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THE GENDER EFFECTS OF TRADE IN BANGLADESH: A GENERAL EQUILIBRIUM ANALYSIS

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THE GENDER EFFECTS OF TRADE IN BANGLADESH: A GENERAL EQUILIBRIUM ANALYSIS

GREATER ACCESS TO TRADE EXPANSION (GATE) PROJECT
UNDER THE WOMEN IN DEVELOPMENT IQC

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INTRODUCTION

Trade liberalization has been alternately lauded by traditional economists as contributing to poverty reduction or derided by development economists as increasing inequality and informality. Trade liberalization is complex and the effects of freer trade are multi-faceted; policymakers' decisions concerning which sectors are opened and which remain protected may improve or erode the livelihoods of producers, workers, or consumers depending upon where they are located within the economy. Changes in the economy that are wrought by trade liberalization may be contradictory or complementary. Multiple effects take place simultaneously, and one person may be helped by certain effects while concomitantly harmed by others.

Just as the effects of trade liberalization are multi-faceted, these effects become multiplied as countries sign bilateral, regional, and multilateral agreements. Trade policies, like other economic policies, are likely to have gender-differentiated effects because of women's and men's varying access to, and control over, resources, and because of their different roles in both the market economy and the household. Policies that are designed without taking gender considerations into account not only neglect important dimensions of individual well-being but may lead to undesirable macroeconomic outcomes.

Trade liberalization alters the distribution of income between different social groups, and between women and men. The primary effect of trade liberalization is a change in the relative prices of goods. A change in the price of goods modifies incentives and induces reallocation of factors of production among sectors which may lead to changes in employment and/or remuneration. Variations in relative prices may lead to changes in real incomes that affect groups differently due to divergences in their consumption patterns. Trade liberalization is also likely to reduce tariff revenues, which in turn may reduce the size and composition of government expenditures on social provisioning such as health care and education.

In addition to these impacts, trade liberalization may increase the risks faced by the poor and their vulnerability to external shocks, since it can cause changes in the portfolio of household activities and in the variability of existing income sources. These effects are likely to be experienced differently by women and men.

The effects of trade liberalization on gender inequalities in a country may be both negative and positive. Many factors mediate the effects and are important in determining final outcomes. These include labor market institutions, resource endowments, systems of property rights, and other socio-economic characteristics. The characteristics of the labor market are especially important in determining the extent to which trade-related changes translate into changes in employment, or in wages, or a mixture of both. For example, the extent to which women will be able to relocate from contracting sectors to expanding sectors will depend on the level of gender segmentation between sectors and occupations, women's education levels, and the opportunity for re-training. The extent of change in women's relative wages will be determined also by the elasticity of their labor supply, the prevailing forms of wage

determination (e.g., free markets or collective bargaining), and the existence and enforcement of anti-discrimination laws.

A variety of tools can be used to examine the outcomes precipitated by trade liberalization and their mediating factors—from econometrics to modeling to qualitative methods. Few studies of the differential effects of trade liberalization on women and men employ general equilibrium models. These models can be useful for gender analysis when appropriately designed to reflect the gendered structure of each country-specific case. As policymakers seek to harness the best aspects of trade liberalization and mitigate displacement and loss; it is important that they understand the effects of past liberalization policies for the poor, anticipate the potential effects of further trade commitments, and consider complementary policy and program initiatives to assist the poor, particularly marginalized groups, in gaining from trade liberalization.

This report uses a gender-augmented computable general equilibrium (CGE) model to simulate the effects of trade changes in the Bangladesh economy. The CGE model is gendered in the sense that it differentiates between female and male workers in the labor market and accounts for non-market activities (household work and leisure) in addition to standard market activities. The model emphasizes linkages among actors and sectors (both market and non-market) and provides quantification of direct and indirect effects, thus offering insights from an economy-wide perspective that could usefully complement more in-depth trade impact analysis of specific sectors.

BANGLADESH TRADE AND GENDER

Bangladesh is an economy in transition from a primarily agrarian base to one dominated by services. Agriculture's contribution to GDP has declined from 56 percent of GDP in 1980 to 22 percent in 2003. Over the same period, value added in services has risen from 41 percent to 52 percent.

Since 1992, Bangladesh has implemented a series of trade liberalization measures to increase openness, reduce tariffs and quotas, and improve customs and excise procedures. Bangladesh joined the World Trade Organization (WTO) in 1995 and participated in a number of multilateral, regional, and bilateral trade agreements designed to lower tariff and non-tariff barriers.

Yet Bangladesh remains heavily dependent on a limited number of exports to earn foreign exchange. Textiles, clothing, and footwear account for approximately 80 percent of all exports. Further liberalization and changes in global agreements on quotas will affect the Bangladeshi economy and workers differently in the short and medium term. Changes in the price of goods may change employment and wages, which may affect women and men differently.

As a result, trade policy can affect gender considerations at the macro-, meso-, and micro-level. Socio-cultural norms, customary law, and practices combine to limit Bangladeshi women's access to goods, financial services, and labor markets. Women have fewer resources to leverage, fewer employment options, less mobility, and greater time-poverty, which combine to restrict their ability to generate income. For example, gender gaps in market participation might narrow if the sectors that expand are more

female-intensive than the sectors that contract (macro-level); public provision of social services that favor women (such as health and education) might be undermined if loss of government revenue from reduced tariffs leads to cuts in such programs (meso-level); female control over household spending might be reduced or extended, depending on whether trade liberalization destroys or creates sources of independent income for women (micro-level).

The ending of the Multi-Fibre Agreement (MFA) in 2004 and its subsequent impact in Bangladesh has been the focus of a number of recent studies.¹ There are concerns that Bangladesh might lose the export advantage it has enjoyed over other competitors under the MFA. This is of particular importance, given that the ready-made garment industry has been the main source of both foreign earnings and formal employment for the country in the last twenty years. Policy recommendations variously emphasize enhancing competitiveness within the textile sector and/or diversifying towards other goods such as shrimp, leather products, and vegetables. However the gender implications of such changes are not given enough prominence.

Policy changes affecting the garment sector have particular relevance from a gender perspective, since this industry is one of the very few employers of women in the labor market. As workers and producers, women in Bangladesh face very limited options: they either work as unpaid labor on the family farm in rural areas (mostly in raising poultry and livestock, and in homestead production of vegetables and fruits), or they have jobs as garment factory workers or domestic workers in the urban areas. In addition to productive work, they bear most of the burden of household caring responsibilities in their roles of mothers and wives. A thorough, pro-poor assessment of the welfare impact of trade reforms must take these dimensions into account.

The first step towards making a model of a particular country is to construct a social accounting matrix (SAM) containing information about its economic and social structure. The Bangladesh SAM used for model simulations in this report is an extended and updated version of Bangladesh SAMs used in previous CGE studies.² The SAM is updated to 2000 and disaggregated to include a greater number of market activities, labor categories, and household types. Two main sets of experiments are analyzed in this report: 1) changes in the quantity and structure of textiles exports; and 2) an expansion of other sectors with export potential, such as shrimp, leather, and vegetables.

The report is organized as follows: It begins by describing the extended SAM. It then continues by analyzing experiment results and discussing simulations with alternative parameter values and specifications. The report concludes by providing policy recommendations. The description of the model and list of equations is provided in an annex.

THE GENDERED SAM

The Bangladesh SAM used for the model experiments analyzed in this report is an extension of another gender-augmented SAM for Bangladesh developed in the last few years at International Food and Policy Research Institute (IFPRI) (documented in Fontana and Wobst, 2001, Arndt et al, 2003, Fontana, 2003) and is for the year 2000.³ Another Bangladesh 2000 SAM exists that differentiates its accounts between male and female labor value added, but these accounts are aggregated for the purpose of policy modeling analysis.⁴ The new Bangladesh SAM distinguishes nine household types (classified according to land-holding size, occupation, educational level, and gender of the household's head) and eight categories of workers (differentiated by both education and gender). It defines 30 market activities (of which nine are agricultural, fourteen are manufacturing, and seven are services). In addition, it has nine social reproduction and nine leisure sectors—as many as the number of households, since these activities cannot be traded among households. This level of detail permits a better understanding of how policy changes have a differentiated impact on female and male workers, depending on whether or not they have education, live in urban or rural areas, and are or are not head of their household.

