

In line with expectations from the bote model, our simulation results in column 1 of Table 5 show that the aggregate level of employment increases by 0.495 percent and hence real GDP increases (by 0.404 percent). On the basis of the employment result, we would expect an increase in GDP of about 0.219 percent (the labour share of GDP times the percentage increase in employment, 0.442*0.495). Part of the additional gain in GDP is provided by the efficiency triangles[7] and these can be calculated as

$$\text{efficiency triangles} = \sum_i \left[\int_{M_{Ii}}^{M_{Fi}} A_i * M_i^{-1/\eta_i} dM_i - \left(M_{Fi} - M_{Ii} \right) * P_{Fi} \right] \qquad (0.6)$$

In equation (0.6)

M_{Ii} and M_{Fi} are the initial and final quantities of imports of commodity i, that is the quantities before and after the removal of tariffs;

P_{Fi} is the final landed-duty-paid price of imported commodity i, which is also the final c.i.f. prices; and

A_i and η_i are positive parameters in the import demand curve for commodity i which is estimated by

$$P_i = A_i * M_i^{-1/\eta_i}, \qquad (0.7)$$

[7] This explanation is given in Dixon et al. (2005).

where

P_i is the landed-duty-paid price of imported commodity i.

Using Figure 5.3, equation (0.6) gives the area abc as the efficiency gain (the effect on GDP) from the elimination of the tariff for commodity i. To estimate abc we require values for A_i, η_i, P_{Ii}, P_{Fi}, M_{Ii} and M_{Fi}.

The values of A_i and η_i are selected in such a way so that the demand curve, DD in Figure 5.3, passes through the initial and final price-quantity points. Dixon et al (2005) assume without loss of generality that P_{Fi} equals 1 for all i and P_{Ii} equals $1+T_i/100$ where the T_is are the tariff rates. The base-year (1999-2000) tariff rates (T_i) for Bangladesh are shown in column 3 of Table 5.10. The initial quantity of imports (M_{Ii}) is the c.i.f. value of imports of commodity i shown in column 1 of Table 5.10. The final quantity (M_{Fi}) imports of commodity i is obtained from M_{Ii} and the percentage changes in imports of commodity i shown in column 5 of Table 5.10.

Given the demand parameters (A_i, η_i) and prices and quantities (P_{Ii}, P_{Fi}, M_{Ii}, M_{Fi}) as explained above, the right-hand side (RHS) of equation (0.6) gives Taka (hereafter, Tk.) 2,505 million or 0.103 percent of GDP. Our bote calculations for the employment effect (0.219 percent of GDP) and the efficiency effect (0.103 percent of GDP) suggest 0.322 percent increase in GDP.

The difference (0.082 percent) between bote calculations result and the BAORANI result is due to indirect tax occurring on imports. Overall, in Bangladesh, indirect taxes or sales taxes occur on imports are greater than tariffs. For example, the value of indirect taxes on imported basic chemicals in the BAORANI database is Tk. 4,235 million compared to the tariffs amount of only Tk. 521 million collected on the same goods. Likewise, the volume of indirect taxes on imports and tariffs, respectively, for petroleum product are Tk. 12,807 million and Tk. 9,454 million, transport equipment (Tk. 4,143 million and Tk. 1,852 million), machinery (Tk. 6,467 million and Tk. 4,570 million) and cement (Tk. 3,053 million and Tk. 1,003 million). Thus

stimulation of imports increases GDP for two reasons. The first, captured in equation (0.6), is the tariff wedge. This makes imported goods more valuable to Bangladesh is than the cost (via exporting) of generating them. The second is the indirect tax wedge which has an additional effect on GDP of the same type.

The removal of tariffs has positive effects on investment (real investment increases by about 2.44 percent). To explain this investment result we again develop a small bote model. Assume that capital earns the value of its marginal product so using equation (0.1) we get

$$Q = A * \frac{\partial F}{\partial K}\left(\frac{K}{L}\right) * P_g, \tag{0.8}$$

where Q is the rental rate on capital and P_g is the GDP price deflator.

Dividing equation (0.8) by the investment price index (P_i) we obtain

$$\text{ROR} = \frac{Q}{P_i} = \frac{P_g}{P_i} * A * \frac{\partial F}{\partial K}\left(\frac{K}{L}\right), \tag{0.9}$$

where ROR is the rate of return on investment. The price ratio on the right-hand-side of equation (0.9) can be regarded as increasing functions of the terms of trade.

As explained earlier, the removal of tariffs increases the aggregate level of employment (L). Since $\partial F/\partial K$ is a decreasing function of K/L, with K fixed, an increase in L implies a rise in $\partial F/\partial K$. Let us assume for the moment that there is no change in the terms of trade. With no change in the terms of trade, the technological variable and the capital stock (K), then it follows from the equation(0.9), the rise in $\partial F/\partial K$ generates an increase in ROR. However, in our simulations there is an increase in the terms of trade (to be explained later). This strengthens the upward movement in ROR. We assume that real private investment is a function of a rate of return i.e. ROR. Our bote model combined with our assumptions of no changes in technology and capital stock would lead us to expect an increase in ROR and consequently an increase in real private investment.

Real private consumption increases by 2.774 percent as a result of the removal of tariffs (Table 5.5, column 1). There are four sources of consumption gain. The first is

the increase in real GDP of about 0.404 percent. With private consumption being 75.21 percent of GDP, the GDP increase translates into a consumption increase of 0.537 percent (= 0.404/0.7521)[8]. The second source of gain is the improvement in the terms of trade. As can be seen from column 1 in Table 5.5, the terms of trade improves by 0.678 percent. This increases the purchasing power of real GDP by increasing the prices of commodities produced in Bangladesh relative to the prices of commodities absorbed in Bangladesh. The shares of exports and imports in GDP are 13.42 percent and 15.52 percent. Thus, an improvement in the terms of trade of 0.678 percent increases the purchasing power of GDP by 0.098 [=0.678*(0.1342 + 0.1552)/2]. This explains an increase in consumption of about 0.130 percent (=0.098/0.7521). The third source of consumption gain is the cut in taxes (in this case, tariffs). It can be seen from column 1 in Table 5.5, the removal of tariffs generates government budget deficit or tax cut of by Tk. 34,691 million. The value of total private consumption in the BAORANI database is Tk. 1,827,992 million. Therefore, the tax cut increases the real private consumption by about 1.898 percent [=(34,691/1,827,992)*100]. Finally, the fourth source of consumption gain is the distribution of income. This gain is estimated to be 0.028 percent. In the subsequent paragraph we explain how the income distribution gain is calculated and why it is small. Together our back-of-the-envelope calculations of the four effects suggests an increase in private consumption of 2.593 percent (=0.537 +0.130+1.898+0.028), close to the BAORANI result of 2.774 percent.

Now we derive an equation which shows the relationship between consumption and income distribution. This equation is used to estimate the consumption gain of income distribution in our simulation. We know

$$C = APC * YD, \tag{0.10}$$

where C is the consumption, APC is the average propensity to consume and YD is the disposable income. We can rewrite (0.10) as follows

$$C = \sum_h APC_h * YD_h, \tag{0.11}$$

where APC_h is the APC for household h and YD_h is the YD for household h.

We can rearrange (0.11) as follows

[8] Note in our simulations, government demand is exogenously held fixed.

$$C = \sum_h \left(APC_h - APC \right) * YD_h + APC * \sum_h YD_h \,, \tag{0.12}$$

or

$$C = \sum_h \left(APC_h - APC \right) * YD_h + APC * YD \,. \tag{0.13}$$

Assuming that APC and APC_h are constants, the percentage change form of (0.13) is

$$\frac{\Delta C}{C} = \sum_h \left(\frac{APC_h - APC}{APC} \right) \left(\frac{\Delta YD_h}{YD_h} \right) \left(\frac{YD_h}{YD} \right) + \frac{APC * \Delta YD}{APC * YD} \,, \tag{0.14}$$

or

$$c = yd + \sum_h \left(\frac{APC_h - APC}{APC} \right) * S_h * yd_h \,, \tag{0.15}$$

or

$$c = yd + \sum_h \left(\frac{APC_h - APC}{APC} \right) * S_h * \left(yd_h - yd \right) , \tag{0.16}$$

where S_h is the share of disposable income for household h and $\sum_h S_h = 1$[9].

Table 5a: Income Distribution Gain of Removing Tariffs

Household group	Average propensity to consume $\left(APC_h \right)$	Change in disposable income (%) $\left(yd_h \right)$	Income share $\left(S_h \right)$	APC: weighted differences $\left(\frac{APC_h - APC}{APC} \right)$	Disposable income differences $\left(yd_h - yd \right)$	Income distribution gain (Columns 3*4*5)
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Landless	0.860	7.760	0.066	0.075	-0.388	-0.002
Marginal farmers	0.915	8.580	0.031	0.144	0.432	0.002
Small farmers	0.927	9.150	0.086	0.159	1.002	0.014
Large farmers	0.778	9.640	0.071	-0.027	1.492	-0.003
Non-farm	0.761	8.110	0.298	-0.049	-0.038	0.001
Illiterates	0.805	8.020	0.113	0.007	-0.128	0.000
Low education	0.851	8.200	0.134	0.063	0.052	0.000
Medium education	0.749	7.830	0.158	-0.064	-0.318	0.003
High education	0.684	6.050	0.042	-0.145	-2.098	0.013
Total	0.800	8.148	1.000	-	-	0.028

[9] To check the plausibility of equation (0.16), we consider two special cases.
First, if $APC_h = APC$ for all h then the second term on the RHS of (0.16) becomes zero. In this case, the percentage change in consumption will only depend on the percentage change in disposable income. Second, if $yd_h = yd$ for all h then the second term on the RHS of (0.16) is also zero.

Equation (0.16) implies that the percentage change in consumption is the sum of the percentage change in disposable income and the term reflecting income distribution. Therefore, the second term of the RHS of (0.16) defines the consumption gain (or loss) due to income distribution. On the basis of our first simulation results, we calculate that the value of this term is about 0.028 percent shown in the last row of column 6 in Table 5a. The magnitude of the income distribution gain or loss to consumption depends on whether the increase in disposable income is biased toward households with higher APC or lower APC. It can be seen from Table 5a that there is not any systematic bias in favour or against households with higher APC or lower APC. In fact, we get mixed results. For example, there are cases that favourably affect consumption gain: small farmers with higher APC receive more money (i.e. relatively a big increase in disposable income) and urban high-educated households with lower APC receive less money. On the other hand, there are cases that affect consumption gain adversely. For instance, landless with higher APC get less money and large farmers with lower APC get more money. This explains why we get a small income distribution gain in our results.

Because private consumption (C) is 75.21 percent of GDP and investment (I) is 22.46 percent, the contribution of the increase in C+I is [=(0.7521*2.774)+(0.2246*2.439)] or 2.086 percent of GDP. Consequently, with zero change in government spending (G) and 0.404 percent change in real GDP, there must be a deficit in trade balance. As can be seen from column 4 in Table 5, the percentage drop in exports is 3.267 percent and the percentage increase in imports is 2.488 percent (i.e. export volume decreases by Tk. (=326,277*0.1069) or 34,879 million and import volume increases by Tk. (=377,280* 0.05493) or 20,724 million. Taking exports and imports together, net exports (i.e. trade balance) deteriorates significantly (a negative net exports of Tk. 14,155 million). The contraction in export volume causes the export price, and hence the terms of trade, to rise by 0.678.

This concludes our discussion of the primary effects (Table 5, column 1) of removing all tariffs in Bangladesh on its macroeconomic indicators. We now turn to the macroeconomic effects of an increase in the general tax rate in maintaining government budget neutrality.

