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EQUITY AND EFFICIENCY TRADEOFF IN BANGLADESH TAX POLICY REFORM: A COMPUTABLE GENERAL EQUILIBRIUM MODEL

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This study has employed a computable general equilibrium (CGE) tax model for Bangladesh to directly assess the efficiency and equity effects of a set of proposed tax reforms, particularly excise tax, import tariff, direct tax and value-added tax.

It has been found that pure excise tax reforms in the short run for resource mobilization have undesirable consequences on both efficiency and equity grounds. Tariff liberalization may enhance welfare even in the short run. But it is only through simultaneous reforms in all taxes that both equity and efficiency can be improved. A limited VAT stands out as a better alternative to excise taxes on efficiency ground but may not be a desirable policy option on equity ground in the short run. The overall results would point out that any single indirect tax reform can not be relied upon for favorable income redistribution in the short run.

1. Introduction

As in any other country, the government of Bangladesh is concerned about the distribution and efficiency consequences of tax policies which are intended to raise public revenues. Thus some tax reforms are being considered in Bangladesh to widen the tax base, have an output-based tax system, as well as, reduce and streamline the trade taxes. A single-stage value added-tax (VAT) is also being considered to ultimately replace the excise taxes.

The distribution and revenue consequences of these reforms are unclear, even as the proposed tax measures are generally regarded to be more efficient. Generally, the three fiscal policy objectives of equity, higher revenues and improved economic effciency are interrelated with one another. In this regard, it is important to examine the existing and proposed taxes in a broader perspective which covers their implications on equity, revenues and efficiency. This is especially important in a poor country like Bangladesh because of its critical resource base, and dismal economic growth performance.

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It is generally perceived that the overall tax system in Bangladesh is inefficient, unbalanced and inequitable leading to serious distortions in resource allocation and distribution (World Bank, 1987). This is because the tax system has not been designed following any systematic set of guidelines. The government has instead responded to ad hoc needs, resulting in more distortionary policies. Consequently, the country has a very low tax to GOP ratio, direct tax to total tax ratio, domestic indirect tax to total indirect tax ratio, and low elasticity of taxes. The heavy dependence on import taxes generally penalizes exports and distorts the production choices.

This paper assesses the alternative tax systems using a computable general equilibrium (CGE) model to evaluate the efficiency, revenue, and distribution impacts of various tax regimes. The CGE models are useful formulations for assessing the efficiency and equity effects of alternative tax policy packages.

Following the neo-classical tradition, the model employs seven production sectors producing domestic output and four household groups distinguished by income differentials. There are five traded and two non-traded sectors with explicit import and export demand functions. The model is numerically specified and solved for the year 1984-85.

2. The Structure of the Model

The seven sectors defined in the model are:

(1) Food crops
(2) Commercial crops and livestock
(3) All fiber industries
(4) Chemical and pharmaceutical industries
(5) Steel, construction, metal and other heavy industries
(6) Housing, trade and banking services (Private Services)
(7) Health, education and public administration (Public Services)

Production

The general production function has the form:

(1) $X_i = \min\ (A_i V_i) \quad i = 1,\ldots 7$

where A_i denotes intermediate inputs, and V_i is value-added in sector i. A_i is given by fixed proportions of intermediate goods:

$$(2) \quad A_i = \min_j \left(\frac{x_{ji}}{a_{ji}} \right) \qquad i = 1,\ldots 7$$

V_i is derived via a CES function:

$$(3) \quad V_i = \beta_i [\delta_i L_i - \mu i + (1-\delta_i)\ \overline{K}_i - \mu i]^{-1/\mu i}$$
$$i = 1,\ldots 7$$

where β_i is efficiency parameter, δ_i is distribution parameter, μ_i is substitution parameter, and L_i and K_i give labor and capital use in sector *i*, respectively. Capital is sectorally fixed.

Labor demand functions can be derived by cost minimization with respect to (3) as:

$$(4) \quad L_i = \delta_i\ \tau_i \left(\frac{P_{ni}}{W} \right) \tau i_{xi} \qquad i = 1,\ldots 7$$

where P_{ni} is sectoral net price, W is market wage rate and τ_i is elasticity of substitution between capital and labor.

Prices, Imports and Exports

The domestic price of exports (PE_i) is denoted as:

$$(5) \quad PE_i = P_{WEi}\, ER \qquad i = 1, 2, 3$$

where P_{WEi} is world prices for exports and ER is exchange rate.

Since imports and domestically produced goods are not perfect substitutes (Armington, 1969), a composite commodity Q_i is defined which is a CES function of domestically produced goods (D_i) and imported goods (M_i):

$$(6) \quad Q_i = B_i [\delta_i M_i^{-\mu i} + (1-\delta i)\, D_i^{-\mu i}]^{-1/\mu i}$$
$$i = 1,\ldots 7$$

where B_i, δ_i and μ_i are parameters, with $\sigma_i = 1/1+\mu_i$ denoting trade substitution elasticity between D_i and M_i.