The construction of a disaggregated SAM is demanding in terms of data. Even when the statistical material is available, the reconciliation of information from various sources—what is called “SAM balancing”—requires some effort. The Bangladesh SAM in this report is based on recent national accounts data, labor force surveys, and household expenditure surveys, and is balanced by using a cross-entropy approach.⁵ Several further extensions and corrections to the original 2000 IFPRI Bangladesh SAM were planned for the purpose of the current analysis but proved difficult, either because data were missing or because the adjustments could not be implemented due to lack of time. Some of the inadequacies of the data are discussed in a separate section.

Insights can be gained into the likely effects of trade liberalization by simply examining the features of the economy through the lens of a gendered SAM. Some of these key features are highlighted in the following sections.

DISAGGREGATION OF FACTORS, HOUSEHOLDS, AND SECTORS

FACTORS

The eight labor types in the SAM are: female and male workers with no formal schooling (labeled in the tables “F no ed” and “M no ed”); female and male workers with between one and five years of education (“F prim ed” and “M prim ed”); female and male workers with between five and ten years of schooling (“F sec ed” and “M sec ed”); and female and male workers with more than ten years of formal education (“F high ed” and “M high ed”).

Unpaid workers, who are mostly women agricultural workers on family farms, are included in the labor force but not treated as a separate labor category in the SAM. Unpaid labor, as well as paid employment, was included in time spent on market activities by both women and men. Including unpaid labor results in a significant

increase in total hours, especially in agriculture.⁶ No distinction is made between formal and informal workers. This is an area that would merit much attention in future work.

HOUSEHOLDS

The nine household types are described in Table 1.⁷ In the rural areas, there are three agricultural households, classified according to land-holding size, and three non-agricultural households, distinguished by both gender of the household's head and asset ownership.⁸ The three urban households are grouped by the educational level of the household's head. It would have been useful for the current analysis to distinguish households also by their dependency ratio (e.g., with and without children), but this information seems not to be available.

Table 1. Household types and their definition

1 Agricultural landless	Rural agricultural households owning no (or less than 0.5 acres of) land
2 Agricultural small	Rural agricultural households owning between 0.5 and 2.49 acres of land
3 Agricultural large	Rural agricultural households owning 2.5 or more acres of land
4 Non-agricultural poor female-headed	Rural households whose head is female and not engaged in agricultural activities, and that own less than 0.5 acres of land
5 Non-agricultural poor male-headed	Rural households whose head is male and not engaged in agricultural activities, and that own less than 0.5 acres of land
6 Non-agricultural rich	Rural households not engaged in agricultural activities, and that own more than 0.5 acres of land
7 Urban low educated	Urban households whose head has fewer than five years of education
8 Urban medium educated	Urban households whose head has between five and ten years of education
9 Urban highly educated	Urban households whose head has more than ten years of education

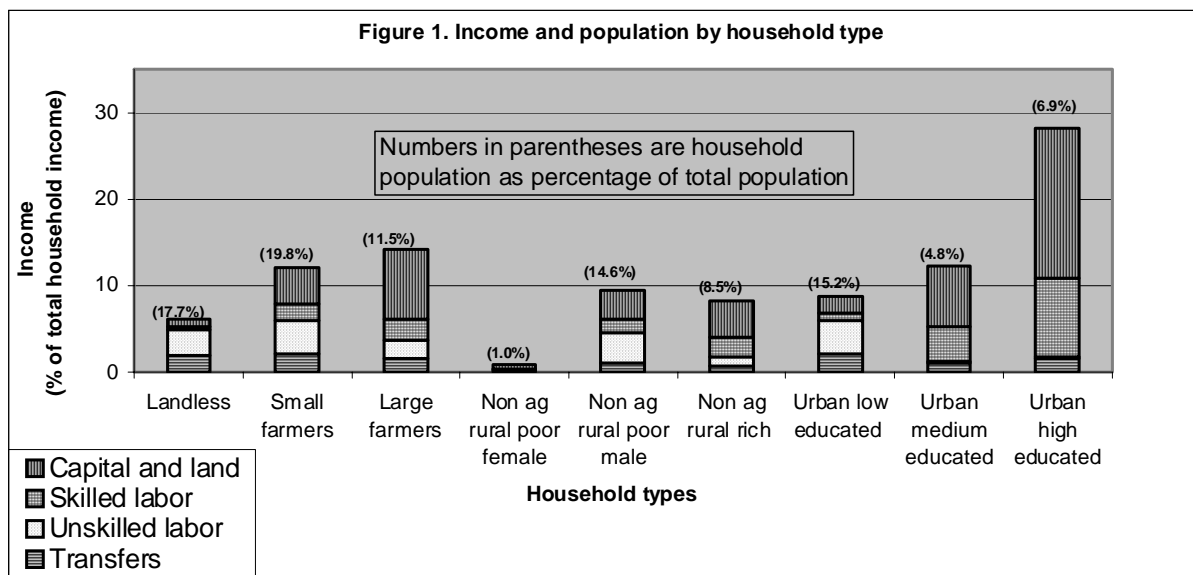
Source: Author's definitions for Bangladesh Social Accounting Matrix, 2005.

As shown in Table 2 below, income distribution is quite unequal: urban educated households receive 28 percent of total income but constitute only 7 percent of the total population, while the landless receive only 6 percent of total income despite comprising 18 percent of the population. These latter households derive their income mostly from labor (about 56 percent) and transfers (mostly remittances and transfers from other households). About 65 percent of the labor income generated by the landless comes from workers with no education, and 25 percent comes from workers with fewer than five years of education. Conversely, about 62 percent of the urban educated households' income derives from capital assets, and their labor income (about 30 percent of their total income) derives almost entirely from male workers with higher education. Urban unskilled households, like the landless in rural areas, receive a share of income which is smaller than their share in total household population. Large farmers receive about half of their income from land and agricultural capital. Poor female-headed households typically rely disproportionately on paid employment as an important source of income, while female contribution to other households' money income is slight. Remittances are an important source of income for the poor. Further details are provided in Table 2. This description of sources of income by different household categories clearly highlights that trade liberalization in Bangladesh can be pro-poor and lead to a more equitable distribution of wealth only if it encourages expansion of sectors that are intensive in unskilled labor. Female contributions to household income are significantly higher when the imputed value of time spent on household non-market activities is also included. This is shown in Figure 2 below. This is an important consideration when assessing the welfare impact of liberalization. Even when reforms lead to an increase in employment opportunities for women, and therefore an increase in income for low-income households, this benefit must be assessed against the opportunity costs of time forgone because it is devoted to valuable social reproduction activities such as nurturing and caring for other household members.

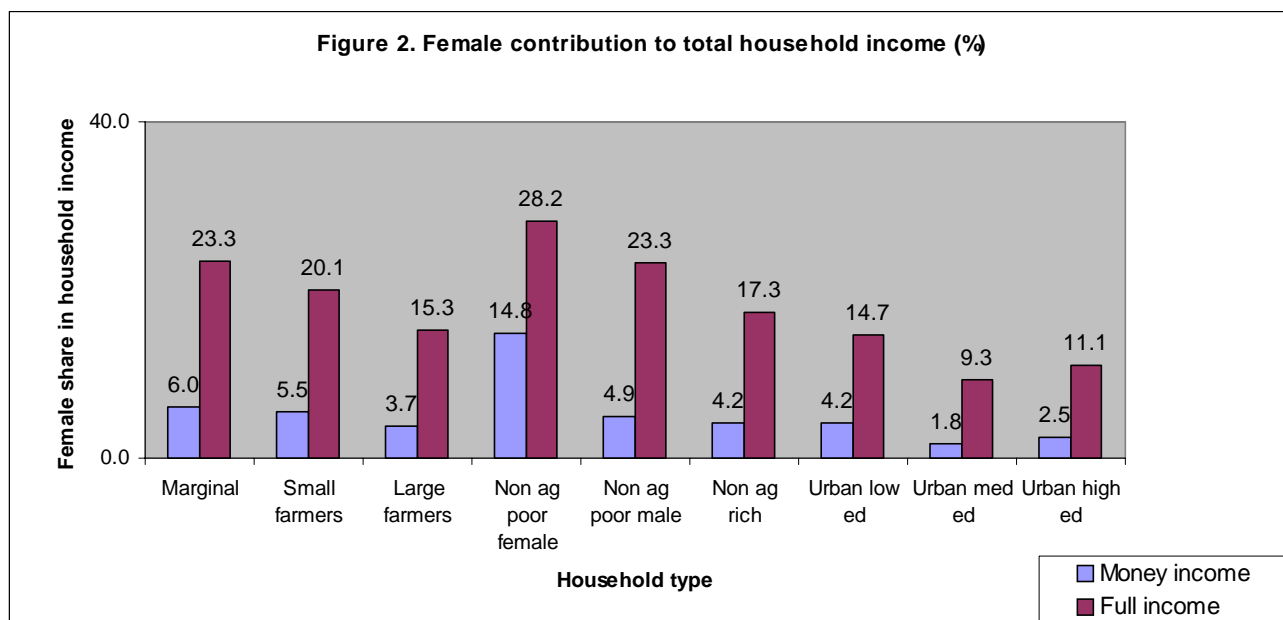
Table 2. Sources of household income (percentage of total income), Bangladesh 2000