5.3 Macroeconomic Effects of General Tax Increase

The second column of Table 5 shows the macroeconomic effects of general tax rate increase in order to maintain government budget neutrality. The advantage of carrying out the decomposition of our macro results into a primary effect, a general tax increase effect and a national savings effect becomes clear when we examine the results and see that while a general tax rate increase reduces the results for the majority of the macro variables, this raises the results for few variables. For example, the negative effect of a general tax rate increase on employment (aggregate employment falls by about 0.39 percent) leads to a drop in real GDP of 0.27 percent compared to a positive primary effect on employment and so on the real GDP. We can explain this as follows. Column 2 of Table 5 shows that the consumer price index (CPI) falls by about 7.33 percent. With an assumption of fixed real consumer wages, the percentage change in the price paid for labour is equal to the percent change in the CPI. Thus average nominal wage rate falls by 7.33 percent. However the prices received by producers fall by more than this amount (the GDP at factor cost deflator falls by 10.19 percent). With GDP at factor cost deflator falling by 10.19 percent and nominal wages falling by 7.33 percent, the real producer wage rises causing a lesser demand for labour and hence, a fall in the level of aggregate employment. A reduced level of aggregate employment leads to less output from industries and therefore, a smaller aggregate output for the economy. With fixed capital stock, real GDP falls by a smaller percentage than employment.

The increase in general tax rate reduces the purchasing power of consumers and investors and hence both private consumption (C) and private investment (I) fall (by about 2.91 percent and 2.94 percent respectively)[10]. The contribution of the fall in C+I, [=(0.7521*-2.909)+(0.2246*-2.937)] or 2.85 percent of GDP is a lot larger than the percentage fall in real GDP (0.27 percent). With government spending fixed, this must result in the trade balance moving toward surplus. The second column of Table 5 shows that a large expansion in the export volume, estimated at 15.83 percent and a drop in import volume, estimated at 3.26 percent. Taking exports and imports together, net exports (i.e. trade balance) improves significantly. The expansion in

[10] The general tax rate is raised quite a substantially in order to maintain government budget neutrality after a complete removal tariffs because the share of tariff revenue in the total tax revenue in Bangladesh is very high (25 percent).

export volume causes the export price, and hence the terms of trade, to fall by 0.96 percent.

5.4 Macroeconomic Effects of National Savings

The third column of Table 5 shows the macroeconomic effects of moving from maintenance of a fixed budget deficit to also fixing real national savings. For all macro indicators, this effect is very small compared to the other two effects (primary and tax increase effects). This is because maintaining budget balance is very similar to maintaining real national saving. An important result is the rise of the average propensity to consume (APC). With fixed capital stocks, the negative effect on employment (about 0.06 percent) leads to a fall in real GDP of 0.02 percent. A positive contribution of increase in (C+I) to GDP along with a fixed government spending, a fall in real GDP must result in the trade balance moving toward deficit. The export volume falls by 1.06 percent and the import volume increases by only 0.16 percent (Table 5, column 3). Taking exports and imports together, the balance of trade deteriorates. The contraction in export volume causes the export price, and hence the terms of trade, to increase by almost 0.06 percent.

5.5 Total Effects of Removing Tariffs: Funded

The fourth column of Table 5 shows the total effects resulting from the removal of tariffs along with adjustment of general tax rates and APCs across all users to maintain government budget neutrality and the fixed real national savings. This is merely the sum of first, second and third columns of Table 5. It can be seen from the fourth column of Table 5 that the aggregate level of employment increases by 0.046 percent and hence real GDP increases (by 0.115 percent). On the basis of the employment result, we would expect an increase in GDP of about 0.020 percent (the labour share of GDP times the percentage increase in employment, 0.442*0.046). The additional gain in GDP is provided by the efficiency triangles and indirect taxes[11].

Given that private consumption (C) is 75.21 percent of GDP and investment (I) is 22.46 percent, together the contribution of the increase in C and the decrease in I is [=0.7521*0.033 + (0.2246*-0.400)] or -0.065 percent of GDP. Consequently, with

[11] A detailed explanation of this (for the primary effects) is provided in Section 5.4.2.

zero change in government spending (G) and 0.115 percent rise in real GDP, there must be a surplus in trade balance. As it can be seen from the fourth column in Table 5, the percentage increase in exports is 4.080 percent and the percentage increase in imports is 2.376 percent (i.e. export volume increases by Tk. (=326,277*0.04080) or 15,661 million and import volume increases by Tk. (=377,280* 0.02376) or 14,186 million and hence a positive net exports of Tk. 1,476 million. The expansion in export volume causes the export price, and hence the terms of trade, to fall by about 0.22 percent. We note that the increase in consumption of 0.033 percent can be considered as welfare gain from the tariff cut.

5.6 Sectoral Effects of Removing Tariffs: Funded

Table 6 shows the estimated effects of the removal of tariffs on output of all 86 industries. In this section, we discuss the total effects of removing tariffs (Table 6, column 4), followed by a discussion of decomposed sectoral output results (Table 6, columns 1, 2 and 3). To understand the industry results, it is important to know the industry's sales and cost structures, which are summarised in Tables E.1 and E.2 located in Appendix E. Table E.4 indicates the import-competing characteristics of Bangladesh's industries as well as providing information on its exports.

It can be seen from the fourth column of Table 5 that our policy of a complete removal of all tariffs generates an increase in the aggregate employment level which gives an increase in household real consumption. Moreover, given the assumptions of fixed technology and capital stocks in the short-run, the increase in aggregate employment means an increase in aggregate output; which implies an increase in the demand for domestic intermediate inputs. In addition, the removal of tariffs produces an expenditure-switching effect in favour of imported goods and services. Therefore, we would expect a contraction in output of import-competing products with high tariffs. This is true from column 4 in Table 6 where our results show a fall in most of these industries' output. For instance, output in cement, glass, basic chemicals, wheat, yarn, edible oil, machinery, transport equipment and cotton contract by 3.14 percent, 2.90 percent, 1.82 percent, 1.52 percent, 1.23 percent, 1.11 percent, 1.02 percent, 0.71 percent and 0.51 percent. Imports of these products account for 72 percent (machinery), 64 percent (glass), basic chemical (56 percent), 55 percent (cement), 52

percent (edible oil), 47 percent (transport equipment), 41 percent (cotton), 39 percent (wheat) and 32 percent (yarn) of total supplies in the Bangladeshi market (Table E.4, column 2). Because of the removal of tariffs they lose market-share to imports.

Nevertheless, there are some import-competing industries (import shares more than 20 percent) that experience expansion in output, for example, readymade garments (hereafter, RMG), knitted readymade garments & hosiery (hereafter, knitting), toiletries, fertiliser & insecticides, miscellaneous industry, and petroleum product. Except petroleum product, all these industries are either highly export-oriented or have low tariffs: the share of exports in the database accounts for 99 percent (RMG), 98 percent (knitting), 45 percent (miscellaneous industry), 25 percent (fertiliser and insecticides) and 21 percent (toiletries). It can be seen from the third column of Table E.1 that the tariff rates for RMG, knitting, miscellaneous industry, fertiliser and insecticides, and toiletries are 0.44 percent, 7.77 percent, 6.59 percent, 0.90 percent, and 12.10 percent respectively. The removal of tariffs generates a reduction in the export-composite prices, which implies a rise in the world demand for traditional-export goods. With high export elasticity values (-20.0), the fall in export prices generates a large foreign demand for traditional-export goods, which offsets any negative import-competing effect.

Now we explain the expansion in output of import-competing petroleum industry. There are two main sources of change in petroleum output. The first is that due to a relative price change favouring imported petroleum product (as a result of the removal of tariffs), everybody who uses petroleum product substitutes away from domestic to imported product. This is bad for domestic production and hence, output of the domestically petroleum product decreases. The second source of output change is that a large reduction in the cost of producing (refined) petroleum product due to the removal of tariffs[12] generates an expansion in domestic production of this product since domestic producers use a large proportion of imported (crude) petroleum product as intermediate input. Note BAORANI database does not make any distinction between crude and refined petroleum products and they are treated as a

[12] The tariff rate for petroleum product is one of the highest tariff rates in Bangladesh and about one third of total tariff revenues' comes from imported petroleum product (see row 54 of column 2 in Table E.1).

single product. Moreover, a large fall in the cost of producing petroleum product reduces the price of export of this product (by 7.30 percent). With a very high export elasticity value of -20.0, the fall of 7.30 percent export price translates into a very large increase in the export of petroleum product (by 355.20 percent). Because the share of exports in total supply is 2.20 percent for petroleum product, a 355.20 percent increase in exports requires 7.74 percent increase in total output. The increase in petroleum production due to the export expansion is more than outweigh to contraction in local production due to the substitution away from domestic to imported petroleum product. Therefore, our result reveals an increase in petroleum output.

However, the true situation is that Bangladesh imports crude petroleum product to use as intermediate input to produce refined petrol. Given that Bangladesh does not produce any crude petroleum product, there is not any scope that domestically produced refined petrol competes with crude petroleum product. At the same time, the cheaper imported petroleum product encourages domestic producers/refineries to use more of it and hence more domestic production of petroleum product. Moreover, the only final user of petroleum product (refined petrol), household sector (22 percent of petrol is used by household sector), finds this product now cheaper and hence demands more of it which causes output to increase. Therefore, petroleum industry experiences a robust expansion in output as a result of a complete removal of tariffs in our simulations.

In general, export-oriented industries (those with large export shares, Table E.4, column 3) exhibit robust expansion in output. The percentage changes in the outputs of these industries are mainly determined by exports. As explained previously, the removal of tariffs generates a reduction in the export-composite prices, which implies a rise in the world demand for export goods. The rise in exports generates an increase in output of these industries. The exception is the export-oriented leather product industry (exports account for 37 percent of its sales) which experiences a fall in output of 0.35 percent. The contraction in leather product output can be explained as follows. Row 30 of the cost matrix shown in Table E.1 located in Appendix E reveals that while intermediate domestic cost contributes the majority of total leather product cost (71 percent), the contribution of intermediate import cost is very small (only 1

percent). Now we consider sales structure of the leather product industry. Row 35 of Table E.2 in Appendix E shows that about 69 percent of leather product goes to household demanders and the remaining 31 percent[13] is exported to overseas. With a little dependence on imported inputs, the removal of tariffs generates a small reduction in leather output price (0.67 percent) compared a fall of 1.80 percent in the domestic price level i.e. GDP deflator. Domestic demand for leather product shrinks (by 0.43 percent) as households substitute away from it (column 2 of row 35 in Table 4.14). Together a slight rise in export demand (by 0.08 percent) and a reduction in domestic demand (by 0.43 percent) accounted for 0.35 percentage points of the total contraction in leather production.

All trade and transport industries (industries 69 to 75) experience strong expansion in output relative to the overall expansion of the economy. This is because trade and transport services are used intensively to facilitate international trade, and both exports and imports are stimulated by tariff cut.

Most of the other service industries also exhibit expansion in output. Public administration and defence industry experiences a robust expansion compared to the other service industries because of its higher export share (the share of exports account for 25 percent: Table E.4, row 86 and column 4). The contraction in output of education services can be explained by the fact that it becomes relatively expensive for consumers. This is because education services use almost no imported inputs. With an increase in the price of education services relative to the price of consumer goods in general there is a substitution away from education services. The contraction in output of health and vet services is explained by the link between health and vet services and livestock production. In our database about 64 percent of health and vet services is an input to the livestock industry. The livestock industry contracts by 1.39 percent and this is sufficient to generate a contraction in the output of the health and vet services. The contraction in the livestock industry is explained by sharp cuts in the tariffs on milk and fat product.

[13] Table E.2 shows shares of purchaser's values whereas Table E.4 shows shares of basic values. In the case of leather products, taxes are concentrated on consumption (not exports). Hence the export share in basic values (37 percent) exceeds the export share in purchaser's values (31 percent).