First-order condition for cost minimization yields the demand functions for imports and domestically produced goods as one derives the input demand functions.

(7) $M_i = (P_{Di} / P_{Mi})^{\sigma i}{}_{Di} \ (\delta_i / 1\text{-}\delta_i)^{\sigma i}$

(8) $D_i = f_i^{-1}(mi,1)\, Q_i$

where P_{Di} and P_{Mi} are domestic goods prices and import prices, σ_i is trade substitution elasticity and δ_i is share parameter. One can also specify use ratios of imported goods to domestically produced goods as $mi = M_i/D_i$ and use ratio of domestically produced good to total composite goods (D_i/Q_i). The composite goods price (P_i) can be obtained from the cost function:

(9) $P_i = 1/B_i[\delta_i\, \sigma i\, P_{Mi}\,(1\text{-}\sigma i) + (1\text{-}\delta i)\, \sigma i_{PDi}{}^{(1-\sigma i)}]^{1/(1-\sigma i)}$
$i = 1,\ldots 7$

Domestic prices of imported goods are given by:

(10) $P_{Mi} = \overline{P}_{Wi}\ (1+tmi+f) \quad ER \quad i = 1,\ldots 5$

where $\overline{P}_{wi}$ is fixed world price of good *i*, *tmi* is tariff rate on good *i*, *f* is wage earners' premium (WES) paid by importers of good *i* and *ER* is exchange rate.

Export demand functions are of constant elasticity form:

(11) $E_i = \overline{\overline{E}}_{io}\,(P_{WEi})^{ni} \qquad i = 1, 2, 3$

where $\overline{\overline{E}}_{io}$ is a constant and n_i is export demand elasticity of Bangladesh goods.

Net price (P_{ni}) or value added price, is defined as:

(12) $P_{Ni} = P_{Di} - \sum_j^3 a_{ji} - td_i\, P_{Di} \qquad i = 1,\ldots 7$

where td_i is indirect tax rate and a_{ji} is input-output coefficient.

Incomes

Each household's (h) income is defined as follows:

(13) $Y_h = {}_hY_L + {}_hY_k + {}_hR_{ER} + {}_hS + {}_hG\tau$
$h = 1,\ldots 4$

where Y_L = Total returns to labor
Y_k = Total returns to capital
R = Total remittances
S = Total wage earners' premium
$G\tau$ = Total transfer from government.

Government income is denoted by:

$$(14)\ Y_g = {}_gY_k + \sum_h {}_{th}Y_h + \sum_i {}_{tmi}\ P_{Wi}\ ERM_i + \sum_i td_i\ X_i\ P_{Di} + \overline{F}_I\ ER$$

$$i = 1,\ldots 7$$

$$h = 1,\ldots 4$$

where F_I is foreign official capital inflow set exogenously. Government tax revenues come from domestic indirect taxes (tdi); import taxes (tmi) and household income taxes (th).

Consumption demand

Total consumption demand is composed of household and government demands:

$$(15)\ C_i = \sum_h C_{ih} + \overline{C}\ \overline{G}_i \quad i = 1,\ldots 7$$

$$h = 1,\ldots 4$$

where C_{ih} is consumption demand of good i by household h. Household demand functions have the form:

$$(16)\ C_{ih} = \frac{\mu_{hi} Y_h}{P_i} \quad i = 1,\ldots 7$$

$$h = 1,\ldots 4$$

where μ_i is expenditure share on good i and P_i is composite price.

Government real consumption is fixed for each good, as $\overline{C}\ \overline{G}_i$.

Intermediate Demand

Intermediate demand for good i is given as:

$$(17) V_i = \sum_j aji\ X_j \quad i, j = 1,\ldots 7$$

where the *aij*'s are the fixed input-output coefficients and the *xj*'s are sectoral domestic output.

Investment Demand

Total investment (*TI*) is equal to total savings at equilibrium:

(18) $TI = S_H + S_G$ where,

(19) $S_H = \sum_h {}_{sh} Y_h \qquad h = 1,...4$

and government savings is residual after it meets all fixed expenditures.

(20) $S_G = Y_G - \overline{C}_G - \overline{G}\tau - \overline{F}_I ER$

where $\overline{C}G$ is fixed public consumption, $\overline{G}\tau$ is fixed transfer to households and $\overline{F}_1$ is fixed net transfers abroad.

Equilibrium Conditions

In the labor market, the equilibrium condition is specified as:

(21) $L^D - \overline{L}^S = 0$

Domestic demand for each good *i* is the sum of intermediate (*Ai*), consumption (*Ci*), and investment (*Ii*) demands:

(22) $Di = di\,(Ai + Ci + Ii) \qquad i=1,...7$

where $di = \dfrac{1}{fi\,(Mi/Di, 1)}$ is the domestic use ratio.