Household type	Earnings from labor								Tot lab	Land	Capital	Hh tr'sfers	G tr'sfers	Remitt	Total
	M no ed	M prim ed	M sec ed	M high ed	F no ed	F prim ed	F sec ed	F high ed							
Landless	31.4	12.6	4.6	0.9	4.5	1.1	0.2	0.1	55.6	13.6	0.0	13.0	3.1	14.6	100.0
Small farmers	15.4	13.1	9.0	5.5	2.8	1.6	0.6	0.5	48.5	30.6	3.9	5.1	1.7	10.1	100.0
Large farmers	5.9	6.4	8.7	7.7	1.3	1.1	0.8	0.6	32.4	51.6	4.9	4.1	1.5	5.4	100.0
Non ag rural poor female	5.1	3.9	2.0	1.7	10.7	1.8	0.7	1.7	27.5	7.2	45.7	5.1	7.2	7.3	100.0
Non ag rural poor male	17.1	15.1	9.4	7.3	2.6	1.4	0.6	0.3	53.8	6.5	28.2	1.3	1.7	8.5	100.0
Non ag rural rich	3.6	7.5	8.6	17.1	1.0	1.2	0.9	1.1	41.0	29.8	20.8	0.8	1.9	5.7	100.0
Urban low educated	19.3	22.1	5.8	3.6	2.2	1.3	0.4	0.3	55.0	0.0	21.4	5.0	3.3	15.2	100.0
Urban medium educated	0.1	0.9	26.8	4.6	0.3	0.4	0.8	0.4	34.3	0.0	57.2	0.7	2.3	5.6	100.0
Urban high educated	0.1	0.2	0.9	28.9	0.3	0.1	0.3	1.8	32.6	0.0	61.6	0.0	0.3	5.4	100.0
	Income Population														
Landless	6.1	17.7													
Small farmers	12.0	19.8													
Large farmers	14.1	11.5													
Non ag rural poor female	0.8	1.0													
Non ag rural poor male	9.5	14.6													
Non ag rural rich	8.3	8.5													
Urban low educated	8.7	15.2													
Urban medium educated	12.3	4.8													
Urban high educated	28.2	6.9													
	100.0	100.0													

Source: Author's Social Accounting Matrix, 2005

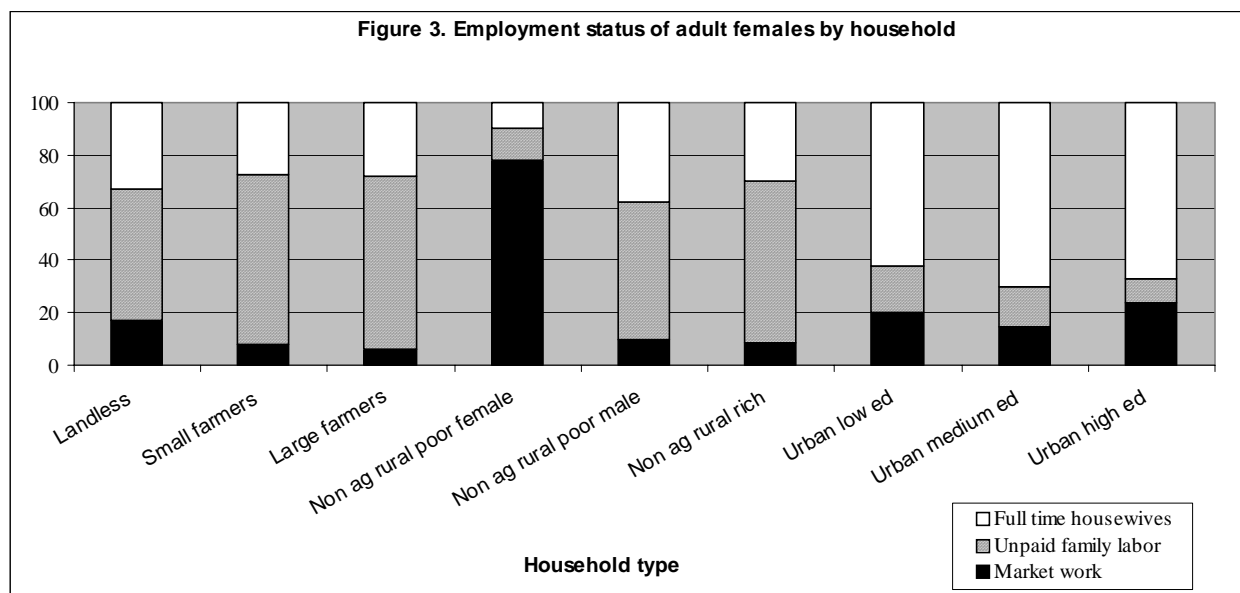


Note: In this figure, different types of transfers (government, inter-household, and remittances) are all grouped together. The unskilled is defined here as a worker with five years of education or fewer (combining the “no ed” and “prim ed” categories).



The SAM household types differ in their gender and skill composition and in the extent of their female members' involvement in market employment. Figure 3 shows employment status according to household type. The proportion of women in paid employment is highest (80 percent of total female household members) in non-agricultural poor female-headed households. These households are smaller than most households, much poorer, and a much higher proportion of their members are women. On average, the share of female household members in paid work is higher in urban households, while farmers' households and rich non-agricultural households have the highest number of female unpaid family workers. Urban households have a greater

proportion of full-time housewives than rural households. In rural areas, women's participation in paid work appears to decline as the socio-economic status of their families improves (women are engaged in market work in landless households, as well as in female-headed households, only because of need), while in urban areas it declines in medium-educated households but increases once again in highly educated households, where female market participation is slightly higher than in unskilled households.



Source: Calculated from Labor Force Survey 2000

SECTORS

For the purpose of the analysis in this report, the SAM was aggregated into 30 market sectors so that experiments would be easier to run but a considerable level of detail would be kept, particularly with reference to gender and trade aspects of the economy. The sectoral disaggregation of the SAM was chosen to emphasize the gendered structure of the Bangladeshi economy. About 60 percent of the total time spent by women in market work is devoted to agriculture, but with a marked gender division of labor across activities. While sugar, jute, and other commercial crops are highly male intensive areas (less than 5 percent of total employment is female), growing vegetables, shrimp farming and, especially, raising poultry and livestock are female intensive activities (35, 32, 76, and 48 percent of total working hours in these sectors respectively are female, as shown in Table 3 and Table 4).⁹ As shown in below, the output attributed to social reproduction is about 36 percent of conventional GDP, which is similar in size to other estimates for developing countries.

In manufacturing, the ready-made garment (RMG) sector and the knitwear sector are singled out for their strategic importance in exports. But while the RMG sector is also the most female-intensive industry (women account for more than 80 percent of total working hours), the share of female employment in the knitwear sector is negligible. Among services, domestic services, which include mainly female-intensive housekeeping services, but also other low-skill activities, are separated from financial

and professional services, characterized by higher male intensity, as well as higher skill intensity. Details of the economic structure are provided in Table 3. Note the highly skewed distribution of women across sectors and occupations. In the market economy, women are concentrated in a few sectors: agriculture (61 percent), domestic services (16 percent) and RMG (11 percent).