Table 6: Effects of Removing Tariffs on Output of all 86 Industries

Industry	Primary effects of removing tariffs (1)	Effects of general tax increase (2)	Effects of national savings (3)	Total effects (4)
1 Paddy	1.51	-1.96	0.10	-0.35
2 Wheat	-1.16	-0.34	-0.03	-1.52
3 OthGrains	1.68	-1.97	0.11	-0.18
4 Jute	-1.97	2.57	-0.19	0.41
5 Sugarcane	0.54	-1.91	0.10	-1.26
6 Potato	1.85	-2.08	0.12	-0.11
7 Vegetables	-0.85	0.85	-0.09	-0.09
8 Pulses	1.69	-2.21	0.11	-0.42
9 Oilseeds	-4.68	1.31	-0.15	-3.52
10 Fruits	0.01	-1.28	0.08	-1.20
11 Cotton	-2.70	2.35	-0.17	-0.51
12 Tobacco	-2.16	0.99	-0.10	-1.27
13 Tea	-2.43	3.22	-0.21	0.58
14 Spices	-1.21	-1.15	0.06	-2.30
15 OthCrops	0.24	-0.82	0.02	-0.56
16 LivestockR	1.30	-2.78	0.09	-1.39
17 PoultryRear	1.78	-2.09	0.12	-0.19
18 Shrimp	-2.92	3.93	-0.25	0.76
19 Fish	1.96	-2.28	0.13	-0.19
20 Forestry	2.45	-3.01	0.15	-0.41
21 RiceFlorBran	1.53	-1.87	0.10	-0.23
22 FlorBranFed	1.68	-2.33	0.12	-0.52
23 FishSeafod	-0.56	0.49	-0.04	-0.11
24 EdibleNonOil	-0.93	-0.17	-0.01	-1.11
25 SugrGurMols	0.36	-1.88	0.10	-1.42
26 TeaProduct	2.21	-2.84	0.16	-0.47
27 Salt	0.47	-1.71	0.07	-1.17
28 ProcssFood	-0.04	-1.47	0.08	-1.44
29 TaningLethr	-1.51	1.31	-0.13	-0.33
30 LethrProdt	-1.44	1.22	-0.12	-0.35
31 Baling	-5.97	7.49	-0.54	0.98
32 JuteProduct	-5.98	7.49	-0.54	0.97
33 Yarn	-3.47	2.41	-0.17	-1.23
34 MillClth	-4.81	5.67	-0.34	0.52
35 HandlmClth	3.14	-3.63	0.20	-0.30
36 DyeBleaching	2.58	-2.92	0.16	-0.18
37 RMG	-5.65	7.44	-0.45	1.35
38 KniRMGH	-5.27	7.40	-0.46	1.67
39 Toiletries	-0.95	2.39	-0.16	1.28
40 Cigarettes	3.13	-3.05	0.19	0.26
41 Bidi	3.49	-3.50	0.20	0.19
42 BasicWProdt	0.48	-1.14	0.05	-0.61
43 WodnFur	0.93	-1.11	0.04	-0.15
44 PulpPaBord	-1.32	0.24	-0.03	-1.11

…Table 6 continues

Table 6 continued

Industry	Primary effects of removing tariffs (**1**)	Effects of general tax increase (**2**)	Effects of national savings (**3**)	Total effects (**4**)
45 PrintingPub	-0.69	0.42	-0.05	-0.32
46 Medicines	0.89	-1.05	0.05	-0.11
47 FertzInsect	-0.84	1.07	-0.07	0.16
48 BasicChemica	-3.90	2.97	-0.19	-1.12
49 PetrolProdt	1.16	0.60	-0.06	1.70
50 ChnPottry	-0.67	0.78	-0.07	0.04
51 ChemicalInd	0.21	-1.51	0.10	-1.20
52 Glass	-1.85	-1.10	0.05	-2.90
53 BricTCProdt	1.83	-2.11	0.09	-0.19
54 Cement	-3.77	0.68	-0.06	-3.14
55 IronStBasic	-2.37	0.63	-0.07	-1.81
56 FabMetProdt	-0.05	-2.00	0.10	-1.95
57 Machinery	-3.44	2.61	-0.21	-1.03
58 TransEquipmt	-1.78	1.17	-0.10	-0.71
59 MisceInd	-1.98	2.58	-0.16	0.44
60 UrbanBldg	2.26	-2.48	0.11	-0.11
61 RuralBldg	2.06	-2.36	0.11	-0.20
62 PowPlntBldg	3.54	-3.63	0.16	0.08
63 RuralRd	2.56	-0.61	-0.07	1.88
64 PortRdRailBg	2.02	-0.64	-0.06	1.32
65 CanlDykOthBg	2.89	-3.41	0.17	-0.36
66 ElecWater	0.87	-0.87	0.04	0.04
67 GasExtrDist	1.81	-2.10	0.12	-0.17
68 MinigQuaring	1.54	-1.90	0.10	-0.27
69 TradWholsale	0.09	0.58	-0.08	0.59
70 TradRetail	1.67	-1.48	0.05	0.25
71 AirTran	0.09	0.58	-0.08	0.59
72 WaterTran	0.09	0.58	-0.08	0.59
73 LandTran	0.09	0.58	-0.08	0.59
74 RailTran	0.09	0.58	-0.08	0.59
75 Warehousing	-2.49	2.94	-0.22	0.23
76 HousingServ	0.00	0.00	0.00	0.00
77 HealthServ	1.16	-2.05	0.07	-0.82
78 EdnServ	1.96	-2.20	0.12	-0.13
79 PubAdmDfen	-7.85	9.94	-0.70	1.39
80 BnkInsRealSt	-0.11	0.29	-0.08	0.10
81 ProfServ	-0.67	0.84	-0.09	0.09
82 HotelRest	3.61	-3.51	0.19	0.28
83 Entertainmnt	2.71	-2.96	0.16	-0.09
84 Communica	-1.79	2.42	-0.19	0.44
85 OtherServ	2.08	-2.38	0.11	-0.19
86 InfTechServ	-1.03	1.42	-0.14	0.24

Note: All figures are percentage changes.

Output in the housing service industry remains steady because it only uses capital and capital stocks in our simulations are exogenously held fixed.

In examining the reasons for effects on the output of individual commodities, it is helpful to decompose these effects into those resulting from changes in domestic demand for a commodity (regardless of source of supply), substitution effects between the locally-supplied commodity and imports, and changes in export demands for that commodity. This information (for simulation 3) is provided for all 94 commodities in Table E.3 in Appendix E. The first column of Table E.3 shows, x0com, output of commodities. The next three columns show how the x0com change may be split between three causes: overall increase in local demand (LocalMarket), replacement of imported goods by domestically produced goods (DomShare), and increase in exports (Export).

Most of the increases in outputs are due to the local market and export effects while domestic-share effects generally make a negative contribution. For example, increase in toiletries output is 1.28 percent (column 1 of Table E.3). Column 2 can be interpreted as saying that given the increase in domestic demand for toiletries (local and imported) we may have anticipated the rise in output to be 0.22 percent. However, column 3 can be interpreted as saying that due to a relative price change favouring imported toiletries, output of the domestically produced toiletries industry decreases by 1.25 percentage points. Column 4 shows that increased export demand accounted for 2.31 percentage points of the total expansion in toiletries production.

Another example of the decomposition of output result: row 57 of column 1 in Table E.3 shows that output of glass product falls by 2.90 percentage points. The decomposition of this result reveals that 6.69 percent of the domestically produced glass product is replaced by imported glass product (DomShare). Note that glass industry is highly-protected and there is a substantial share of imports in the local glass market. Overall local demand (regardless of source of supply) for the glass product is increased by 3.79 percent (Localmarket). The strong response of local market demand is a reflection of a reduction in the prices of both domestic and imported glass product and a high price elasticity of demand by households for glass product.

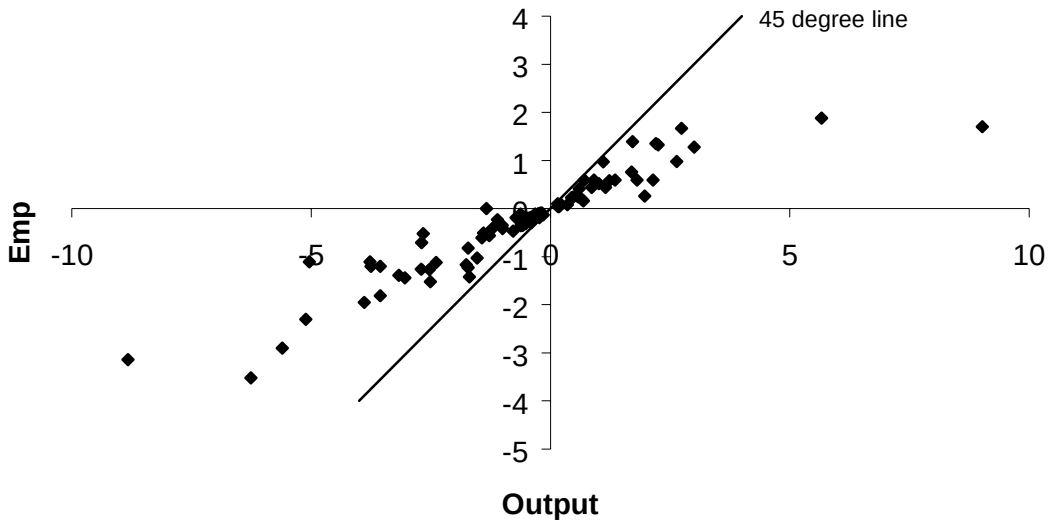


Figure 5: Relationship between Output and Employment

In the short-run with fixed technology and capital stock assumptions, the movements in the industries' outputs also imply movements in their employment. The employment effects of removing tariffs for all 86 industries are presented in Table E.2 in Appendix E. These employment movements are determined according to the relationship

$$emp(j) = \frac{output(j)}{S_L(j)}, \tag{0.17}$$

where $emp(j)$ is the employment deviation in industry j (fourth column of Table E.2), $output(j)$ is the output deviation in industry j (fourth column of Table 6) and $S_L(j)$ is the labour share in j's primary factor cost. Relationship (0.17) is illustrated in Figure 4 which shows a scatter of employment and output results for the 86 industries. Notice that the employment results are always more extreme (bigger in absolute size) than the output results.

5.7 Decomposition of Sectoral Effects

The first column of Table 6 shows the primary effects of removing tariffs on output of all 86 industries. In general, the industry outputs follow the macro absorption. For example, aggregate household consumption increases, so industries which sell goods to households' expand. For instance, hotel & restaurant, bidi, handloom cloth, cigarettes and entertainment exhibit a robust expansion in output. Households are

their only customers (except hotel & restaurant, which sells 88.5 percent of its output to households). Similarly, all construction industries (i.e. urban building, rural building, power plant building, rural road building, port road & railway building, and canal dyke & other building) exhibit robust expansion in activity/output. Investors are their only customers (except port road and railway building, which sells 78.6 percent of its output to investment sector). With increased aggregate real investment, construction industries are able to sell more to investors, and they thus experience a robust expansion.

Our macroeconomic results of removing tariffs alone show a large drop in the volume of exports and a large increase in the volume of imports (Table 5, column 1). In line with the macro results we would expect a reduction in outputs of export-oriented and import-competing industries. It can be seen from the first column of Table 6 that output in public administration & defence, jute product, baling, RMG, and knitting contract by 7.85 percent, 5.98 percent, 5.97 percent, 5.65 percent and 5.27 percent respectively. Except baling, all these industries are highly export-oriented. The contraction in baling output can be explained by the fact that the majority of output in this industry is supplied to the jute fabrication industry, which contacts sharply. Similarly, output in mill cloth, oil seeds, basic chemicals, cement, yarn, machinery and cotton contract by 4.81 percent, 4.68 percent, 3.90 percent, 3.77 percent, 3.47 percent, 3.44 percent and cotton 2.70 percent respectively. They all are import-competing industries. Overall, both export-oriented and import-competing industries exhibit contraction in output.

To a large extent general tax rate increase (shown in Table 6, column 2) reverses the results (shown in column 1). That is, for many industries the result in column 2 has the opposite sign to that in column 1 and is of a similar size. This is particularly true for industries such as paddy, sugarcane, fish, cigarettes and bidi that face relatively less import-competition and are not export-oriented. For these industries what is important is domestic demand. In simulation 1 domestic demand (both consumption and investment) is stimulated by tax cut (the unfunded reduction in tariffs). In simulation 2 the tax cut is reversed.

For import-competing goods (e.g. wheat, cotton, yarn, basic chemicals, cement, machinery and transport equipment) the direct effect of tariff cut is dominant. These industries have large negative entries in column 1 of Table 6. They may have either a positive or a negative entry in column 2. For example, entries for the import-competing goods cotton, yarn, cement, machinery and transport equipment in column 2 are positive and those for the import-competing goods wheat, fabricated metal product, glass product, chemical product and medicines are negative. For import-competing industries the general tax increase has two effects that go in opposite directions and the overall outcome for these industries in column 2 depends on which effect is the stronger. The two effects are: reduction in direct demand (negative effect on import-competing industries) and real devaluation or improvement in competitiveness (positive effect on import-competing industries). In combination results in columns 1 and 2 of Table 6 generally give a negative outcome for import-competing industries. This reflects the proposition that funded tariff cut is harmful to import-competing industries.