With this domestic demand, we add export demand to obtain total demand:

(23) $X_i^D = Di + Ei \qquad i = 1,...7$

The product market is cleared by setting all excess demands equal to zero:

(24) $X_i^D - X_i^S = 0 \qquad i = 1,...7$

where X_i^s is sectoral supply of good *i*.

Equations (21) and (24) are solved for wage rate and domestic prices (*PDi*) of each good *i*.

The balance of payments condition is imposed to clear the foreign sector:

$$(25)\quad \Sigma \bar{P}_{\overline{Wi}} M_i + \bar{F}_2 = \Sigma P_{Wi} E_i + \bar{R} + \bar{F}_1$$

where M_i, E_i are exports and imports, respectively, $\bar{F}_1$ stand for official capital inflow, $\bar{R}$ denotes private remittances and $\bar{F}_2$ denotes government foreign exchange settlements on debt. Since inflows and outflows are exogenous, changes in exchange rate assure balance of payments. The government budget balance condition is satisfied by equation (20).

Since the model is solved only for relative prices, we set the cost of living index of household one as the numeraire. Thus all prices can be expressed in terms of this price index.

3. Data, Numerical Specification and Parameterization of the Model

The model was numerically specified for the year 1984-85 for which all the data were available. The model has been solved by using "HERCULES", a social accounting matrix (SAM)-based modelling system.

Since it incorporates all the benchmark data, a SAM was constructed for Bangladesh which fulfills all the equilibrium conditions in the model economy and is thus capable of creating a consistent set of data.

The main sources of data were the:

(1) *Third Five-Year Plan Macro Model of the Planning Commission, Bangladesh.*
(2) *The 1981-82 input-output table, Bangladesh.*
(3) *Census of manufacturing industries, Bangladesh.*
(4) *Fiscal statistics, Bangladesh.*

The key parameters were exogenously specified as shown in Table 1. There is no recent estimate of the key parameters for Bangladesh.

Therefore, following the current practice in CGE modeling (Mansur and Whalley, 1984), other international and regional estimates were consulted like Caddy (1976) for elasticities of substitution in value-added functions; and Adelman and Robinson (1978) and Habito (1984) for trade aggregation functions.

Table 1 - Elasticities Used in the Model

Sectors	CES Production function	Trade Aggregation function	Export Demand function
One	1.20	1.80	1.20
Two	1.10	1.80	1.20
Three	.80	1.30	1.50
Four	.60	1.20	
Five	.60	1.20	
Six	.80		
Seven	.80		

Note: The equilibrium data set as contained in the SAM, being print estimates combined with the specified parameters, automatically calculates the other set of secondary and share parameters of all the functions.

4. Empirical Results

Selected policy experiments have been performed to assess the equity and efficiency effects of various tax policies. These include excise tax experiments with various rate schedules; tariff experiments; experiments with various packages of excise taxes, tariffs and direct taxes; and finally, experiments with VAT.

The conclusions emerging from these policy experiments will help the policymakers in assessing the desirability of any particular tax reform package that they may conceive in the near future.

Excise Tax Experiments: XXXA

Four simulations with different rate structures of domestic excise taxes were performed, leaving other taxes unchanged. Prefixed as XXXA, these are:

XXXA1: Uniform excise tax at 2.5%;
XXXA2: Uniform excise tax at 4.00%;
XXXA3: Lower rates for primary (1, 2) and services sectors (6, 7) but

higher rates for manufacturing sectors (3, 4, 5);
XXXA4: Different combination of taxes as in XXXA3 but higher rates in all sectors.

As a result of unifying the excise tax rate, certain sectors received tax cuts while others were imposed higher tax rates. For instance, tax rates in food and services increased substantially. The average excise tax in the food sector increased by 100 percent while a policy reversal occurred in the public services sector since base run tax in that sector was zero. As a result, prices of value added declined by 2.4 and 1.6 percent, respectively, in the food and public services sectors. Despite a tax increase in the private services sector, the unit value added of the sector slightly increased mainly because the cost of its intermediate inputs declined. The taxes and the corresponding net prices are reported in Table 2.

Table 2 – Tax Rates and Net Prices in XXXA

	BASE	XXXA1	XXXA2	XXXA3	XXXA4
Excise Taxes					
Food Crops	0.005	0.025	0.040	0.010	0.015
Com'l Crops & Livestock	0.064	0.025	0.040	0.015	0.025
All fiber Ind.	0.031	0.025	0.040	0.030	0.045
Heavy Ind.	0.031	0.025	0.040	0.050	0.080
Chem. Ind.	0.032	0.025	0.040	0.040	0.060
Private Services	0.014	0.025	0.040	0.020	0.035
Public Services	00000	0.025	0.005	00000	00000
Net prices					
Food Crops		0.976	0.940	0.998	0.976
Com'l Crops & Livestock		1.008	1.040	1.033	1.010
All Fiber Ind.		1.005	1.009	1.008	1.001
Chem. Ind.		1.015	1.002	1.007	0.959
Heavy Ind.		1.036	1.100	0.926	0.932
Private Service		1.009	1.003	0.982	0.963
Public Services		0.986	0.957	0.998	0.980

One can see the percentage changes of sectoral use of labour, production and wage/rental ratios in Table 3. As expected, production is positively related to the sector's net price. Changes in production are larger in either direction, the larger the changes in wage/rental ratios. For example, the food producing sector experienced the greatest reduc-

tion in output. Its wage/rental ratio increased by the largest percentage. Accordingly, the demand for labour in that sector went down along with the labour-capital ratio and output.