	Net output	Export intensity	Import penetration	Female intensity	Female labor	Male labor
	(% of GDP)	*	*		(% of total)	(% of total)
All market sectors, of which:	100.0			20.1	11.4	46.4
Rice and grains	7.6	0.0	4.5	16.0	1.72	9.3
Jute	0.3	16.2	0.0	6.6	0.05	0.7
Sugarcane	0.4	0.0	0.0	4.5	0.02	0.3
Commercial crops	2.2	1.0	14.2	1.6	0.01	0.7
Vegetables	5.6	0.7	9.5	34.7	1.36	2.6
Livestock	2.5	0.1	22.7	48.2	2.99	3.3
Poultry	0.5	0.0	0.3	76.4	0.29	0.1
Shrimp	0.5	36.2	0.0	32.1	0.06	0.1
Fish	5.6	0.0	0.0	29.8	0.44	1.1
Rice and grain processing	2.9	0.0	1.5	35.8	0.16	0.3
Edible oil	0.3	0.0	44.4	0.2	0.00	0.0
Sugar	0.3	0.0	6.9	2.8	0.01	0.2
Other food	0.6	11.1	12.5	10.6	0.02	0.2
Tobacco products	0.5	0.1	2.0	32.4	0.02	0.0
Leather	0.2	69.5	11.0	2.0	0.00	0.0
Jute textiles	0.2	66.1	29.1	0.5	0.00	0.2
Yarn	0.3	0.2	68.0	9.5	0.02	0.2
Mill cloth	0.2	0.0	82.2	1.9	0.00	0.2
Other cloth	1.0	0.0	0.0	11.5	0.13	1.0
RMG	2.8	77.7	19.3	80.2	1.22	0.3
Knitwear	0.6	88.5	21.6	0.0	0.00	0.0
Other textiles	0.1	0.2	22.6	43.4	0.05	0.1
Other industries	2.8	0.4	65.0	15.5	0.22	1.2
Infrastructure	12.6	0.0	0.0	1.8	0.02	1.3
Trade and hotels	16.7	0.0	0.0	3.7	0.39	10.3
Transport	11.1	0.0	0.0	0.8	0.05	6.7
Communications	0.8	0.0	0.0	4.0	0.01	0.2
Public sector	11.9	0.0	0.0	15.9	0.32	1.7
Domestic services	3.7	0.0	0.0	39.5	1.81	2.9
Financial services	5.2	0.0	0.0	1.5	0.02	1.1
All social reproduction,	36.6	0.0	0.0	80.8	45.1	6.4

of which:						
Landless	4.5	0.0	0.0	88.4	9.3	1.2
Small farmers	5.5	0.0	0.0	88.1	8.5	1.2
Large farmers	3.5	0.0	0.0	91.2	4.8	0.5
Non ag poor female	0.3	0.0	0.0	94.2	0.5	0.0
Non ag poor male	4.4	0.0	0.0	89.6	8.0	1.0
Non ag rich	3.1	0.0	0.0	91.5	3.8	0.4
Urban low ed	5.8	0.0	0.0	80.1	5.5	1.4
Urban med ed	2.8	0.0	0.0	85.2	1.9	0.3
Urban high ed	6.7	0.0	0.0	86.7	2.8	0.4

All leisure, of which:	52.6	0.0	0.0	46.6	43.5	47.1
Landless	6.3	0.0	0.0	52.8	9.2	8.4
Small farmers	8.8	0.0	0.0	50.9	7.9	7.8
Large farmers	6.5	0.0	0.0	51.9	4.4	4.2
Non ag poor female	0.2	0.0	0.0	70.3	0.4	0.2
Non ag poor male	6.4	0.0	0.0	56.6	8.2	6.4
Non ag rich	5.4	0.0	0.0	52.6	3.7	3.5
Urban low ed	6.9	0.0	0.0	36.4	5.2	9.3
Urban med ed	3.7	0.0	0.0	37.6	1.9	3.2
Urban high ed	8.4	0.0	0.0	39.7	2.6	4.1
Total	199.2				100.0	100.0

Source: Bangladesh 2000 Social Accounting Matrix

Note: Export intensity is measured as the share of exports in gross output, and import penetration is measured as the share of imports in domestic use.

ACCOUNTING FOR NON-MARKET ACTIVITIES

This section explains how non-market activities were estimated, as well as some of the problems surrounding these estimations. Employment in the SAM is recorded in hours. This is an unusual feature, since conventional SAMs typically account just for number of workers. But it is only by measuring employment in hours that one can record time spent in both the market and non-market spheres by the same worker.

The gender-augmented SAM for Bangladesh used for model simulations in this report contains two additional non-market activities: social reproduction and leisure. Social reproduction includes services provided within households for own-consumption, which the standard System of National Accounts (SNA) defines as “economic” but not “productive”,¹⁰ such as: cooking and cleaning; care of children, the sick, and the elderly; repairing the house, furniture, and clothes; and personal, social, and community support services. Leisure covers activities which the SNA defines as “non-economic” (because they cannot be delegated to a third person) but excludes the minimum time needed for sleeping, eating, personal hygiene, and medical treatment. This is assumed to be 10

hours for both men and women. Some studies suggest that in Bangladesh, time spent eating and sleeping might also vary by gender.¹¹ In this SAM, however, for simplicity's sake, differences in time spent on personal care by men and women are all captured by differences in leisure time.

A social reproduction sector and a leisure sector are constructed for each household type. Members of each type of household “produce” particular kinds of social reproduction and leisure (reflecting each household's educational and gender composition), which are not traded among households but “consumed” by the members of that household category only. The value added in the social reproduction and leisure sectors is estimated in the following way: The key building block for the valuation is an estimate of the allocation of women's and men's time, in hours per week, between market and non-market productive activities. Leisure time is then residually calculated.

The valuation of non-market time proved particularly hard, since time-use data available for Bangladesh are neither complete nor reliable. Weekly hours worked in market activities were calculated from the 2000 Bangladesh Labour Force Survey (LFS) and non-market time values were estimated, for each type of worker in each type of household, based on various sources (mostly Hamid (1996) and a recent (still unpublished) survey by Khondhaker).¹² In the absence of better data, several strong assumptions had to be made.

Social reproduction time was calculated by adding, for each household type, the time spent in household work by paid workers, unpaid workers, and an additional group of people of working age classified in the 2000 LFS as engaged full-time in housework (these are overwhelmingly women, with the exception of poor non-agricultural female-headed households, where 8 percent of full-time “housewives” are male).

Leisure was calculated residually, for each skill category in each household type, after all other market and non-market activities were accounted for, but this approach too is rather problematic. Leisure time may be voluntary or involuntary. Time spent on leisure could be a function of a lack of employment—particularly in rural areas during the slack agricultural season, where people often work fewer hours than they would wish.

As shown in Table 4, social reproduction is always more female intensive than leisure, but the gender and skill composition of both social reproduction and leisure activities varies across households, reflecting differences in their gender and skill structure.