For export-oriented industries results in column 1 of Table 6 are generally negative. These results are more than reversed in column 2 via real devaluation. For example, -5.65 percent and 7.44 percent (RMG), -5.27 percent and 7.40 percent (knitting), -2.92 percent and 3.93 percent (shrimp). Thus together columns 1 and 2 illustrate the proposition that for export-oriented industries a funded cut in tariffs is beneficial.

The third column of Table 6 shows the sectoral output results of maintaining a fixed real national savings. In line with the macro results, the effect of national savings on sectoral outputs is much smaller compared to the primary and tax increase effects. As explained earlier, generally, the industry outputs follow the macro absorption. Since aggregate household consumption increases, industries which sell goods to households' expand. For instance, handloom cloth, bidi, cigarettes, and entertainment experience an expansion in output results. Households are their only customers. Similarly, most of the construction industries experience an expansion in output results. Investors are their only customers. With increased aggregate real investment, construction industries are able to sell more to investors, and they thus experience an expansion.

We know from macro results that the real national saving effects shrink exports and expand imports (Table 5, column 3). Therefore, we would expect a reduction in outputs of export-oriented and import-competing industries. For instance, output in the highly export-oriented industries such as public administration & defence, jute product, knitting, RMG and shrimp contract. Output in mill cloth, machinery, basic chemicals, machinery and cotton also contract. All these are import-competing industries. In general, both export-oriented and import-competing industries exhibit contraction in output results (Table 6, column 3).

5.8 Effects on Employment by Labour Type

Our macroeconomic results show that a complete removal of tariffs with fixed budget deficit and real national savings generates a small increase (0.046 percent) in the level of aggregate employment (Table 5, column 4). Decreased employment in the import-competing sector is slightly less than offset by rises in employment elsewhere in the economy. As shown in column 4 of Table E.2 located in Appendix E, the results of employment by labour type indicate that expansion is felt most heavily in the export sector (export-related employment experiences the largest increase).

Table 7: Effects of Removing Tariffs on Employment by Labour Type[14]

Type of Labour	Primary effects of removing tariffs (**1**)	Effects of general tax increase (**2**)	Effects of national savings (**3**)	Total effects (**4**)
Male	0.76	-0.69	-0.04	0.02
LEdu0M	1.80	-1.93	0.03	-0.10
LEdu1M	1.41	-1.50	0.01	-0.08
LEdu2M	0.85	-0.86	-0.03	-0.04
LEdu3M	-0.54	0.90	-0.14	0.22
Female	-1.21	1.57	-0.16	0.07
LEdu0F	0.02	0.00	-0.06	-0.04
LEdu1F	-2.30	2.95	-0.23	0.41
LEdu2F	-2.48	3.22	-0.25	0.49
LEdu3F	-1.50	1.96	-0.19	0.27

Note: All figures are percentage changes.

If we consider employment of male and female workers separately, it can be seen from the fourth column of Table 7 that employment of female workers increases by 0.07 percent compared to a small drop in employment of male workers (0.02 percent).

[14] For definitions of different types of labour see Appendix B.

The type of labour which experiences the largest increase in employment is the medium-educated female workers (0.49 percent), followed by low-educated female workers (0.41 percent). Note that the majority of these workers are employed in RMG sector[15] (32 percent of medium educated and 30 percent of low-educated) and knitting sector (9 percent of medium educated and 8 percent of low-educated), and these sectors experience robust expansion in employment results (1.63 percent in RMG and 2.15 percent in knitting). Consequently, both medium- and low-educated female workers experience the largest increase in employment. On the other hand, illiterate male workers, a majority (24 percent) of whom are employed in paddy cultivation sector experience a contraction in employment (0.10 percent). Note that overall employment in paddy cultivation sector falls by 0.58 percent (Table E.2: row 1 and column 4).

The decomposition of employment results by labour type is presented in columns 1, 2 and 3 of Table 7. While the primary effects of removing tariffs generally increase the employment of male workers (by 0.76 percent), they reduce the employment of female workers (by 1.21 percent). Our sectoral output results show that while the primary effects generate a robust expansion in activity for construction and service sectors where the majority of male workers are employed, they generate a fall in activity for agriculture and TCF sectors where the majority of female workers are employed. That is why we get favourable effects for male workers and adverse effects for female workers. In contrast, the effects of a general tax rate increase generate an opposite results than that of the primary effects. In general, the employment effects of real national savings are very small compared to the other two effects.

5.9 Effects on Real Consumption by Household Type

The real consumption effects of the funded tariff cut with fixed real national savings are shown in the fourth column of Table 8. We note that the change in real consumption can be considered as a welfare gain of tax cut. While there are differences in consumption across household groups, the numerical size of these

[15] The RMG sector in Bangladesh plays a key role in employment, directly employing about 1.8 million people, or about half of the nation's industrial workforce, 90 percent of whom are women. The indirect employment in the RMG sector i.e. workers in other sectors that owe their employment to this sector, totals approximately 10 million, making total direct and indirect employment of the RMG sector a quarter of total Bangladesh's workforce of 40 million (USITC, 2004).

differences is small. Nevertheless, there are some noticeable effects on the distribution of real consumption between rural and urban households. For example, real consumption for urban households rises by 0.09 percent compared to a 0.01 percent drop in consumption for rural households. In general, all four urban household groups experience welfare gain as measured by real consumption whereas all rural household groups except the non-farm group experience welfare loss.

There are three sources of real consumption gain. The first is the consumer price index (CPI) which is inversely related to real consumption gain. That is, increase in CPI implies fall in real consumption and vice versa. The second source of consumption gain is the disposable income. The relationship between consumption and disposable income is positive. Finally, the third source of consumption gain is the average propensity to consume (APC) which has a direct relationship with consumption. These three effects are set out in the first three columns of Table 8.

Table 8: Distributional Effects of Funded Tariffs Cut (Simulation 3)[16]

Household Group	CPI (**1**)	Disposable income (**2**)	APC (**3**)	Real consumption (**4**)
Rural	-1.61	-1.76	0.14	-0.01
Landless	-1.59	-1.75	0.14	-0.02
Marginal farmers	-1.62	-1.78	0.14	-0.03
Small farmers	-1.60	-1.80	0.14	-0.07
Large farmers	-1.60	-1.83	0.14	-0.09
Non-farm	-1.62	-1.73	0.14	0.03
Urban	-1.67	-1.72	0.14	0.09
Illiterates	-1.64	-1.75	0.14	0.03
Low education	-1.67	-1.75	0.14	0.06
Medium education	-1.68	-1.72	0.14	0.11
High education	-1.77	-1.54	0.14	0.38
All	-1.64	-1.74	0.14	0.03

Note: All figures are percentage changes.

Now we explain why CPI varies across household groups (shown in the first column of Table 8). Our database shows that there are inter-household variations in the share of imported goods in consumption bundle. This explains why the percentage change in CPI is different for different household groups. We note that the removal of tariffs reduces the purchasers' prices of imported goods. This feeds into CPI, which also falls. For example, the share of imported goods in consumption bundle is relatively

[16] For definitions of different types of household see Appendix C.

higher for urban households compared to rural households and hence a fall in CPI for urban households (1.67 percent) is greater than that of rural households (by 1.61 percent).

Table 9: Shares of GOS and Labour Income and Sources of Disposable Income Change

	Share of GOS in disposable income	Share of wage in disposable income	Percentage changes		
Household Group	**(1)**	**(2)**	Rental and wage effect **(3)**	Employment effect **(4)**	Disposable income **(5)=(3)+(4)**
Rural	0.62	0.38	-1.77	0.01	-1.76
Landless	0.32	0.68	-1.70	-0.05	-1.75
Marginal farmers	0.58	0.42	-1.76	-0.03	-1.78
Small farmers	0.78	0.22	-1.80	-0.01	-1.80
Large farmers	0.90	0.10	-1.83	0.00	-1.83
Non-farm	0.57	0.43	-1.76	0.03	-1.73
Urban	0.47	0.53	-1.74	0.02	-1.72
Illiterates	0.43	0.57	-1.73	-0.03	-1.75
Low education	0.54	0.46	-1.75	0.00	-1.75
Medium education	0.51	0.49	-1.75	0.03	-1.72
High education	0.26	0.74	-1.69	0.15	-1.54
All	0.55	0.45	-1.76	0.02	-1.74

Note: Figures in columns 1 and 2 are from BAORANI database and figures in columns 3 and 4 are based on simulation 3.

The second source of consumption gain is disposable income. There are two effects that underlie the differences in disposable income across household groups. They are: rental and wage effect and employment effect (shown in the third and fourth column of Table 9). We encounter rental and wage effect because price of labour and price of capital and land move differently (e.g. average nominal wage increases relative to average capital and land rental price). Note households get almost all their income from two sources: gross operating surplus (GOS) and labour wage. It can be seen from columns 1 and 2 in Table 9 that the shares of GOS income and labour income to household disposable income are different for different household groups. For example, the shares of GOS income and labour income to household disposable income are 90 percent and 10 percent respectively for large farmers and the corresponding figures for urban high-educated households are 26 percent and 74 percent respectively. Due to the variation in the shares of GOS income and labour income to disposable we get difference in rental and wage effect across household

groups. We would expect households that rely heavily on labour income would perform relatively better than households which depend more on capital. From the third column of Table 9 we can see that the rental and wage effect dampen the reduction in disposable income for urban high-educated households (which rely a lot on labour income) compared to large farmers (which rely slightly on labour income). For example, entries for the labour-dependent households such as urban high-educated households and rural landless (1.69 percent and 1.70 percent respectively) are smaller in absolute size than less labour-dependent households such as large and small farmers (1.83 percent and 1.80 percent respectively). This reflects the proposition that the rental and wage effect is favourable to households that rely heavily on labour income.

The employment effect of disposable income is shown in the fourth column of Table 9. This effect acts against employment prospects of landless, marginal and small farmers and urban illiterates but it favours employment prospects of urban high-educated and medium-educated households and non-farm households. As discussed in the previous section, the results of our simulation show that while the skilled (highly educated) labour experience the largest increase in employment, the unskilled (illiterate) labour experience the largest contraction in employment (Table 7, column 4). Note that the majority of the skilled labour belongs to urban high-educated and medium-educated households and non-farm households whereas most of the unskilled labour comes from landless, marginal and small farmers and urban illiterate households.

Table 8, column 3 shows that APC, the third and final source of consumption gain, increases uniformly and hence has an equal effect on all household groups (APC increases by 0.14 percent, Table 5, column 4).

Together the three effects suggest an increase in real consumption i.e. welfare gain for urban households and welfare loss for rural households (except the non-farm households). In particular, the households that gain most are the urban high-educated households (0.38 percent increase in their real consumption). They gain because: (a) they have a relatively high input share in their consumption (large CPI reduction); (b)

they rely mainly on labour for their income (rental and wage effect); and (c) they receive an employment boost from a tariff reduction (employment effect).

6. CONCLUSIONS

This paper focused on the possible short-run economic impact of tariff cut in Bangladesh. The paper began with an overview of trade policy reform in the country. The next section provided details of the three simulations that were carried out to examine the impact of a complete removal of tariffs in Bangladesh. The final section discussed the results for macroeconomic variables and for output and employment by sector, as well as the results for household consumption.

We can conclude that an unfunded tariff cut would increase the aggregate level of employment slightly and hence would expand GDP in the short-run. Real consumption and investment would also increase sharply. Together a substantial rise in imports and a large reduction in exports would dampen the GDP expansion in spite of a considerable increase in domestic absorption.

To a large extent general tax rate increase would reverse the results of unfunded tariff cut. That is, for main macro indicators the result of unfunded tariff cut would have the opposite sign to that of general tax increase and would be of a similar size. Our results revealed a reduction in employment and hence a fall in GDP. We also found a large fall in consumption and investment.

The total effects resulting from the removal of tariffs along with adjustment of general tax rates and average propensity to consume across all users to maintain government budget neutrality and the fixed real national savings would increase employment slightly and hence would expand GDP. There would be a small economy-wide welfare gain as measured by real consumption.

Our sectoral results showed that the unfunded tariff cut would expand the industries that face little import competition and are not export-oriented. For these industries all that matter is domestic demand. In this simulation domestic demand (both consumption and investment) was stimulated by the tax cut (the unfunded reduction in

tariffs). By contrast, both export-oriented and import-competing industries experienced contraction in output, reflecting real appreciation (loss of international competitiveness).