The other sectors whose tax burden was lowered have expanded output, particularly the heavy industries sector and chemical based industries as can be seen in Table 3.

In XXXA3, higher rates were imposed for more capital-intensive sectors (chemical-based and heavy industries) and lower rates were imposed for the primary sectors (food crops, and commercial crops and livestock) and private service sector.

On the production response, the results can be seen in Table 3. An increase in the tax rates in capital-intensive sectors by 15 and 90 percent respectively, reduced those two sectors' output by 7 and 6 percent, respectively. Because of varying government surpluses with experiments XXXA3 and XXXA4, two alternative rates of taxes, i.e., 29 percent increase in XXXA3 but 9 percent increase in XXXA4, resulted in a fairly similar output response in the machineries sector equal to 6.8 percent and 6 percent declines, respectively. In the latter case, the investment demand for machineries is fairly more substantial. The expected pattern in wage/rental ratios can be observed in Table 3. One can see that the cash crops sector (2) has an output expansion by 3.7 percent while the wage/rental ratio declined by 6 percent.

Table 3 – Percentage Change in Labor Use, Production and Wage Rental Ratios in XXXA

	XXXA1			XXXA2		
	Labour use	Output	w/r ratio	Labour use	Output	w/r ratio
Sectors						
Food crops	-3.68	-2.60	1.02	-8.00	-5.6	1.03
Cash crops	3.86	2.70	.95	.89	1.6	.99
Fibre inds.	.17	1.10	.99	1.15	1.0	.99
Chemical inds.	.41	1.20	.97	1.01	.4	.98
Heavy inds.	4.14	4.20	.91	11.30	13.0	.77
Prv. services	.65	1.16	.93	.50	1.0	.97
Pub. services	-1.28	-.80	.99	-4.00	-.9	.99

Table 3 (Continued)

	XXXA3			XXXA4		
	Labour use	Output	w/r ratio	Labour use	Output	w/r ratio
Food crops	-.49	-.4	1.004	-2.93	-2.0	1.008
Cash crops	7.70	4.1	.930	5.00	3.7	.940
Fiber ind.	2.00	1.3	.975	.93	1.2	.960
Chemical inds.	.12	.4	.999	-3.50	-.7	1.024
Heavy inds.	-8.20	-6.8	1.150	-7.30	-4.0	1.097
Prv. services	-.160	-1.9	1.020	-3.50	-3.7	1.020
Pub. services	-.08	-.2	1.001	-2.00	-1.6	1.001

Only the household income of group IV increased in XXXA1 and XXXA2. Otherwise, all other households' income has declined in all the above four cases of excise tax reform. The two exceptions can be accounted for by the relatively higher factor returns received by group four due to resource reallocation. Though the excise tax rates were uniform, in the above two experiments the capital-intensive sectors (chemical-based, and heavy industries) had a tax cut under XXXA1 and only a marginal increase under XXXA2. The primary sectors have been adversely affected in terms of production as resources moved out of these sectors. The relative returns to labor has declined which consequently meant a lower factor income for household groups one and two.

The overall real consumption of all the households contracted in varying magnitudes because of the decline of real income. It can be noted that movements of real consumption and real disposable income will have the same direction and magnitude because of the specification of the Cobb-Douglas utility function. In the two cases of XXXA1 and XXXA2 when household group four's income increased, its real consumption also went up as is seen in Table 4.

Table 4 also reports the overall results of excise tax experiments in terms of changes in welfare and equity. The decline in nominal GDP in varying magnitudes can be explained by the adverse resource reallocation consequent upon the proposed tax reforms.

The results on welfare will be sensitive to the revenue effects of the given tax structure. Overall tax revenue from the taxes has increased by 5.2 and 14.6 percent, respectively, in experiments XXXA1 and XXXA2 but declined by 7.5 and 2.6 percent, respectively, in the other two experiments. Since we have resorted to changes in equiva-

Table 4 – Percentage Changes in Real Consumption Welfare & Equity Effects in XXXA

	XXXA1	XXXA2	XXXA3	XXXA4
% change (cons.)				
H1	-1.70	-4.60	-.05	-1.90
H2	-1.23	-3.70	-.02	-1.80
H3	-.73	-2.60	-.02	-2.30
H4	1.09	1.02	-1.30	-2.70
GDP	-.76	-2.80	-.66	-2.60
EV	-1.30	-.80	-2.30	-3.70
Gini Index	1.07	2.50	-.63	2.86

lent variation (EV) as an indicator of welfare change, these revenue effects have to be incorporated. Since changes in government revenue are reflected in the changes in government investment expenditure (government consumption expenditure is fixed in real terms across all the experiments), we have included total government real expenditures in calculating the changes in EV along with the changes in private real consumption. In fact, two sets of EV have been calculated, one without the public expenditure and the other with the public expenditure. The changes in direction are the same but the magnitude of changes in EV will be higher or lower depending on the changes in public expenditure. Table 4 reports the EV measure based on the total expenditure, both private and public.