Table 4. Female percentage of total hours worked in each sector, 2000

	Total female	of which, by educational level:			
		No ed	Prim ed	Sec ed	High ed
All market sectors, of which:	100.0				
Rice and grains	16.0	9.9	4.2	1.7	0.3
Jute	6.6	4.1	1.8	0.5	0.1
Sugarcane	4.5	2.6	1.3	0.5	0.1
Commercial crops	1.6	0.9	0.6	0.1	0.0
Vegetables	34.7	21.8	9.3	3.1	0.5
Livestock	48.2	30.5	12.1	4.9	0.7
Poultry	76.4	49.4	17.9	7.6	1.5
Shrimp	32.1	24.7	3.9	2.3	1.2
Fish	29.8	24.8	3.3	1.4	0.3
Rice and grain processing	35.8	27.5	7.1	0.8	0.4
Edible oil	0.2	0.1	0.1	0.0	0.0
Sugar	2.8	2.2	0.5	0.1	0.0
Other food	10.6	7.7	2.6	0.2	0.1
Tobacco products	32.4	24.6	7.0	0.6	0.2
Leather	2.0	0.8	0.8	0.3	0.1
Jute textiles	0.5	0.3	0.2	0.1	0.0
Yarn	9.5	4.4	3.3	1.5	0.3
Mill cloth	1.9	0.8	0.7	0.3	0.1
Other cloth	11.5	5.5	4.0	1.4	0.6
RMG	80.2	36.5	29.9	9.2	4.6
Knitwear	0.0	0.0	0.0	0.0	0.0
Other textiles	43.4	19.8	14.4	7.1	2.1
Other industries	15.5	10.6	3.3	0.9	0.8
Infrastructure	1.8	1.1	0.3	0.0	0.4
Trade and hotels	3.7	3.2	0.3	0.1	0.1
Transport	0.8	0.5	0.2	0.0	0.1
Communications	4.0	0.0	1.3	0.0	2.7
Public sector	15.9	1.6	0.7	1.6	12.0
Domestic services	39.5	30.1	5.5	2.6	1.3
Financial services	1.5	0.0	0.1	0.2	1.2
All social reproduction, of which:					
Landless	88.4	72.4	13.6	2.3	0.1
Small farmers	88.1	60.3	19.9	6.9	1.1
Large farmers	91.2	49.4	24.4	14.0	3.4

Non ag poor female	94.2	75.5	14.3	3.0	1.4
Non ag poor male	89.6	60.5	20.0	7.6	1.5
Non ag rich	91.5	37.5	29.4	18.7	5.9
Urban low ed	80.1	52.7	20.8	5.7	0.9
Urban med ed	85.2	21.6	27.2	32.8	3.6
Urban high ed	86.7	12.7	12.0	27.7	34.3

All leisure, of which:

Landless	52.8	43.1	8.2	1.4	0.1
Small farmers	50.9	35.1	11.2	4.1	0.5
Large farmers	51.9	28.3	13.6	8.1	1.9
Non ag poor female	70.3	54.1	13.0	2.5	0.7
Non ag poor male	56.6	38.2	12.5	4.9	1.0
Non ag rich	52.6	21.7	16.8	10.9	3.3
Urban low ed	36.4	23.9	9.4	2.7	0.4
Urban med ed	37.6	9.3	12.0	14.7	1.6
Urban high ed	39.7	4.0	5.5	14.0	16.1

Total

The next step was to impute a value to the time spent in social reproduction and leisure. The estimates of the market hourly wage rates provided the basis for this valuation. This valuation of labor time is also the valuation of the output of the leisure and reproduction sectors, since, following SNA conventions, these sectors use neither capital nor intermediate inputs.¹³

The limitations of this way of valuing labor in reproduction and leisure should be noted. Setting the opportunity cost equal to the market wage assumes no constraints on people's ability to sell their time in the labor market. In the presence of market failures, each individual's subjective price for her time would no longer be equal to the market price, leading to different behavior than with perfect markets.

Hourly wages by sector for the eight labor categories were computed from various sources.¹⁴ This required several calculations and assumptions,¹⁵ to correct for missing observations and other problems. Wages vary across sectors as well as between sexes and educational groups, with agricultural wages being the lowest. Female wages are significantly lower than male wages in all educational categories: Table 5 shows that women earn less than 50 percent of what men earn in all groups, except for the highly educated group, in which women's wages are about 70 percent of men's wages.¹⁶ The smaller gap in earnings between female and male workers with university education could be explained by the fact that most highly-educated women are employed by the public sector, where gender disparities in wages are less marked than in other sectors.

Table 5. Female/male wage gap by educational level

	No ed	Low ed	Med ed	High ed
Average female hourly wages as percentage of male wages	46	48	52	72
Average wages (takas per hour)				
Female	3.82	5.63	7.83	22.52
Male	8.25	11.76	15.04	31.16

Source: Bangladesh 2000 SAM

Table 6. Allocation of time between market and non-market activities (%)

Bangladesh				
	Total	Female	Male	
Market		28.7	11.4	46.4
Social reproduction		26.0	45.1	6.4
Leisure		45.3	43.5	47.2
Total	100.0	100.0	100.0	

Source: Bangladesh 2000 SAM

Because of all these data limitations and strong assumptions, the estimates provided should be treated with caution.

TRADE POLICY SIMULATIONS

Since 1992, Bangladesh has implemented a series of liberalization measures to increase trade openness, revise and reduce tariffs and quotas, and improve customs and excise procedures. Bangladesh became a member of the World Trade Organization (WTO) in 1995, and has subsequently negotiated participation in a number of multilateral, regional, and bilateral trade agreements designed to lower tariff and non-tariff barriers.

Further liberalization and changes in global agreements on quotas, such as the ending of the MFA in 2004, and changes in the demand for agricultural exports are likely to have negative effects on the Bangladeshi economy. Among the forecast effects is a decline in external demand or a decrease in prices for its exports—most notably RMG.¹⁷ Policy recommendations variously emphasize enhancing competitiveness within the textile sector and/or diversifying towards other goods such as shrimp, leather products, and vegetables. The policy simulations described in this section aim to contribute to this debate, particularly focusing on the gender implications of these reforms.

TRADE FEATURES OF THE BANGLADESHI ECONOMY

Bangladesh remains a country heavily dependent on a limited number of exports to earn foreign exchange. As shown in Table 7, textiles, clothing, and footwear account for approximately 90 percent of all exports in the 2000 SAM. More specifically, RMG and knitwear exports contributed about 45 percent of foreign earnings and respectively 56 percent and 18 percent of Bangladesh's total gross export receipt. Exports of frozen food (about 5 percent of total exports) had initially raised much hope, but future

prospects remain uncertain. Leather has shown reasonable growth, with approximately a 10 percent share of total export value. The SAM reveals that about half of total import payments are accounted for by capital goods, while about 20 percent are due to imports of fabrics and other raw materials for garment production. The principal exports are dependent on a high level of intermediate and capital imports, as shown in Table 9. This dependency both increases imports and reduces net earnings from trade. Since 1992, both imports and exports have risen, but net exports (exports minus imports) have remained negative at about –6 percent of GDP.

Table 7. Sectoral structure of Bangladesh: exports, imports, and tariffs

	Net output (% of GDP)	Exports (% of total exports)	Export intensity*	Import penetration**	Tariff revenue (% of imports)
All market sectors, of which:	100.0				
Rice and grains	7.6	0.0	0.0	4.5	10.9
Jute	0.3	0.9	16.2	0.0	
Sugarcane	0.4	0.0	0.0	0.0	
Commercial crops	2.2	0.5	1.0	14.2	3.5
Vegetables	5.6	0.7	0.7	9.5	6.3
Livestock	2.5	0.1	0.1	22.7	0.0
Poultry	0.5	0.0	0.0	0.3	0.0
Shrimp	0.5	3.8	36.2	0.0	
Fish	5.6	0.0	0.0	0.0	
Rice and grain processing	2.9	0.0	0.0	1.5	11.0
Edible oil	0.3	0.0	0.0	44.4	80.2
Sugar	0.3	0.0	0.0	6.9	71.0
Other food	0.6	2.2	11.1	12.5	78.0
Tobacco products	0.5	0.0	0.1	2.0	5.8
Leather	0.2	9.9	69.5	11.0	0.0
Jute textiles	0.2	6.2	66.1	29.1	0.0
Yarn	0.3	0.1	0.2	68.0	8.2
Mill cloth	0.2	0.0	0.0	82.2	12.6
Other cloth	1.0	0.0	0.0	0.0	
RMG	2.8	56.4	77.7	19.3	4.7
Knitwear	0.6	18.3	88.5	21.6	0.0
Other textiles	0.1	0.0	0.2	22.6	4.7
Other industries	2.8	0.9	0.4	65.0	22.1
Infrastructure	12.6	0.0	0.0	0.0	
Trade and hotels	16.7	0.0	0.0	0.0	
Transport	11.1	0.0	0.0	0.0	
Communications	0.8	0.0	0.0	0.0	
Public sector	11.9	0.0	0.0	0.0	
Domestic services	3.7	0.0	0.0	0.0	
Financial services	5.2	0.0	0.0	0.0	
All social reproduction, of which:	36.6		0.0	0.0	
Landless	4.5		0.0	0.0	
Small farmers	5.5		0.0	0.0	
Large farmers	3.5		0.0	0.0	
Non ag poor female	0.3		0.0	0.0	

Non ag poor male	4.4	0.0	0.0
Non ag rich	3.1	0.0	0.0
Urban low ed	5.8	0.0	0.0
Urban med ed	2.8	0.0	0.0
Urban high ed	6.7	0.0	0.0
All leisure, of which:	52.6	0.0	0.0
Landless	6.3	0.0	0.0
Small farmers	8.8	0.0	0.0
Large farmers	6.5	0.0	0.0
Non ag poor female	0.2	0.0	0.0
Non ag poor male	6.4	0.0	0.0
Non ag rich	5.4	0.0	0.0
Urban low ed	6.9	0.0	0.0
Urban med ed	3.7	0.0	0.0
Urban high ed	8.4	0.0	0.0
Total	199.2		

Source: 2000 Bangladesh SAM

* Export intensity refers to the share of exports in gross output.