A general tax rate increase across all users to maintain government budget neutrality would reverse the sectoral results of the unfunded tariff cut experiment. For industries that face relatively less import-competition and are not export-oriented the result in the second simulation (i.e. general tax increase) would have the opposite sign to that in the first simulation (i.e. unfunded tariff cut). The results of our simulation also revealed that a funded cut in tariffs were harmful to import-competing industries and beneficial to export-oriented industries.

In case of removing tariffs along with adjustment of general tax rates and average propensity to consume across all users to maintain government budget neutrality and the fixed real national savings, the sectoral results showed that the industries which experienced the most positive effects on their output and employment were the export-oriented industries. There were also positive effects on the suppliers to these industries. Lightly-protected industries, which relied heavily on imported intermediate inputs, showed robust expansion as they benefited from a cost reduction. However, highly-protected, import-competing industries suffered a contraction in output and employment as they faced increased competition from imports due to the removal of tariffs.

The results of our simulations indicated that there are some noticeable effects on the distribution of real consumptions between different household groups. Overall, urban households experienced an expansion in real consumption and rural households suffered a contraction as a consequence of the funded tariff cut with fixed real national savings.

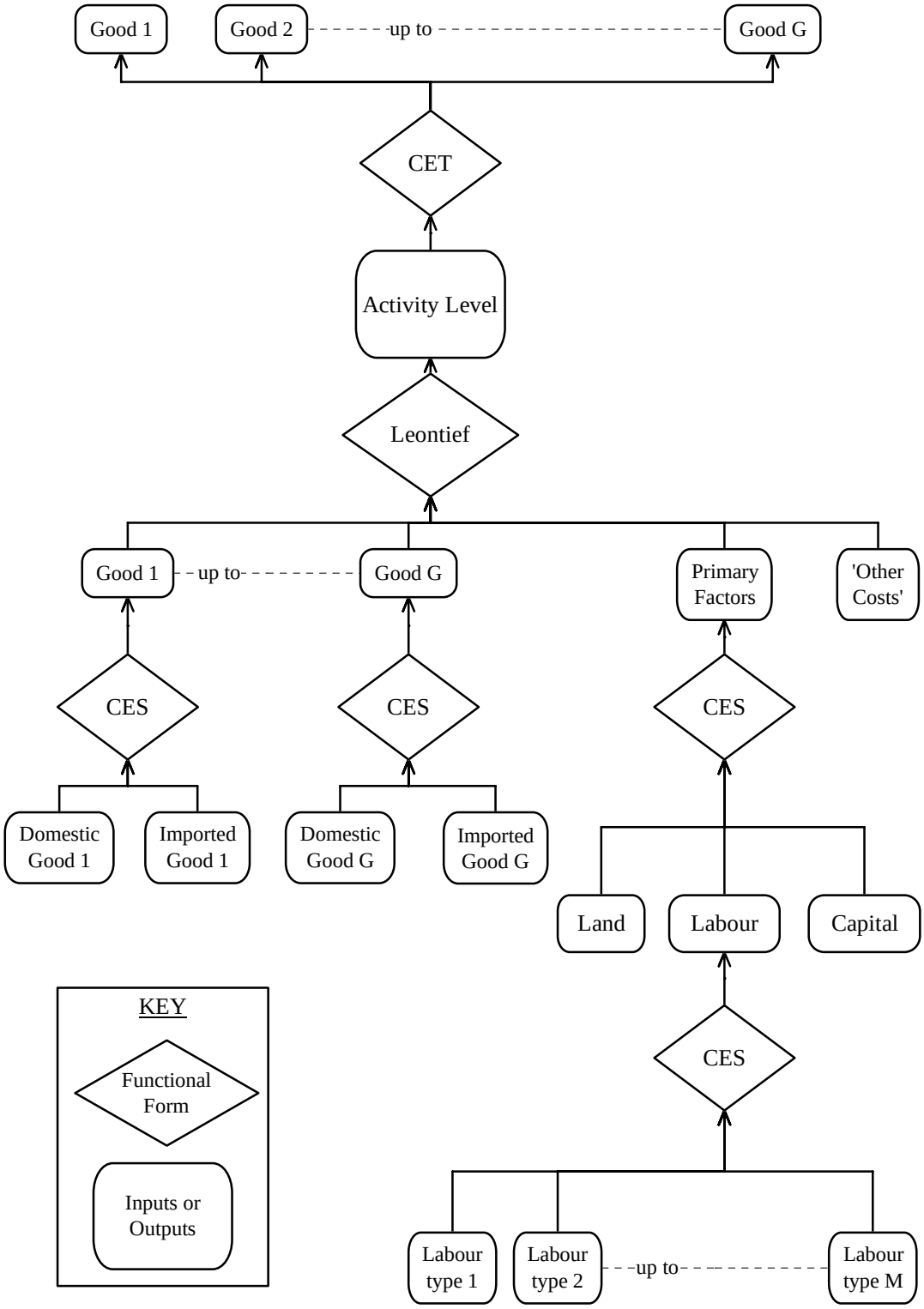
There are three sources of welfare gain for urban households. Firstly, urban households have a higher share of imported goods in consumption bundle. The removal of tariffs reduces the purchasers prices of imported goods and hence reduction in CPI. Because of a relatively higher share of imported goods in their consumption bundle, the CPI for urban households fell relatively sharply. Secondly,

urban households have a higher share of wage income in total disposable income compared to rural households. In our simulation average nominal wage increased relative to average capital and land rental price. Due to their higher wage shares in total income, urban households received more income and hence experienced a consumption gain. The third source of welfare gain is the employment effect which acted in favour of employment prospects of urban households. Our employment results showed that skilled labour experienced the largest increase in employment and the bulk of this labour was supplied by urban households. For this reason urban households received more income and therefore they experienced further consumption gain

On the other hand, rural households, except the non-farm households, experienced a contraction in real consumption because of their low shares of imported goods in consumption bundle and their low shares of wage income in total disposable income. Moreover, the employment effect acted against employment prospects of rural households and hence a further reduced in their consumption.

In conclusion, the results of our simulations suggested that, having a low domestic tax base together with a very high share of tariffs in total tax revenues which are common in the developing countries like Bangladesh, a complete removal of tariffs along with adjustment of general tax rates across all users to maintain government budget neutrality, might not be a policy option for favourable income distribution in the short-run.

Appendix A: Structure of Production in BAORANI



Appendix B: BAORANI Occupation Classifications

	Element of Set LAB	Labour description
Male		
1	LEdu0M	Male labour with no education (no formal schooling)
2	LEdu1M	Male labour with low education (class I to class V)
3	LEdu2M	Male labour with medium education (class VI to class X)
4	LEdu3M	Male labour with high education (graduate and above)
Female		
5	LEdu0F	Female labour with no education (no formal schooling)
6	LEdu1F	Female labour with low education (class I to class V)
7	LEdu2F	Female labour with medium education (class VI to class X)
8	LEdu3F	Female labour with high education (class I to class V)

Appendix C: BAORANI Household Classifications

	Element of Set HOU	Household description
Rural		
1	Landless	Landless (no land)
2	Marginal	Marginal farmers (landholding up to .49 acres)
3	Small	Small farmers (0.5 to 2.49 acres of land)
4	Large	Large farmers (2.50 acres of land and above)
5	NonFarm	Non- Farm
Urban		
6	Illitera	Illiterates (no education)
7	LowEdu	Low education (class I to class IX)
8	MedEdu	Medium education (class X to class XII)
9	HighEdu	High education (graduate and above)

Appendix D: BAORANI Commodity and Industry Classifications

Element of Set COM	Commodity Description	Element of Set IND	Industry Description
1 Paddy	Paddy	1 Paddy	Paddy Cultivation
2 Wheat	Wheat	2 Wheat	Wheat Cultivation
3 OthGrains	Other Grains	3 OthGrains	Other Grain Cultivation
4 Jute	Jute	4 Jute	Jute Cultivation
5 Sugarcane	Sugarcane	5 Sugarcane	Sugarcane Cultivation
6 Potato	Potato	6 Potato	Potato Cultivation
7 Vegetables	Vegetables	7 Vegetables	Vegetable Cultivation
8 Pulses	Pulses	8 Pulses	Pulses Cultivation
9 Oilseeds	Oilseeds	9 Oilseeds	Oilseed Cultivation
10 Fruits	Fruits	10 Fruits	Fruit Cultivation
11 Cotton	Cotton	11 Cotton	Cotton Cultivation
12 Tobacco	Tobacco	12 Tobacco	Tobacco Cultivation
13 Tea	Tea	13 Tea	Tea Cultivation
14 Spices	Major Spices	14 Spices	Spice Cultivation
15 OthCrops	Other Crops	15 OthCrops	Other Crop Cultivation
16 Meat	Meat	16 LivestockR	Livestock Rearing
17 MilkFat	Milk and Fat	17 PoultryRear	Poultry Rearing
18 Animldraft	Animal draft	18 Shrimp	Shrimp Farming
19 Manure	Manure	19 Fish	Fishing
20 HidesSkins	Hides and Skins	20 Forestry	Forestry
21 PoltryMeat	Poultry Meat	21 RiceFlorBran	Rice Milling
22 PoltryEggs	Poultry Eggs	22 FlorBranFed	Grain Milling
23 Shrimp	Shrimp	23 FishSeafod	Fish Process
24 Fish	Fish	24 EdibleNonOil	Oil Industry
25 Forestry	Forestry	25 SugrGurMols	Sweetener Industry
26 RiceFlorBran	Rice flour Bran	26 TeaProduct	Tea Product
27 FlorBranFed	Flour Bran Feed	27 Salt	Salt Refining
28 FishSeafod	Fish and Seafood	28 ProcssFood	Food Process
29 EdibleNonOil	Edible-Nonedible Oil	29 TaningLethr	Tanning and Finishing
30 SugrGurMols	Sugar Gur Molasses	30 LethrProdt	Leather Industry
31 TeaProduct	Tea Product	31 Baling	Baling
32 Salt	Salt	32 JuteProduct	Jute Fabrication
33 ProcssFood	Processed Food	33 Yarn	Yarn Industry
34 TaningLethr	Tanning and Leather	34 MillClth	Cloth Milling
35 LethrProdt	Leather Product	35 HandlmClth	Handloom Cloth
36 Baling	Baling	36 DyeBleaching	Dyeing and Bleaching
37 JuteProduct	Jute Product	37 RMG	RMG
38 Yarn	Yarn	38 KniRMGH	Knitting
39 MillClth	Mill Cloth	39 Toiletries	Toiletries Mfg.
40 HandlmClth	Handloom Cloth	40 Cigarettes	Cigarette Industry
41 DyeBleaching	Dyed Bleach Yarn Fabrics	41 Bidi	Bidi Industry
42 RMG	Ready Made Garments	42 BasicWProdt	Saw and Plane
43 KniRMGH	Knitted RMG and Hosiery	43 WodnFur	Furniture Industry
44 Toiletries	Toiletries	44 PulpPaBord	Paper Industry
45 Cigarettes	Cigarettes	45 PrintingPub	Printing and Publishing
46 Bidi	Bidi	46 Medicines	Pharmaceuticals Mfg.
47 BasicWProdt	Basic Wood Product	47 FertzInsect	Fertiliser Industry
48 WodnFur	Wooden Furniture	48 BasicChemica	Basic Chemical
49 PulpPaBord	Pulp Paper and Board	49 PetrolProdt	Petroleum Ref.
50 PrintingPub	Printing and Publishing	50 ChnPottry	Earth ware Industry