Our numerical results of welfare changes as measured by EV (with sign convention) shows that welfare has declined in all the four cases of excise tax reforms.

In terms of the equity and distribution consequences of these reforms, it is seen that (Table 4) the Gini concentration ratio has increased except in the case of XXXA3 where it declined by .63 percent from the base case. This decline may be explained by the relatively higher income earned by poorer households (1, 2) as a result of relatively lower tax burdens in the primary sectors.

Tariff Experiments: XXXB

Three experiments were carried out with changes in tariff rates on imports. The new rate structures of these experiments are:

XXXB1: A uniform tariff rate of 10 percent.
XXXB2: Reduction of tariff by 30 to 33 percent in all sectors.

XXXB3: 50% increase in the two primary sectors (food and cash crops) and 35% decline in the three manufacturing sectors (fiber, chemical-based and heavy industries).

The imposition of uniform tariffs across all importable goods at 10 percent meant a reduction of protection in the manufacturing sectors and an increase of average tariffs in the primary sectors like food and cash crops. For example, the food crops sector had a 350 percent increase of tariff from the base run. It is expected that the changes in tariffs would affect the net prices through the gross price and especially through the aggregate price of other goods weighted by that sector's intermediate use.

The resulting net prices can be seen in Table 5. Though the food sector had an increase in tariff rate, its net price increased because of a reduction of its intermediate cost. This sector uses a substantial amount of machineries and farm implements produced in the heavy industries sector (5) whose average tariff was reduced and output expanded.

Table 5 – Taxes and Net Prices in XXXB

	Base	XXB1	XXXB2	XXXB3
Tariffs				
Tm1	0.022	0.100	0.015	0.033
Tm2	0.089	0.100	0.059	0.132
Tm3	0.339	0.100	0.220	0.220
Tm4	0.16	0.100	0.110	0.110
Tm5	0.365	0.100	0.243	0.243
Net prices				
Pn1		1.027	1.013	1.014
Pn2		0.971	0.997	0.996
Pn3		0.976	0.997	0.993
Pn4		0.663	0.872	0.842
Pn5		1.287	1.113	1.139
Pn6		1.240	1.072	1.088

Table 6 shows sectoral changes in production and factor price ratios. The trend is regular and expected.

In the experiment indexed as XXXB2, tariffs in all sectors were reduced in the range of 30 to 33 percent from the base run. Aside from favorable resource allocation and output growth in the food and heavy industries sectors, the non-traded services sectors (public and private)

also experienced a growth in output mainly because of the favourable cascading effect of tariff reduction as they use imported intermediate goods.

Tariff rates were increased by 50 percent in the primary sectors and were reduced by 35 percent in the manufacturing sectors in the experiment prefixed as XXXB3. The heavy industries sector's value added price increased by 14 percent while output expanded by 15 percent. Though the food sector had a higher tariff rate, its net price and output also grew as in the earlier findings.

In all the three cases of tariff liberalization, both sectoral and aggregate landed price of imported goods have declined by 28, 9, and 12 percent, respectively. Overall imports increased substantially. The aggregate changes in imports, exports and exchange rate can be seen in Table 7. One can trace the sectoral changes in imports and exports in Appendix Table A1 via the equations pertaining to import and export demand functions of section 2. Because of product differentiation, the changes in imports depend on the elasticity of substitution between domestic and imported good and their price ratios. The results are

Table 6 – Percentage Changes in Sectoral Labor Use, Production and Wage Rental Ratio in XXXB

	XXXBI			XXXB2		
	Labour Use	Output	w/r ratio	Labour Use	Output	w/r ratio
Food crops	2.57	2.5	.999	1.20	1.00	1.01
Cash crops	-9.90	-4.6	1.127	-2.50	-1.40	1.04
Fibre inds.	9.50	-3.7	1.17	-2.60	-1.10	1.05
Chem. inds.	-2.30	-14.6	1.62	-8.20	-5.80	1.18
Heavy inds.	3.07	20.0	.67	12.20	8.0	.84
Prv. services	21.80	26.0	.80	6.68	7.7	.93
Pub. services	3.90	4.9	.98	1.67	1.8	.97