** Import penetration refers to the proportion of goods and capital that are imported. It reflects the value of imports as a share of total domestic consumption.

As shown in Table 8, the average tariff rate in Bangladesh was about 18 percent in 2000. However, the last column of Table 7 also shows that the degree of tariff dispersion is high, ranging from 0 percent in leather, jute textiles, and livestock to about 80 percent in edible oil and processed food. Tariffs provide a significant share of government revenue (more than 54 percent).¹⁸r.

Table 8. Tariffs and openness (%) in Bangladesh	Percentage
Average tariff rate	18.2
Tariffs as share of government revenue	54.3
Imports as share of GDP m.p.	24.4
Exports as share of GDP m.p.	11.1

Source: 2000 Bangladesh SAM

CHANGES IN TEXTILE EXPORTS

Since the mid-1980s, Bangladesh's exports have risen significantly, with exports of ready-made garments accounting for most of the increase. A favorable domestic policy of export promotion and increasing adherence to a regulated international trade regime led to this increase. Moreover, access to a guaranteed quota-based market through the Multi-Fibre Arrangement (MFA) played a crucial role. Entrepreneurs from other Asian countries took advantage of the initial absence of MFA quotas on exports in Bangladesh, after having hit the quota ceilings in their home countries. Domestic entrepreneurs also began to respond to the incentives provided by the New Industrial Policy implemented since the early 1980s.¹⁹

In this context, it is not surprising that the garment sector has made a significant contribution to the country's growth and foreign exchange earnings. RMG employment growth has averaged about 8 percent per year and accounted in 2000 for about 66 percent of total female manufacturing employment, as shown in Table 3. The garment industry is one of the main sources of market employment for women and pays women higher wages than many other activities available to them such as agriculture and domestic services. In all educational categories, the female/male wage gap in this sector is smaller than in other sectors.²⁰ Most female garment workers are migrants from poor rural areas,²¹ though not from the very poorest segments.²²

Despite this extraordinary performance, there is pessimism about the future of the industry related to the phase out of the MFA. There has not been much increase over time in the value of production. For example, the labor value added of RMG and knitwear production combined in terms of foreign earnings is around 20 percent. Most of the cotton and other intermediate inputs are imported.

Within the garment sector, the share of knitwear has increased dramatically in recent years. Prospects for this sector are more favorable than those for the woven garment sector. There is some evidence of increased efficiency in knitwear factories producing trousers and jerseys. But knitwear too relies to a large extent on imported yarn and does not have strong production linkages (for example the value of backward linkages as estimated from the SAM is 2.1 for RMG production and 2.4 for knitwear production, and the value of forward linkages is just slightly greater than one in both RMG and knitwear production). The knitwear sector is also more technologically intensive and much more male intensive than the woven garment sector. Fewer than 20 percent of the workers are women.²³

With the dismantling of the MFA, the Bangladesh garment industry will necessarily face greater competition. Some observers believe that the industry needs to move into more value-added, higher-priced products, which would involve more technologically intensive processes. This could be an effective strategy for some firms. However not all sections of the industry have the capacity to upgrade, nor would there be a favorable outcome for all sections of the workforce.

Higher-value items are generally more capital intensive and need better trained workers and supervisors. Growing evidence from other parts of the world shows that women lose out as manufacturing processes become more capital and/or skill intensive, leading

to increased employment of educated male workers and reduced employment of less educated female workers—what some authors call the “defeminization” of the labor force.²⁴

This is an important point that needs to be emphasized in the context of Bangladesh under the current policy changes. Even if the textile industry were to maintain its competitiveness in the future, women would be at higher risk of losing their jobs than men, and they would face more limited options.

The model simulations described in the next section provide further support for these points. The first simulation describes the effects of a 20 percent decline in RMG world export prices, while the second describes the effects of a price decline of the same proportion in knitwear exports. In a third experiment, the first simulation of a decline in RMG export prices is re-run with alternative gender-related parameters. More specifically, the experiment analyzes whether the decline in garment exports would have less negative effects on women if firms had a greater inclination to change the mixture of female and male workers in market sectors in response to changes in their relative wages (as measured by the elasticity of substitution between male and female labor in market production). Other simulations, such as a decline in the import price of inputs into the garment production, or various offsetting changes in the knitwear and RMG sectors, are not reported here but are available from the author on request.

The discussion of each simulation is limited to a few gender-related aspects of the results. For each educational group, the following features are analyzed: (i) the allocation of female labor among employment in the market economy (and among its different sectors), social reproduction, and leisure; and (ii) the female wage rate, both absolute and relative to male wages. Annex 2 describes employment and wages in the SAM (or base case), while Table 9 reports percentage changes from the base case.

Table 9 reports values for both the RMG and knitwear sector calculated from the SAM. The SAM highlights differences in the structure of production, input use, and trade between these two sectors. In both sectors, value added accounts for a small share of the value of production (34.3 percent in RMG and 26.9 percent in knitwear). Female labor, typically operating small sewing machines, accounts for about 37 percent of value added in RMG production, almost three times the value added of male labor. In contrast, essentially no female labor is used in production of knitwear, where production using knitting machines is more capital intensive. Female value added in the knitwear sector is equal to 0 percent in the SAM. Capital accounts for more than 90 percent of value added in knitwear, but only 50 percent of value added in the RMG sector. The major input into RMG production is milled cloth, and the major input into knitwear is yarn. As described in Table 7, much of both inputs are imported (80.5 percent of total milled cloth production and 66.0 percent of total yarn production). Arguably, the features of the knitwear sector as calculated from the SAM—not one single female worker, and such high capital intensity—appear quite extreme and inaccurate. Other evidence suggests, for example, that women make up about 20 percent of the total knitwear labor force.²⁵ Clearly, more accurate and recent data is needed to update the SAM and reflect these changes in the composition of the sector and the workforce. Given the data limitations, the magnitudes of the effects simulated in these experiments should be

regarded with caution. However some broad and useful lessons can still be deduced from the simulations examining the trends and the relative impacts on men and women.

Table 9. Structure of the garment and knitwear sectors

	RMG billion takas	RMG (% of production)	Knitwear billion takas	Knitwear (% of production)
Production	180.3	100.0	52.6	100.0
Inputs	118.5	65.7	38.4	73.1
Milled cloth	70.9	39.3	0.2	0.4
Yarn	0.6	0.3	32.5	61.8
Other textiles	12.8	7.1	0.0	0.1
Other inputs	34.2	19.0	5.2	9.8
Value added	61.8	34.3	14.1	26.9
Female labor	22.7	12.6	0.0	0.0
Male labor	8.2	4.6	1.2	2.2
Capital	30.8	17.1	12.9	24.6
Exports	140.5	78.0	45.6	86.8
Share in total exports (%)		57.1		18.6

Source: Bangladesh SAM, 2000

Because of the structural differences previously highlighted, the decline in one sector or the other is likely to have a differential impact on women and men, and on returns to other factors of production.