…Appendix D continues

Appendix D continued

Element of Set COM	Commodity Description	Element of Set IND	Industry Description
51 Medicines	Medicines	51 ChemicalInd	Chemical Industry
52 FertzInsect	Fertilizer, Insecticides	52 Glass	Glass Industry
53 BasicChemica	Chemicals	53 BricTCProdt	Clay Industry
54 PetrolProdt	Petroleum Product	54 Cement	Cement Mfg.
55 ChnPottry	China Pottery	55 IronStBasic	Basic Metal Mfg.
56 ChemProdt	Chemical Products	56 FabMetProdt	Metal Mfg.
57 Glass	Glass Products	57 Machinery	Machinery and Equipments
58 BricTCProdt	Bricks, Tiles and Clay Products	58 TransEquipmt	Transport Equipments
59 Cement	Cement	59 MisceInd	Miscellaneous Industry
60 IronStBasic	Iron Steel Basic	60 UrbanBldg	Urban Building
61 FabMetProdt	Fabricated Metal Products	61 RuralBldg	Rural Building
62 Machinery	Machinery	62 PowPlntBldg	Power Plant Building
63 TransEquipmt	Transport Equipment	63 RuralRd	Rural Road Building
64 MisceInd	Miscellaneous Industry Products	64 PortRdRailBg	Port Road Railway Building
65 UrbanBldg	Urban Buildings	65 CanlDykOthBg	Canal Dyke Other Buildings
66 RuralBldg	Rural Buildings	66 ElecWater	Electricity and Water
67 BldgMantence	Building Maintenance	67 GasExtrDist	Gas Extraction and
68 PowPlntBldg	Plants for construction	68 MinigQuaring	Mining and Quarrying
69 RuralRd	Rural Roads	69 TradWholsale	Wholesale Trade
70 PortAirRlwy	Ports, Airports Railways	70 TradRetail	Retail Trade
71 CDOthrBldg	Canal, Dyke, Other Buildings	71 AirTran	Air Transport
72 InfrastrMtn	Infrastructure Maintenance	72 WaterTran	Water Transport
73 ElecWater	Electricity and Water	73 LandTran	Land Transport
74 GasExtrDist	Gas Extraction and Distribution	74 RailTran	Railway Transport
75 MinigQuaring	Mining and Quarrying	75 Warehousing	Other Transport
76 TradWholsale	**Trade Wholesale** (margin)*	76 HousingServ	Housing Service
77 TradRetail	**Trade Retail** (margin)*	77 HealthServ	Health and Vet Service
78 AirTran	**Air Transport** (margin)*	78 EdnServ	Education Service
79 WaterTran	**Water Transport** (margin)*	79 PubAdmDfen	Public Administration and
80 LandTran	**Land Transport** (margin)*	80 BnkInsRealSt	Bank Insurance and Real estate
81 RailTran	**Railway Transport** (margin)*	81 ProfServ	Professional Service
82 Warehousing	Warehousing	82 HotelRest	Hotel and Restaurant,
83 HousingServ	Housing Service	83 Entertainmnt	Entertainment
84 HealthServ	Health and Vet Services	84 Communica	Communication
85 EdnServ	Education Services	85 OtherServ	Other Services
86 PubAdmDfen	Public Administration & Defence	86 InfTechServ	Information Technology &
87 BnkInsRealSt	Bank Insurance		E-commerce
88 ProfServ	Professional Services		
89 HotelRest	Hotels and Restaurants		
90 Entertainmnt	Entertainments		
91 Communica	Communications		
92 OtherServ	Other Services		
93 InfTechServ	Information Technology & Services		
94 Waste	Waste		

Note:* Commodities shown in block letters represent margin commodities

Appendix E: Additional Result Tables

Table E.1: Tariff Rates for Base-Year and Simulation Experiment

	Base-year (1999-2000)			Simulation	Changes in
	Import values	Tariff revenues	Tariff rates	tariff rates	import values
Commodity	(1)	(2)	(3)	(4)	(5)
1 Paddy	0	0	0.00	0.00	0.00
2 Wheat	21,276	682	3.21	0.00	3.14
3 OthGrains	11	0	0.00	0.00	13.62
4 Jute	0	0	0.00	0.00	0.00
5 Sugarcane	0	0	0.00	0.00	0.00
6 Potato	74	4	4.97	0.00	1.86
7 Vegetables	8,944	340	3.80	0.00	9.11
8 Pulses	0	0	0.00	0.00	0.00
9 Oilseeds	4,428	207	4.67	0.00	4.33
10 Fruits	2,496	526	21.07	0.00	32.96
11 Cotton	5,245	0	0.00	0.00	-3.88
12 Tobacco	1,127	121	10.74	0.00	15.18
13 Tea	0	0	0.00	0.00	0.00
14 Spices	643	149	23.15	0.00	31.80
15 OthCrops	3,505	94	2.68	0.00	11.60
16 Meat	3,712	2	0.05	0.00	12.80
17 MilkFat	3,519	1,112	31.60	0.00	16.82
18 Animldraft	920	3	0.30	0.00	11.44
19 Manure	154	0	0.00	0.00	4.00
20 HidesSkins	502	3	0.61	0.00	-0.03
21 PoltryMeat	203	0	0.00	0.00	12.07
22 PoltryEggs	69	7	10.19	0.00	1.81
23 Shrimp	0	0	0.00	0.00	0.00
24 Fish	31	3	11.16	0.00	1.95
25 Forestry	42	3	7.90	0.00	2.70
26 RiceFlorBran	6,037	96	1.59	0.00	15.06
27 FlorBranFed	556	66	11.83	0.00	27.35
28 FishSeafod	757	122	16.16	0.00	29.07
29 EdibleNonOil	39,114	2,290	5.85	0.00	5.14
30 SugrGurMols	2,417	439	18.17	0.00	37.50
31 TeaProduct	38	8	20.50	0.00	41.12
32 Salt	58	9	15.97	0.00	36.04
33 ProcssFood	2,606	449	17.24	0.00	29.47
34 TaningLethr	7	0	1.57	0.00	-1.51
35 LethrProdt	200	29	14.38	0.00	6.10
36 Baling	0	0	0.00	0.00	0.00
37 JuteProduct	4	0	10.75	0.00	3.30
38 Yarn	13,358	450	3.37	0.00	3.44
39 MillClth	11,060	212	1.92	0.00	-4.11
40 HandlmClth	0	0	0.00	0.00	0.00
41 DyeBleaching	197	0	0.00	0.00	11.75
42 RMG	3,848	17	0.44	0.00	0.82
43 KniRMGH	69	5	7.77	0.00	5.91
44 Toiletries	1,486	180	12.10	0.00	12.85
45 Cigarettes	87	2	2.05	0.00	8.57
46 Bidi	0	0	0.00	0.00	0.00
47 BasicWProdt	63	11	17.65	0.00	32.78
48 WodnFur	94	22	23.18	0.00	37.32
49 PulpPaBord	12,093	888	7.34	0.00	4.95
50 PrintingPub	960	29	3.07	0.00	5.74

…Table E.1 continues

Table E.1 continued

Commodity	Base-year (1999-2000) Import values (1)	Tariff revenues (2)	Tariff rates (3)	Simulation tariff rates (4)	Changes in import values (5)
51 Medicines	4,717	54	1.15	0.00	5.64
52 FertzInsect	9,086	81	0.90	0.00	0.90
53 BasicChemica	6,126	521	8.51	0.00	1.90
54 PetrolProdt	38,822	9,454	24.35	0.00	7.75
55 ChnPottry	646	173	26.75	0.00	31.33
56 ChemProdt	2744	132	4.82	0.00	6.47
57 Glass	2193	365	16.67	0.00	17.07
58 BricTCProdt	150	11	7.61	0.00	15.05
59 Cement	6031	1,003	16.63	0.00	5.11
60 IronStBasic	17,956	959	5.34	0.00	4.08
61 FabMetProdt	10,321	1,579	15.30	0.00	14.33
62 Machinery	77,625	4,570	5.89	0.00	3.14
63 TransEquipmt	20,929	1,852	8.85	0.00	3.91
64 MisceInd	16,637	1,097	6.59	0.00	1.98
65 UrbanBldg	0	0	0.00	0.00	0.00
66 RuralBldg	0	0	0.00	0.00	0.00
67 BldgMantence	0	0	0.00	0.00	0.55
68 PowPlntBldg	0	0	0.00	0.00	0.00
69 RuralRd	0	0	0.00	0.00	0.00
70 PortAirRlwy	0	0	0.00	0.00	0.00
71 CDOthrBldg	0	0	0.00	0.00	0.00
72 InfrastrMtn	0	0	0.00	0.00	0.00
73 ElecWater	0	0	0.00	0.00	0.68
74 GasExtrDist	37	3	7.41	0.00	1.76
75 MinigQuaring	2,770	221	7.98	0.00	1.28
76 TradWholsale	0	0	0.00	0.00	0.00
77 TradRetail	0	0	0.00	0.00	0.00
78 AirTran	0	0	0.00	0.00	0.00
79 WaterTran	0	0	0.00	0.00	0.00
80 LandTran	0	0	0.00	0.00	0.00
81 RailTran	0	0	0.00	0.00	0.00
82 Warehousing	0	0	0.00	0.00	0.00
83 HousingServ	0	0	0.00	0.00	0.06
84 HealthServ	0	0	0.00	0.00	0.00
85 EdnServ	0	0	0.00	0.00	0.00
86 PubAdmDfen	3,562	0	0.00	0.00	0.15
87 BnkInsRealSt	1,304	0	0.00	0.00	0.72
88 ProfServ	2,537	0	0.00	0.00	0.28
89 HotelRest	0	0	0.00	0.00	3.44
90 Entertainmnt	4	0	0.00	0.00	2.77
91 Communica	308	0	0.00	0.00	3.40
92 OtherServ	0	0	0.00	0.00	1.88
93 InfTechServ	65	0	0.00	0.00	0.29
94 Waste	700	49	7.05	0.00	4.43
Total	377,280	30,705	8.14	-	-

Note: Import values (c.i.f.) and tariff revenues are in million Tk. and tariff rates are in percentages. Changes in import values in column 5 are from simulation 1.

Table E.2: Effects of Removing Tariffs on Employment of all 86 Industries

Industry	Primary effects of removing tariffs (1)	Effects of general tax increase (2)	Effects of national savings (3)	Total effects (4)
1 Paddy	2.57	-3.32	0.17	-0.58
2 Wheat	-1.91	-0.55	-0.05	-2.51
3 OthGrains	3.81	-4.44	0.24	-0.39
4 Jute	-2.88	3.77	-0.29	0.60
5 Sugarcane	1.19	-4.10	0.21	-2.70
6 Potato	4.60	-5.15	0.28	-0.26
7 Vegetables	-1.88	1.86	-0.19	-0.21
8 Pulses	4.15	-5.40	0.26	-1.00
9 Oilseeds	-8.25	2.25	-0.26	-6.26
10 Fruits	0.02	-3.80	0.22	-3.56
11 Cotton	-7.16	6.20	-0.45	-1.40
12 Tobacco	-4.29	1.94	-0.19	-2.53
13 Tea	-4.99	6.66	-0.44	1.23
14 Spices	-2.73	-2.51	0.13	-5.11
15 OthCrops	0.54	-1.87	0.05	-1.28
16 LivestockR	3.05	-6.41	0.19	-3.17
17 PoultryRear	6.99	-8.14	0.43	-0.72
18 Shrimp	-6.21	8.46	-0.56	1.69
19 Fish	5.38	-6.21	0.33	-0.50
20 Forestry	7.59	-9.23	0.43	-1.21
21 RiceFlorBran	7.82	-9.40	0.48	-1.11
22 FlorBranFed	9.40	-12.67	0.61	-2.66
23 FishSeafod	-3.06	2.67	-0.24	-0.63
24 EdibleNonOil	-4.25	-0.75	-0.04	-5.04
25 SugrGurMols	0.43	-2.24	0.12	-1.69
26 TeaProduct	3.75	-4.79	0.26	-0.78
27 Salt	0.70	-2.56	0.11	-1.76
28 ProcssFood	-0.09	-3.12	0.16	-3.04
29 TaningLethr	-4.61	3.98	-0.40	-1.04
30 LethrProdt	-4.09	3.43	-0.36	-1.01
31 Baling	-14.42	18.56	-1.49	2.64
32 JuteProduct	-6.72	8.43	-0.62	1.10
33 Yarn	-4.80	3.32	-0.24	-1.72
34 MillClth	-8.81	10.47	-0.66	1.01
35 HandlmClth	4.20	-4.86	0.26	-0.40
36 DyeBleaching	4.25	-4.80	0.26	-0.29
37 RMG	-8.86	11.81	-0.74	2.20
38 KniRMGH	-8.29	11.80	-0.76	2.74
39 Toiletries	-2.17	5.55	-0.39	3.00
40 Cigarettes	29.06	-28.49	1.40	1.97
41 Bidi	13.20	-13.23	0.69	0.66
42 BasicWProdt	1.15	-2.70	0.12	-1.43
43 WodnFur	2.24	-2.68	0.09	-0.35
44 PulpPaBord	-4.47	0.79	-0.09	-3.77