	XXXB3		
	Labour use	Output	w/r ratio
Food crops	1.27	1.03	1.02
Cash crops	-2.78	-1.40	1.04
Fibre inds.	-3.67	-1.60	1.07
Chemical inds.	-9.00	-5.00	1.24
Heavy inds.	15.13	10.00	.82
Prv. services	8.13	9.40	.93
Pub. services	1.87	2.00	1.04

Table 7 – Trade Effects in XXXB
(% changes from the base)

	XXXB1	XXXB2	XXXB3
Total import (cif)	90.0	25.0	31.0
Total export	-38.0	-12.0	-17.0
Import price index	-28.0	-9.0	-12.0
Export price index	3.0	1.0	1.0
Exchange rate	28.0	8.7	11.8

shown in Appendix Tables A1 & A2. Sectoral and overall exports declined because of the loss of competitiveness of Bangladeshi exports. On the other hand, given the exogenous foreign capital inflow and the changes in imports and exports, the exchange rate in all three cases depreciated by 28, 8.7 and 11.8 percent, respectively, to preserve the balance in external payments.

In terms of welfare effects, the GDP has increased by 8.46, 2.92 and 3.45 percent, respectively, in the three scenarios of tariff liberalization. Welfare, as measured by changes in EV, also clearly improved by 9.6, 7.9 and 5.6 percent, respectively, as the real consumption of households and government grew. These are noted in Table 8.

The distribution impacts have, however, been unfavourable as indicated by changes in the Gini ratio because the richer households gained relatively more due to tariff liberalization.

Tax Packages: XXXC

In any real tax policy reforms, it is generally expected that all taxes may change. This kind of analysis is most convenient in computable general multiple policy changes. Thus, we have carried out three policy experiments where all sets of taxes like excise, tariff and direct

Table 8 – Percentage Change in Household Real Consumption, Welfare and Equity in XXXB

	XXXB1	XXXB2	XXXB3
% change (cons.)			
H1	2.80	1.29	1.31
H2	5.20	1.94	2.10
H3	8.78	2.93	3.10
H4	11.00	3.60	3.00
GDP	8.46	2.92	3.45
EV	9.60	7.90	5.60
Gini Index	3.00	.50	2.00

tax rates have been changed to see their effects on resource allocation and distribution. These proposed reforms are contemplated because the policymakers may think to reduce excise taxes and increase reliance on more direct taxes or reduce both excise tax and tariffs but increase direct taxes. Thus, three experiments were performed as indicated below:

XXXC1: Reduce excise taxes by 50 percent across the board and increase direct taxes by 100 percent (household groups 3 and 4);

XXXC2: Reduce both tariff and excise tax by 50 percent but increase direct tax by 200 percent (household groups 3 and 4);

XXXC3: Reduce both domestic indirect and direct tax by 50 percent and increase tariffs by 50 percent.

Table 9 – Tax Rates and Net Prices in XXXC

	BASE	XXXC1	XXXC2	XXXC3
Excise Tax				
Td1	0.005	0.0025	0.002	0.002
Td2	0.064	0.0300	0.030	0.030
Td3	0.031	0.0150	0.015	0.015
Td4	0.031	0.0150	0.015	0.015
Td5	0.032	0.0160	0.016	0.016
Td6	0.014	0.0070	0.007	0.007
Td7	00000	000000	000000	0.001
Tariffs				
Tm1	0.022	0.0220	0.011	0.034
Tm2	0.089	0.0890	0.045	0.132
Tm3	0.339	0.3390	0.170	0.450
Tm4	0.167	0.1670	0.085	0.250
Tm5	0.365	0.3650	0.180	0.450
Income tax				
Th2	0.002	0.0040	0.006	0.001
Th3	0.023	0.0500	0.065	0.014
Th4	.041	0.0820	0.120	0.021
Net prices				
Pn1		0.979	1.018	1.013
Pn2		1.001	1.027	1.036
Pn3		0.972	1.014	1.018
Pn4		1.079	0.921	1.141
Pn5		1.006	1.131	0.888
Pn6		0.968	1.080	0.975
Pn7		0.976	1.020	1.011

Table 10 – Percentage Change in Labor Use, Production and Wage Rental Ratios in XXXC

	XXXC1			XXXC2		
	Labor Use	Output	*w/r* ratio	Labor Use	Output	*w/r* ratio
Sectors						
Food crops	-2.10	-1.40	1.001	1.11	.800	1.009
Cash Crops	1.63	3.30	.966	3.29	1.300	.990
Fibre inds.	-3.70	-2.90	1.022	.02	.700	1.028
Chemical inds.	3.72	5.40	.898	-4.50	-3.80	1.120
Heavy inds.	.85	3.90	.950	14.20	8.50	.833
Prv. services	-3.12	-3.20	1.013	7.50	8.50	.940
Pub. services	-2.70	-2.00	1.008	1.71	1.60	1.004

As excise tax rates were reduced by half on all the domestic goods in XXXC1, the resulting changes in production and factor returns can be seen in Table 10. The output in the cash crops sector (2) and the two manufacturing sectors, chemical and heavy industries (4, 5) has increased as a result of the proposed tax cuts.