DECLINE IN RMG EXPORTS

The reduction in RMG exports is simulated by modeling a 20 percent decline in world prices. This causes the volume of garment exports to decline by more than 35 percent, because of the severe fall in profitability of garment production. Exports in all other sectors increase, especially in leather, jute textiles, and vegetables (although the latter from a very small initial base) because of the significant depreciation of the exchange rate (by 15 percent). The exchange rate depreciation is required to restore the trade balance, which is held constant in the model. As a result, garment exports fall to 44 percent of total exports. However, knitwear exports increase, so that the combined share of knitwear and RMG in total exports remains high (about 66 percent). Because of the exchange rate depreciation, imports decline (by 10 percent) in all market sectors and especially in mill cloth, a major input into RMG production. Output falls by 30 percent in the garment sector and increases for agricultural goods—especially jute and livestock, which are major inputs into the expanding jute textile and leather industries

respectively.²⁶ All services, which are non-traded sectors, experience a moderate output fall, as do most of the non-market sectors, because of decline in domestic demand. However, in small farmer households and large farmer households, as well as in the non-agricultural rural rich households, time spent on household work and leisure increases. These households are the ones that gain from the policy change, as land and agricultural capital (the only factors of production for which returns increase in the experiment) provide their main source of income.

As described in Table 10, employment in the garment sector falls by about 50 percent for both women and men, but the absolute decline is higher for women than for men, reflecting their much larger initial share of garment employment.²⁷ Although there is an increase in female employment in other market sectors, the net effect for all women is a decline in labor market participation. Female workers with different skills are affected differently. The decline in market employment is largest for women with primary education (4 percent) and slightly less for female workers with tertiary education (3.5 percent), and secondary education (2.5 percent), while labor participation declines less than 1 percent for women with no education. In this group, a larger proportion of those previously in the garment sector find employment in agriculture, especially vegetable production and livestock.

Thus, for all women, non-market time increases, and time spent in social reproduction increases on average more than their leisure time. Many of these changes are involuntary and reflect their retrenchment. These overall changes in social reproduction and leisure mask differences between households. While women in rural landless households and most urban households reduce the time they spend in social reproduction and leisure, women of the same skill level in rural rich households increase both.

For men of all educational groups there is a small increase in market participation—less than 1 percent—because the sectors that expand are more male intensive.

Because the decline of the most female-intensive sector reduces the economy-wide demand for female labor more than the demand for male labor, the wage rate of women declines both absolutely and relative to that of men. For all women but the unskilled group, wages decline more than 4 percent in absolute terms, and by about 3 percent relative to those of men with similar skills.

Total consumption of both market and non-market goods rises slightly for the large farmers but falls for all other households. This is because large farmers benefit from higher returns on land and agricultural capital. All other households experience a decline in their income. Urban households, both poor and rich, are more negatively affected than the rural households.

The price of non-market activities falls for all households because the cost of labor declines, with the price of social reproduction falling more than the price of leisure, because it is more female intensive. The share of social reproduction and leisure in total consumption increases in all households, but their absolute level of consumption declines in most of them. The positive substitution effect on consumption from lower

relative prices is smaller than the negative income effect, resulting in most households being worse off.

The impact on women's well-being is unambiguously negative, especially for women with only a primary education. Unskilled female workers experience the smallest decline in market participation but move to low-productivity agricultural activities for which, in some cases, they might not even receive a wage (the model would record earnings accruing to activities such as raising poultry or helping with the livestock, but evidence suggests that such earnings are often appropriated by male members of the household). Thus, a shift from the manufacturing sector to agriculture could have potentially negative effects, even when there are net increases in participation, since the former sector generally offers better terms and condition of work, and also provides women with independent income. Overall, the increase in women's non-market time is taken up more by social reproduction activities than by leisure.

DECLINE IN KNITWEAR EXPORTS

The second simulation models a 12 percent decrease in the export volume of knitwear brought about by a 20 percent decline in its export price. Exports in all other sectors increase, but only moderately, since the exchange rate depreciation that results is only about 2 percent. Output falls by more than 20 percent in the knitwear sector and increases for most other manufacturing sectors, especially RMG and other textiles. Output in agriculture declines overall by less than 1 percent. Changes are negligible in services and most of the non-market sectors. All these effects are slight compared with the previous experiment, given that knitwear exports are only about one-third the size of RMG exports.

Table 11 shows that male employment in the knitwear sector falls by 69 percent, but overall men's market participation remains unchanged as new employment opportunities are created in other manufacturing sectors. Market participation moderately increases for female workers in all skill categories (by about 1 percent) because of the indirect effect of the expansion of the RMG sector stimulated by the depreciation of the exchange rate. Overall, the increase in women's market time is at the expense of their leisure time (rather than at the expense of time spent on household work).

Returns to capital decline less when knitwear contracts, despite the fact that knitwear is more capital intensive than RMG. This is because the magnitude of the initial price shock is smaller. Similarly, the fall in returns to male labor is lower than in the previous experiment, but larger than the decline in returns to female labor, so that the gender wage gap narrows slightly for all skill categories. Income decreases for the same households as in the previous experiment, but by a smaller magnitude.

DECLINE IN RMG EXPORTS WITH HIGHER SUBSTITUTABILITY BETWEEN MALE AND FEMALE LABOR

This experiment is a variant of the previous exercise. It is run by increasing the elasticity of substitution between male and female workers for each skill category from the original value of 0.5 to 2.5 in all market sectors. A higher elasticity of substitution between female and male labor could be taken as a proxy for a greater inclination on

the side of firms towards hiring more women when their wages fall relative to male wages. Hence what this section intends to do is simply to show how different attitudes of employers towards gender relations (perhaps influenced by programs that provide incentives to firms outside of the RMG sector to hire women) can lead to less negative outcomes. Depending on the assumptions made about the values of these key parameters, the magnitudes of the effects are likely to vary, which is important to consider when designing policies.

The effect of increasing this elasticity is to reduce the fall in female labor participation resulting from the decline in the garment industry. This is shown in Table 12. The decline in total market employment is now less than 1 percent for both women with secondary education and no education, and less than 2 percent (from about 4 percent in the main experiment) for female workers with primary education. Market participation of highly-skilled female workers increases instead of declining. This increase is mostly due to higher demand for them in the public sector (this sector slightly contracts but becomes much more female intensive). Because of the higher substitution elasticities and the fall in the relative wage of women, all market sectors absorb more female labor than in the main experiment, so that women previously in the garment industry more easily find employment elsewhere. Conversely, male market participation increases less than before. As a result, female wages decline less than in the previous case, while male wages decline more. Hence the wage gap between female and male workers of each skill level widens less.

The rise in time spent on social reproduction by women of all skill levels is now smaller than in the previous experiment, as is the rise in their leisure time. These results show that firms' higher propensity to substitute female workers for male workers would moderate the negative market impact of a potential decline in the textile sector. The magnitude of the changes is quite small, however, given the very small initial share of women in most market sectors

OTHER EXPERIMENTS

Various other textile-related simulations were run. One simulation modeled a 10 percent decline in the import price of both yarn and mill cloth. Mill cloth is the main input into garment production, while yarn is the main input into knitwear. The main effect is an increase in knitwear output and exports when yarn become cheaper, and an increase in garments output and exports when the price of mill cloth declines. These changes have gender-differentiated effects. In the case of yarn, capital increases more than any other factor of production, and the gender wage gap widens, while in the case of mill cloth, female wages increase both absolutely and relative to men's wages. Details of these additional simulations are reported in the appendix.

DIVERSIFYING EXPORTS: HIGHER EXPORT PRICES FOR SHRIMP, LEATHER, AND VEGETABLES

The CGE model simulated a 15 percent price increase in three sectors which are considered to have good export potential: shrimp, leather, and vegetables. Because of differences in the production structure, the factor intensity and the backward and forward linkages in these sectors, increases in these sectors are likely to have a

differential impact on women and men. The rise in export prices was simulated separately for each sector but the results are analyzed here in a comparative perspective. Selected results are presented in Tables 13–15.