…Table E.2 continues

Table E.2 continued

Industry	Primary effects of removing tariffs (**1**)	Effects of general tax increase (**2**)	Effects of national savings (**3**)	Total effects (**4**)
45 PrintingPub	-1.11	0.68	-0.09	-0.52
46 Medicines	2.08	-2.44	0.10	-0.26
47 FertzInsect	-3.52	4.50	-0.29	0.69
48 BasicChemica	-8.08	6.10	-0.41	-2.39
49 PetrolProdt	6.00	3.36	-0.34	9.02
50 ChnPottry	-2.92	3.42	-0.32	0.18
51 ChemicalInd	0.68	-4.73	0.30	-3.75
52 Glass	-3.60	-2.09	0.09	-5.60
53 BricTCProdt	4.36	-5.00	0.20	-0.44
54 Cement	-10.46	1.78	-0.15	-8.83
55 IronStBasic	-4.62	1.20	-0.14	-3.56
56 FabMetProdt	-0.10	-3.99	0.20	-3.89
57 Machinery	-5.04	3.82	-0.30	-1.53
58 TransEquipmt	-6.57	4.25	-0.37	-2.69
59 MisceInd	-4.99	6.55	-0.41	1.15
60 UrbanBldg	6.52	-7.14	0.30	-0.32
61 RuralBldg	7.10	-8.09	0.34	-0.65
62 PowPlntBldg	19.12	-19.52	0.75	0.35
63 RuralRd	7.82	-1.94	-0.21	5.66
64 PortRdRailBg	3.48	-1.12	-0.11	2.25
65 CanlDykOthBg	5.19	-6.10	0.29	-0.62
66 ElecWater	3.94	-3.95	0.17	0.16
67 GasExtrDist	6.60	-7.59	0.41	-0.59
68 MinigQuaring	3.63	-4.46	0.22	-0.61
69 TradWholsale	0.20	1.33	-0.19	1.35
70 TradRetail	3.92	-3.48	0.13	0.57
71 AirTran	0.14	0.89	-0.12	0.91
72 WaterTran	0.32	2.12	-0.30	2.14
73 LandTran	0.27	1.79	-0.25	1.81
74 RailTran	0.11	0.70	-0.10	0.71
75 Warehousing	-4.67	5.53	-0.42	0.44
76 HousingServ	7.53	-9.34	0.47	-1.34
77 HealthServ	2.46	-4.32	0.15	-1.72
78 EdnServ	2.34	-2.63	0.14	-0.15
79 PubAdmDfen	-9.45	12.03	-0.86	1.71
80 BnkInsRealSt	-0.17	0.45	-0.13	0.15
81 ProfServ	-1.72	2.17	-0.23	0.22
82 HotelRest	7.10	-6.91	0.35	0.54
83 Entertainmnt	5.29	-5.77	0.31	-0.18
84 Communica	-3.38	4.60	-0.36	0.86
85 OtherServ	2.53	-2.89	0.14	-0.23
86 InfTechServ	-1.97	2.71	-0.27	0.47

Note: All figures are percentage changes.

Table E.3: Decomposition of Output Results (Simulation 3: Total Effects)

	Output	Decomposition		
	x0com	LocalMarket	DomShare	Export
Commodity	**(1)**	**(2)**	**(3)**	**(4)**
1 Paddy	-0.35	-0.35	0.00	0.00
2 Wheat	-1.52	-0.97	-0.55	0.00
3 OthGrains	-0.18	-0.19	0.02	0.00
4 Jute	0.41	0.29	0.00	0.12
5 Sugarcane	-1.26	-1.26	0.00	0.00
6 Potato	-0.11	-0.11	0.00	0.00
7 Vegetables	-0.09	-0.08	-0.71	0.69
8 Pulses	-0.42	-0.42	0.00	0.00
9 Oilseeds	-3.52	-2.21	-1.31	0.00
10 Fruits	-1.20	0.24	-1.44	0.00
11 Cotton	-0.51	-0.92	0.41	0.00
12 Tobacco	-1.27	-0.33	-2.15	1.21
13 Tea	0.58	-0.26	0.00	0.84
14 Spices	-2.30	0.01	-2.31	0.00
15 OthCrops	-0.56	-0.52	-0.17	0.13
16 Meat	-1.78	-1.91	0.13	0.00
17 MilkFat	-6.35	2.12	-8.47	0.00
18 Animldraft	-0.53	-0.53	0.00	0.00
19 Manure	-0.78	-0.81	0.02	0.00
20 HidesSkins	-0.54	-0.53	-0.01	0.00
21 PoltryMeat	-0.19	-0.21	0.02	0.00
22 PoltryEggs	-0.20	-0.20	0.00	0.00
23 Shrimp	0.76	0.06	0.00	0.70
24 Fish	-0.19	-0.19	0.00	0.00
25 Forestry	-0.41	-0.41	0.00	0.00
26 RiceFlorBran	-0.23	-0.23	0.00	0.00
27 FlorBranFed	-0.52	-0.33	-0.20	0.00
28 FishSeafod	-0.09	-0.19	-0.81	0.92
29 EdibleNonOil	-1.11	-0.19	-0.92	0.00
30 SugrGurMols	-1.42	-0.16	-1.26	0.00
31 TeaProduct	-0.47	-0.18	-0.29	0.00
32 Salt	-1.17	-0.67	-0.50	0.00
33 ProcssFood	-1.45	0.28	-1.73	0.00
34 TaningLethr	-0.33	-0.33	0.00	0.00
35 LethrProdt	-0.35	-0.43	0.00	0.08
36 Baling	0.98	0.98	0.00	0.00
37 JuteProduct	0.97	-0.20	0.00	1.16
38 Yarn	-1.23	-0.03	-1.20	0.00
39 MillClth	0.52	0.96	-0.45	0.00
40 HandlmClth	-0.30	-0.30	0.00	0.00
41 DyeBleaching	-0.20	-0.28	0.08	0.00
42 RMG	1.35	0.00	0.00	1.35
43 KniRMGH	1.67	0.00	-0.01	1.68
44 Toiletries	1.28	0.22	-1.25	2.31
45 Cigarettes	0.26	0.25	0.01	0.00
46 Bidi	0.19	0.19	0.00	0.00
47 BasicWProdt	-0.67	-0.27	-0.41	0.00
48 WodnFur	-0.15	0.04	-0.19	0.00
49 PulpPaBord	-1.11	-0.14	-0.96	0.00
50 PrintingPub	-0.34	-0.21	-0.13	0.00

…Table E.3 continues

Table E.3 continued

	Output	Decomposition		
	x0com	LocalMarket	DomShare	Export
Commodity	**(1)**	**(2)**	**(3)**	**(4)**
51 Medicines	-0.11	-0.39	0.28	0.00
52 FertzInsect	0.16	-0.42	-0.07	0.65
53 BasicChemica	-1.82	-0.40	-1.41	0.00
54 PetrolProdt	1.70	1.18	-7.22	7.74
55 ChnPottry	0.04	-0.22	-1.88	2.14
56 ChemProdt	-0.86	-0.54	-0.32	0.00
57 Glass	-2.90	3.79	-6.69	0.00
58 BricTCProdt	-0.19	-0.08	-0.11	0.00
59 Cement	-3.14	-0.69	-2.45	0.00
60 IronStBasic	-1.81	-1.16	-0.65	0.00
61 FabMetProdt	-1.94	0.33	-2.28	0.00
62 Machinery	-1.02	0.18	-2.13	0.92
63 TransEquipmt	-0.71	1.13	-1.83	0.00
64 MisceInd	0.44	-0.01	-1.49	1.94
65 UrbanBldg	-0.21	-0.21	0.00	0.00
66 RuralBldg	-0.21	-0.21	0.00	0.00
67 BldgMantence	0.09	0.09	0.00	0.00
68 PowPlntBldg	0.11	0.11	0.00	0.00
69 RuralRd	2.15	2.15	0.00	0.00
70 PortAirRlwy	1.39	1.39	0.00	0.00
71 CDOthrBldg	-0.35	-0.35	0.00	0.00
72 InfrastrMtn	0.11	0.11	0.00	0.00
73 ElecWater	0.04	0.04	0.00	0.00
74 GasExtrDist	-0.17	-0.17	0.00	0.00
75 MinigQuaring	-0.27	-0.27	0.00	0.00
76 TradWholsale	0.59	0.59	0.00	0.00
77 TradRetail	0.25	0.25	0.00	0.00
78 AirTran	0.59	0.59	0.00	0.00
79 WaterTran	0.59	0.59	0.00	0.00
80 LandTran	0.59	0.59	0.00	0.00
81 RailTran	0.59	0.59	0.00	0.00
82 Warehousing	0.23	0.23	0.00	0.00
83 HousingServ	0.00	0.00	0.00	0.00
84 HealthServ	-0.82	-0.82	0.00	0.00
85 EdnServ	-0.13	-0.13	0.00	0.00
86 PubAdmDfen	1.39	0.02	0.00	1.38
87 BnkInsRealSt	0.10	-0.09	0.00	0.19
88 ProfServ	0.08	-0.15	0.00	0.24
89 HotelRest	0.28	0.28	0.00	0.00
90 Entertainmnt	-0.09	-0.13	0.00	0.04
91 Communica	0.44	-0.48	0.00	0.92
92 OtherServ	-0.19	-0.19	0.00	0.00
93 InfTechServ	0.24	-0.03	0.00	0.27
94 Waste	0.85	0.74	0.11	0.00

Note: Figures for x0com are percentage changes. Figures for LocalMarket, DomShare and Export are percentage point contributions to x0com.

Table E.4: Shares of Domestic Production, Imports and Exports

Commodity	Share of domestic production in total supply (**1**)	Share of imports in total supply (**2**)	Share of exports in total output (**3**)
1 Paddy	1.000	0.000	0.000
2 Wheat	0.613	0.387	0.000
3 OthGrains	0.993	0.007	0.000
4 Jute	1.000	0.000	0.175
5 Sugarcane	1.000	0.000	0.000
6 Potato	0.997	0.003	0.000
7 Vegetables	0.735	0.265	0.035
8 Pulses	1.000	0.000	0.000
9 Oilseeds	0.758	0.242	0.000
10 Fruits	0.924	0.076	0.000
11 Cotton	0.588	0.412	0.000
12 Tobacco	0.797	0.203	0.023
13 Tea	1.000	0.000	0.373
14 Spices	0.885	0.115	0.000
15 OthCrops	0.901	0.099	0.003
16 Meat	0.973	0.027	0.000
17 MilkFat	0.484	0.516	0.000
18 Animldraft	0.983	0.017	0.000
19 Manure	0.983	0.017	0.000
20 HidesSkins	0.976	0.024	0.000
21 PoltryMeat	0.990	0.010	0.000
22 PoltryEggs	0.996	0.004	0.000
23 Shrimp	1.000	0.000	0.351
24 Fish	1.000	0.000	0.000
25 Forestry	0.999	0.001	0.000
26 RiceFlorBran	0.982	0.018	0.000
27 FlorBranFed	0.986	0.014	0.000
28 FishSeafod	0.962	0.038	0.080
29 EdibleNonOil	0.477	0.523	0.000
30 SugrGurMols	0.944	0.056	0.000
31 TeaProduct	0.989	0.011	0.000
32 Salt	0.975	0.025	0.000
33 ProcssFood	0.898	0.102	0.000
34 TaningLethr	1.000	0.000	0.000
35 LethrProdt	0.995	0.005	0.369
36 Baling	1.000	0.000	0.000
37 JuteProduct	1.000	0.000	0.516
38 Yarn	0.682	0.318	0.000
39 MillClth	0.728	0.272	0.000
40 HandlmClth	1.000	0.000	0.000
41 DyeBleaching	0.967	0.033	0.000
42 RMG	0.971	0.029	0.994
43 KniRMGH	0.998	0.002	0.984
44 Toiletries	0.846	0.154	0.298
45 Cigarettes	0.991	0.009	0.000
46 Bidi	1.000	0.000	0.000
47 BasicWProdt	0.976	0.024	0.000
48 WodnFur	0.991	0.009	0.000
49 PulpPaBord	0.578	0.422	0.000
50 PrintingPub	0.876	0.124	0.000