In XXXC2, when both excise tax and tariffs were lowered across all sectors, the output response was stronger as can be noted in Table 10. In relative terms, the heavy industries sector's output expansion was greater (8.5%).

The resulting equity and efficiency effects can be read from Table 11. In the case of package 1, the reduction in excise taxes had a positive output impact for certain sectors, but the disposable income of richer households declined as a result of increasing direct tax burden. This necessarily reduced the real consumption of richer households. The overall nominal GDP declined by 2.13 percent, and welfare, as measured by changes in EV, declined by 4.8 percent. In the case of both excise tax and tariff reduction with an accompanying increase in direct taxes in XXXC2, GDP increased by 3.9 percent, while welfare increased by 3.8 percent as measured by changes in EV.

The decline of disposable income and real consumption of the two richer households is due to a 200 percent increase of income taxes paid by them. The overall effect on equity is favourable in these tax packages because of the decline in relative income of the richer households

Table 11 – Percentage Change in Household Real Consumption, Welfare and Equity in XXXC

	XXXC1	XXXC2	XXXC3
% change (cons.)			
H1	-1.87	2.12	.96
H2	-2.40	2.61	.79
H3	-4.60	-.02	.71
H4	-4.90	2.00	.74
GDP	-2.13	3.90	.06
EV	-4.80	3.70	.09
Gini Index	-3.70	-5.70	-1.90

due to higher average direct tax rates. It may be seen in Table 11 that the Gini ratio had the highest percentage fall when both excise taxes and tariffs were reduced with an increase in direct taxes.

Experiments with Value-Added Tax: XXXVAT

Since the introduction of a limited VAT in the current agenda of tax reform, we have carried out a few policy experiments with value-added tax replacing the domestic excise taxes. These taxes are computed as a percentage of value added, i.e., the value of output at the factory gate minus the value of intermediate inputs or the value of factor payments. To introduce VAT in the model, an adjustment in the production accounts was needed. Following the procedure laid down in HERCULES, the value added accounts were unchanged but taxes were added in the value added tax accounts before intermediate inputs were added in the community accounts. This is because the tax is computed on the value-added only.

The experiments and corresponding rates are as follows:

XXXVAT1: A proportional or uniform VAT of 2.8 percent in all sectors;

XXXVAT2: A lower rate of VAT in the primary sectors (food and cash crops) and services sectors (public and private).

In the case of uniform VAT, production choices are relatively less distortive than in the case of uniform excise tax experiment (XXXA1) discussed earlier. The changes in aggregate sectoral production in the two cases can be compared by looking at Tables 12 and 13. One can see that the output in the food sector (1) declined in both cases because of

Table 12 – Taxes and Net Prices in XXXVAT

	XXXVAT1	XXXVAT2	XXXVAT3
VAT			
V1	0.028	0.010	0.060
V2	0.028	0.030	0.060
V3	0.028	0.040	0.060
V4	0.028	0.100	0.060
V5	0.028	0.010	0.060
V6	0.028	0.035	0.060
V7	0.028	0.010	0.060
Net Prices			
V1	0.979	1.002	0.952
V2	1.034	1.034	1.002
V3	1.009	1.007	1.004
V4	1.162	1.046	0.844
V5	0.855	0.922	1.167
V6	0.946	0.966	1.087
V7	1.001	1.001	1.055

Table 13 – Percentage Change in Labor Use, Production and Wage Rental Ratios in XXXVAT

	XXXVAT1			XXXVAT2		
	Labor Use	Output	*w/r* ratio	Labor Use	Output	*w/r* ratio
Food crops	-280	-.26	1.01	.52	1.12	1.00
Cash crops	10.40	6.70	.90	.95	5.90	.99
Fibre inds.	4.41	4.60	.92	2.60	4.20	.99
Chemical inds.	9.50	8.40	.83	2.69	6.20	.94
Heavy inds.	-4.00	-2.20	1.30	8.60	5.30	.97
Prv. services	-5.00	-3.00	1.04	-3.10	-.36	1.03
Pub. services	2.20	.07	1.07	.05	.06	.99

the higher average tax rate in that sector than in the base case. But the decline is only .26 percent in case of uniform VAT but 2.6 percent in the case of uniform excise tax of almost the same magnitude. For other sectors whose output grew (cash crops, fibre industries and chemical industries), the magnitude of growth is much higher in case of VAT than in excise tax.

In case of a lower VAT for the primary sectors, the production response is more pronounced (Table 13).

When proportional VAT was introduced, the income of poorer households declined and those of richer households increased slightly. As a result, real consumption also changed in the same direction and magnitude. This is mainly due to changes in relative factor returns as the poorer households were adversely affected because the average VAT was higher for primary producing sectors compared to the existing low excise taxes in these sectors in the base run.

In both the packages with VAT, GDP slightly declined and welfare as measured by changes in EV also deteriorated. In the case of proportional VAT, equity worsened slightly, but in the case of lower VAT in the primary sectors, the Gini ratio declined by 63 percent. Though the disposable income of all households declined, the poorer households were affected less adversely.

However, results with the limited VAT seem not to be encouraging. There is no reason to believe that the VAT will not be a better alternative in the medium to longer run and especially when it is combined with corresponding tariff reforms.

5. Conclusions and Policy Recommendations

The present study is the first known attempt to systematically address both welfare and equity implications of alternative tax policy reforms within a general equilibrium framework for Bangladesh. It is hoped that the results will give an input to the current policy debate in Bangladesh.

Table 14 – Percentage Changes in Household Consumption, Welfare and Equity in XXXVAT

	XXXVAT1	XXXVAT2	XXXVAT3
% change (cons.)			
H1	-1.60	-.60	3.40
H2	-1.50	-.75	-1.50
H3	.09	1.00	.60
H4	1.60	-1.02	4.50
GDP	-.260	-.150	.05
EV	-2.50	-1.40	2.30
Gini Index	.39	-.63	2.20

The excise tax experiments have shown that, even with a revenue neutral tax structure, taxing the primary sectors heavily will have a dampening impact on them. The corresponding distribution consequences are also adverse. When the target revenue is increased substantially (as in XXXA2), the decline in GDP is substantial. The experiments with the excise tax alone indicate that it may not be desirable either on welfare or equity consideration to rely on these taxes as a source of domestic resource mobilization.

Tariff liberalization yields unambiguously encouraging results for resource allocation and welfare. Both the primary producing sectors and machineries sectors gain much in the proposed reforms. They are also import substitute sectors. The interindustry effect of tariff reduction in the manufacturing sectors seems to be more favourable.

In the case of tax packages involving all the taxes, the results are encouraging for both welfare and equity. These and other policy packages should be further looked into for designing proper tax structures because the tariffs and excise taxes can always be combined in an appropriate manner for better industrial structure and desirable allocation of resources. These packages also indicate that efficiency can be enhanced with a proper mixture of tariffs and excise taxes without adversely affecting the income distribution. In fact, equity can be improved with direct tax reform along with efficiency-enhancing indirect tax reforms (both domestic and trade).

In the case of value-added tax, nothing definitive can be said from the experiments because of the limited nature of the VAT and short-run nature of the model. The results may be more encouraging if VAT is combined with tariff reforms.

In conclusion, one can argue that attaining more equity may not be a feasible option in the short-run indirect tax reform. Given the present state of the economy, tax reforms should strive towards better resource allocation in the short run. When government is concerned with equity in the short run, it can be better achieved by direct taxes or transfers without distorting the production choices.

Appendix Table A1 – Percentage Changes in Commodity Compositions in XXXB

	XXXB1	XXXB2	XXXB3
Composite goods			
Comp1	5.51	1.91	2.30
Comp2	2.76	1.16	.76
Comp3	2.00	1.10	1.65
Comp4	12.30	4.15	5.20
Comp5	60.00	18.90	23.20
Comp6	2.03	.65	.760
Comp7	.65	.37	.375
Imports			
Imp1	65.80	21.5	25.6
Imp2	78.00	24.3	19.4
Imp3	105.00	34.0	35.4
Imp4	31.80	10.2	12.5
Imp5	132.90	35.5	47.9
Domestic goods			
Dom1	.23	.04	.20
Dom2	-2.70	-.72	-.61
Dom3	-1.61	-.34	-.32
Dom4	-2.65	-.85	-.92
Dom5	11.14	4.72	5.80
Dom6	2.03	.61	.74
Dom7	.65	.34	.347
Exports			
Exp1	-34.0	-11.5	-15.8
Exp2	-34.0	-10.9	-4.8
Exp3	-42.8	-14.8	-19.4

Appendix Table A2 – Composite Goods & Import/Export Prices in XXXB

	XXXB1	XXXB2	XXXB3
Composite goods prices			
Pc1	0.998	1.000	0.999
Pc2	0.990	0.995	1.000
Pc3	1.022	1.007	1.008
Pc4	0.779	0.911	0.890
Pc5	0.794	0.928	0.916
Pc6	1.235	1.071	1.086
Pc7	1.041	1.016	1.018
Import prices			
Pm1	0.776	0.907	0.891
Pm2	0.729	0.888	0.916
Pm3	0.595	0.833	0.804
Pm4	0.682	0.869	0.840
Pm5	0.584	0.832	0.804
Domestic goods prices			
Pd1	1.027	1.010	1.011
Pd2	1.021	1.006	1.008
Pd3	1.048	1.016	1.018
Pd4	0.878	0.949	0.937
Pd5	1.081	1.032	1.041
Pd6	1.235	1.071	1.086
Pd7	1.041	1.016	1.018
Export prices			
Pe1	1.027	1.010	1.011
Pe2	1.021	1.006	1.008
Pe3	1.048	1.016	1.018

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