…Table E.4 continues

Table E.4 continued

Commodity	Share of domestic production in total supply (**1**)	Share of imports in total supply (**2**)	Share of exports in total output (**3**)
51 Medicines	0.744	0.256	0.000
52 FertzInsect	0.609	0.391	0.250
53 BasicChemica	0.439	0.561	0.000
54 PetrolProdt	0.395	0.605	0.022
55 ChnPottry	0.916	0.084	0.068
56 ChemProdt	0.770	0.230	0.000
57 Glass	0.361	0.639	0.000
58 BricTCProdt	0.979	0.021	0.000
59 Cement	0.453	0.547	0.000
60 IronStBasic	0.727	0.273	0.000
61 FabMetProdt	0.752	0.248	0.000
62 Machinery	0.283	0.717	0.023
63 TransEquipmt	0.535	0.465	0.000
64 MisceInd	0.601	0.399	0.451
65 UrbanBldg	1.000	0.000	0.000
66 RuralBldg	1.000	0.000	0.000
67 BldgMantence	1.000	0.000	0.000
68 PowPlntBldg	1.000	0.000	0.000
69 RuralRd	1.000	0.000	0.000
70 PortAirRlwy	1.000	0.000	0.000
71 CDOthrBldg	1.000	0.000	0.000
72 InfrastrMtn	1.000	0.000	0.000
73 ElecWater	1.000	0.000	0.000
74 GasExtrDist	0.978	0.022	0.000
75 MinigQuaring	0.913	0.087	0.000
76 TradWholsale	1.000	0.000	0.000
77 TradRetail	1.000	0.000	0.000
78 AirTran	1.000	0.000	0.000
79 WaterTran	1.000	0.000	0.000
80 LandTran	1.000	0.000	0.000
81 RailTran	1.000	0.000	0.000
82 Warehousing	1.000	0.000	0.000
83 HousingServ	1.000	0.000	0.000
84 HealthServ	1.000	0.000	0.000
85 EdnServ	1.000	0.000	0.000
86 PubAdmDfen	0.968	0.032	0.245
87 BnkInsRealSt	0.980	0.020	0.014
88 ProfServ	0.986	0.014	0.020
89 HotelRest	1.000	0.000	0.000
90 Entertainmnt	1.000	0.000	0.001
91 Communica	0.981	0.019	0.128
92 OtherServ	1.000	0.000	0.000
93 InfTechServ	0.985	0.015	0.035
94 Waste	0.291	0.709	0.000
Total	0.917	0.083	0.060

Source: BAORANI database (Hoque, 2006).

Appendix F: Back-of-the-Envelope Explanation of Economy-wide Tariff Cut Results[17]

In this appendix we seek to illustrate with a one-sector model, why the Bangladesh model gives the key result that a broad-based tariff cut leads to an economy-wide increase in activity and employment. We approach this task by developing an equation which gives a rough approximation to the form of the short-run supply function which underlies an industry's output responses under our chosen simulation environment.

We proceed by formulating an equation covering industry demands for primary factors. We assume that limited substitution possibilities between different primary factor inputs are governed by a constant elasticity of substitution (CES) function. Specifically we assume that the industry chooses its primary factor inputs X_i $(i = 1, 2)$ to minimise the cost $\sum_i P_i X_i$ of producing a given bundle of effective primary factor inputs Z, subject to the CES production:

$$Z = \left(\sum_i \delta_i X_i^{-\rho} \right)^{-1/\rho} \tag{F.18}$$

The associated first order conditions are:

$$\frac{\partial L}{\partial X_i} = P_i + \frac{\Lambda}{\rho} \left[\sum_i \delta_i X_i^{-\rho} \right]^{-1/\rho - 1} \left(-\rho \delta_i X_i^{-\rho - 1} \right) = 0 , \tag{F.19}$$

or, solving for (F.19)

$$P_i = \Lambda \delta_i X_i^{-(1+\rho)} \left[\sum_i \delta_i X_i^{-\rho} \right]^{-(1+\rho)/\rho} , \tag{F.20}$$

$$\frac{\partial L}{\partial \Lambda} = \left[\sum_i \delta_i X_i^{-\rho} \right]^{-1/\rho} - Z = 0 , \tag{F.21}$$

or, solving for Z

$$Z = \left[\sum_i \delta_i X_i^{-\rho} \right]^{-1/\rho} . \tag{F.22}$$

Substituting from (F.22) into (F.20) we obtain:

$$P_i = \Lambda \delta_i X_i^{-(1+\rho)} \left[Z \right]^{(1+\rho)} , \tag{F.23}$$

or, solving for X_i

[17] Part of this appendix is adapted from Madden (1990, pp. 310-315).

$$X_i = \left[\Lambda\delta_i\right]^{1/(1+\rho)} \left[P_i\right]^{-1/(1+\rho)} Z\,. \tag{F.24}$$

Transforming (F.24) to percentage changes we get:

$$x_i = \lambda/(1+\rho) - p_i/(1+\rho) + z\,, \tag{F.25}$$

or
$$x_i = \sigma\lambda - \sigma p_i + z\,, \tag{F.26}$$

where
$$\sigma = 1/(1+\rho)\,. \tag{F.27}$$

The percentage form of (F.22) is

$$z = 1/\rho\left[\sum_i S_i \rho x_i\right], \tag{F.28}$$

or
$$z = \sum_i S_i x_i\,, \tag{F.29}$$

where
$$S_i = \frac{\delta_i X_i^{-\rho}}{\sum_k \delta_k X_k^{-\rho}}\,. \tag{F.30}$$

Multiplying both sides of (F.20) by X_i we get:

$$P_i X_i = \Lambda\delta_i X_i^{-\rho}\left[\sum_i \delta_i X_i^{-\rho}\right]^{-(1+\rho)/\rho}\,. \tag{F.31}$$

Hence
$$\sum_k P_k X_k = \Lambda\delta_1 X_1^{-\rho}\left[\sum_i \delta_i X_i^{-\rho}\right]^{-(1+\rho)/\rho} + \ldots + \Lambda\delta_n X_n^{-\rho}\left[\sum_i \delta_i X_i^{-\rho}\right]^{-(1+\rho)/\rho} \tag{F.32}$$

Therefore
$$\frac{P_i X_i}{\sum_k P_k X_k} = \frac{\Lambda\delta_i X_i^{-\rho}\left[\sum_i \delta_i X_i^{-\rho}\right]^{-(1+\rho)/\rho}}{\Lambda\left[\sum_i \delta_i X_i^{-\rho}\right]^{-(1+\rho)/\rho}\left(\delta_1 X_1^{-\rho} + \ldots + \delta_n X_n^{-\rho}\right)}, \tag{F.33}$$

or
$$\frac{P_i X_i}{\sum_k P_k X_k} = \frac{\delta_i X_i^{-\rho}}{\sum_k \delta_k X_k^{-\rho}} = S_i \tag{F.34}$$

i.e. the S_i of (F.34) turn out to be cost shares.

To get rid of λ, substituting (F.26) into (F.29) we obtain:

$$z = \sum_i S_i(\sigma\lambda - \sigma p_i + z)\,, \tag{F.35}$$

or, solving for λ
$$\lambda = \sum_i S_i p_i \tag{F.36}$$

since $\sum_i S_i = 1$.

Substituting λ from (F.36) back into (F.26) we obtain the input demand functions:

$$x_i = z - \sigma\left(p_i - \sum_i S_i p_i \right) \qquad \text{(F.37)}$$

We continue by restating a simplified version of equation (F.37) assuming here only two primary factors, labour and capital.

$$l = z - \sigma(w - S_L w - S_K r) \qquad \text{(F.38)}$$

$$k = z - \sigma(r - S_L w - S_K r) \qquad \text{(F.39)}$$

where l and k are the percentage changes in the demand for labour and capital respectively by a representative industry, z is the percentage change in the activity level of the representative industry, w and r are the percentage changes in the prices paid for labour and the rental of capital respectively by the industry, σ is the parameter reflecting the degree of substitutability between labour and capital and S_L and S_K are primary factor shares.

We can rewrite (F.38):

$$l = z - \sigma[w(1 - S_L) - S_K r], \qquad \text{(F.40)}$$

or

$$l = z - \sigma S_K (w - r). \qquad \text{(F.41)}$$

For the short-run k = 0 and (F.39) becomes:

$$z = \sigma(r - S_L w - S_K r), \qquad \text{(F.42)}$$

or

$$S_K r = -z/\sigma + r - S_L w. \qquad \text{(F.43)}$$

Substituting (F.43) for the term $S_K r$ in (F.41):

$$l = z - \sigma\left(S_K w + z/\sigma - r + S_L w\right), \qquad \text{(F.44)}$$

or

$$l = -\sigma\left(w - r\right). \qquad \text{(F.45)}$$

We can also rearrange (F.42) to obtain:

$$z = \sigma r - \sigma S_L w - \sigma(1 - S_L) r, \qquad \text{(F.46)}$$

or

$$z = -\sigma S_L (w - r) \qquad \text{(F.47)}$$

Dividing (F.45) by (F.47) we get:

$$l/z = 1/S_L, \qquad \text{(F.48)}$$

or

$$l = z/S_L. \qquad \text{(F.49)}$$

Accounting for all costs in creation of primary factor input bundle:

$$PZ = P_L X_L + P_K X_K \qquad \text{(F.50)}$$

The percentage form of (F.50) is

$$p + z = S_L(p_L + x_L) + S_K(p_K + x_K) \tag{F.51}$$

Using (F.29) to substitute for z in (F.51) we obtain:

$$p + S_L x_L + S_K x_K = S_L(p_L + x_L) + S_K(p_K + x_K), \tag{F.52}$$

or, solving for p

$$p = S_L p_L + S_K p_K, \tag{F.53}$$

or

$$p = S_L w + S_K r. \tag{F.54}$$

where p is the basic price of output from the industry.

Rearranging (F.45) to solve for r which we then substitute into (F.54), we obtain:

$$p = S_L w + S_K(w + l/\sigma), \tag{F.55}$$

or

$$p = S_L w + (1 - S_L)w + (1 - S_L)l/\sigma, \tag{F.56}$$

or

$$p = w + (1 - S_L)l/\sigma, \tag{F.57}$$

or

$$l = \sigma(p - w)/(1 - S_L). \tag{F.58}$$

Using (F.49) to substitute for l in (F.58) we obtain the short-run supply function:

$$z = \sigma(p - w)S_L/(1 - S_L) \tag{F.59}$$

Therefore, it can be seen from (F.59) that the output response of an industry is dependent on the primary factor substitutability, the share of non-fixed factors in total factor costs and the difference between the percentage changes in output price and labour costs.

For the purpose of explaining the output response of the whole economy to the tariff shock, let us assume that the economy has only one industry and the output of that industry is both exported and sold domestically. Thus we now take z in (F.59) to cover the supply response of the whole economy.

Whether the economy's output (and employment) is expected to expand or contract as a result of the tariff cut will now depend solely on p and w. An assumption of our tariff experiment is full wage-indexation. Thus, w is equal to the percentage change in the consumer price index, p_c, which can be written as:

$$p_c = S_d^c p + (1 - S_d^c)(p_m + t) \tag{F.60}$$

where p_m is the percentage change in the basic price of imports, t is the percentage change in the power of the tariff (i.e. one plus the tariff rate) and S_d^c is the share of domestic commodities in total household consumption.

In our experiment we assumed that $p_m = 0$ and we can also assume that the following approximately holds:

$$p = p_x = 0 \qquad \text{(F.61)}$$

where p_x is the Bangladeshi currency 'free on board' (f.o.b) export price. That is, we assume that the export price sets the domestic price and we further assume that Bangladesh is too small a country for a change in its tariff rate to have any effects on the terms of trade. Thus from (F.60) we have:

$$p_c = (1 - S_d^c)t \qquad \text{(F.62)}$$

and since $t < 0$, this means $p_c < p$ and therefore $w < p$.

Therefore, on the basis of (F.59) we would expect an expansion in economy-wide output as a result of tariff cut, and on the basis of (F.58) also an expansion in economy-wide employment.

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