The vegetable sector—which in the SAM also includes pulses, spices, fruits, and other minor crops—accounts for more than 5 percent of conventional GDP. It is one of the most female-intensive crops in agriculture but production is geared toward the domestic market. As shown in Table 3, less than 1 percent of total output is currently exported. The shrimp sector is more open (almost 40 percent of production is exported) and employs a similar share of female labor (32 percent of total hours are female), although its labor force is slightly less skill intensive than that of vegetables (unskilled women constitute 77 percent of the total female labor force in the shrimp sector and 62 percent of the total female labor force in the vegetable sector).²⁸ Labor costs account for about 57 percent of shrimp value added (with water being the other main factor of production). Vegetables are less labor intensive (labor accounts for 33 percent and land for 77 percent of total value added). Leather is also a rather small sector (accounting for only 0.2 percent of conventional GDP), and is the most open of the three sectors, with about 70 percent of what is produced being exported. Leather is a very male intensive sector, with female hours being only 2 percent of total labor hours, but it has strong backward linkages to the livestock sector in which half of the workforce is female.

In all simulations, the export increase causes an appreciation of the exchange rate because the trade deficit in the model is held constant and hence there needs to be a similarly sized rise in the volume of imports. The effects on total exports and output are rather small in all experiments, but particularly so when an increase in vegetable exports is simulated. Production in the vegetable sector increases by less than 1 percent and all other changes are negligible. In the case of shrimp, total exports fall by about 3 percent because of the negative effects of the exchange rate appreciation on other export sectors. In the case of leather, leather exports increase by more than 200 percent (from a very small initial base) and total exports increase by more than 3 percent.

The effects on female market force participation are rather small, but are similar in all three experiments. Market participation of female unskilled workers is unchanged (in the vegetable and shrimp simulations) or rises (by almost 1 percent, in the leather experiment), while participation of women with other skills marginally declines. Male market force participation is unchanged in most cases. This pattern reflects the fact that the sectors that expand are labor intensive for unskilled labor.

Due to changes in the demand for female and male labor, the wage rate of women increases both absolutely and relative to that of men for the unskilled labor, while it declines for the other skill categories. Water is the factor of production that gains the most when shrimp exports rise, while cattle is the factor of production that gains the most from expansion of the leather sector. Total consumption increases for rural households, including landless households, which benefit from higher returns to unskilled labor, both men and women.

The changes in exports are notable for two reasons. First, the distributional implications of these changes suggest that expansion of the shrimp sector and the footwear sector would create employment opportunities mostly for uneducated women. Unlike the garment industry, which has primarily benefited urban women with some schooling, expansion of these other sectors could have a greater pro-poor impact, especially in rural areas, provided the extent of the change is sufficiently large. Another notable point is about control of income. The potential to increase employment opportunities for unskilled women must be evaluated in light of the terms and conditions of work that they are offered. For example, the leather industry has a strong link with employment in livestock production. But the model is not able to capture the fact that the women working in this sector might be excluded from specific tasks and not directly involved in the sale of the animals.

Importantly, these experiments draw attention to the critical role of the exchange rate. What if the exchange rate didn't adjust? When the simulations are run under the assumption of a fixed exchange rate and a flexible trade balance, the positive female employment effects are stronger than in the previous case. Increases in employment are larger in all experiments, but more favorable to women with some education than to women with no education, compared to the previous case with exchange rate appreciation. As shown in Table 16, the impact is strongest when the leather sector expands (a 4 percent increase for women with no or primary education and almost 5 percent for women with secondary education). Female employment rises by about 1 percent in all educational categories in the shrimp experiment, compared to a slight decline under the assumption of flexible exchange rate (Table 17). Changes are slight in the case of a vegetable export expansion (Table 18).

CONCLUSIONS

The simulations described in this report have shown how trade reforms in Bangladesh have a different impact on men and women. The effects are also different among women themselves, depending on their education, the main source of their employment, their location, and the type of household they belong to. By identifying groups and individuals that are likely to be most vulnerable to changes in trade, this analysis can help in designing more effective policy interventions.

The policy experiments have confirmed that women in Bangladesh are more vulnerable than men to the likely decline of the garment industry, as employment opportunities available to them outside of the textile sector are very limited. The distribution of female employment across formal sectors is extremely skewed and the labor market is highly segmented. This requires emphasis on interventions to provide incentives to firms outside of the RMG sector to hire women and to foster labor mobility.

Female workers with different skills are likely to be affected differently by the decline of the garment industry. In the simulations analyzed in this report, the decline in market employment is largest for women with primary education (4 percent). Women with no education experience the smallest decline in market participation but move to low productivity agricultural activities.

A shift from the manufacturing sector to agriculture could have potentially negative effects for female workers, even when there are net increases in their participation, since agriculture generally offers worse terms and condition of work as well as less access to independent sources of income for women. These possible drawbacks must receive attention in the context of initiatives to promote diversification of exports of other goods such as shrimp, leather products, and vegetables. Simulations in this report show that the employment effects of an expansion of such exports are rather small. The leather sector has the greatest potential for female employment creation, due to its backward linkages with the livestock sector. However the extent of women's involvement in the sale of livestock (and hence their ability to control the income earned) is not clear. The shrimp industry could also provide some employment opportunities for women, while the employment effects of an expansion of vegetable exports are slight. The same experiments are run under different assumptions about the exchange rate. It is important to note that, in all experiments, the employment creating effects of non-traditional exports are larger when the exchange rate is fixed and hence no appreciation occurs.

Another insight that emerges from the simulations is that increases in female labor market participation usually happen at the expense of women's leisure time. Women must continue to work in the household as well as in the market, with resulting heavy time burdens that might affect negatively their welfare in the long term. This draws the attention to the need for policies to address the combined productive and reproductive roles of women.

POLICY RECOMMENDATIONS

Women in Bangladesh are more vulnerable than men to the likely decline of the garment industry, as the opportunities for formal and stable employment available to them outside of the textile sector are very limited. Even within the textile industry, women are concentrated in the RMG sub-sector, while the knitwear sub-sector is overwhelmingly male.

Trade has led to significant increases in female employment in one export sector. However, women remain constrained in their ability to access job opportunities and improve the terms and conditions of employment. While their combined productive and reproductive responsibilities represent important constraints, critical demand factors also play a role—the distribution of female employment across formal sectors is extremely skewed. Expansion of other traded sectors such as shrimp, horticulture, and jute narrowly benefits women in these sectors, but has significant negative secondary effects on other sectors as the exchange rate appreciates. Exchange rate appreciation in a highly sex-segmented labor market leads to significant employment loss in low-wage, low value-added sectors where women are concentrated. This means that a revised export strategy away from the RMG sector would lead to significant drawbacks for women. What can be done to prevent this?

This section recommends a set of initiatives that could improve trade outcomes for women. It is divided in two parts: 1) policies and 2) research and data needs.

POLICIES

LABOR MARKET POLICIES

Policies should be designed to reduce the markedly sex-segmented labor market and facilitate the insertion of women in sectors other than the garment industry. Measures should be taken to increase labor mobility. Active labor market policies could be considered as part of a range of labor market initiatives that could benefit women. Specialized training in addition to general education could be provided, particularly to women retrenched from the textile sector. Efforts to promote women's participation in more technical subjects that will better equip them for the market place should be encouraged. Vocational training and other forms of training should be supported, including technical support from international donors.

POLICIES TO ADDRESS WOMEN'S MULTIPLE ROLES

There is a need to develop policies which address the combined productive and reproductive roles of women. Time usage and other studies document the disproportionate amount of time women spend on household responsibilities in comparison to men. Greater investment is required to reduce women's excessive time burdens. Time and labor saving infrastructure could play a role, including investment in water supply and sanitation, energy for household needs, and transportation. It has been shown (in South Africa, for example) that women who are heavily involved in water collection are also more likely to be engaged in part-time casual work. Thus, improving infrastructure would not only be an effective way to enhance Bangladesh's competitiveness in global markets, but would also reduce women's time burden and enable them to participate more fully in the new employment opportunities created by trade. It is also important to recognize that there are significant differences between women too, depending on their educational attainment and whether they live in rural or urban areas.

RESEARCH AND DATA NEEDS

There is a need to both strengthen current tools of analysis and extend areas of research.

A gendered SAM is one of the most effective tools to assess the economy-wide impact of macroeconomic reforms on inequalities. The SAM used in this analysis contained some inaccuracies, and there also exist discrepancies between different SAMs produced under various initiatives (namely the IFPRI-Bangladesh Institute for Development Studies Bangladesh SAM and the UNDP Bangladesh SAM). It is important to support steps to redress these inaccuracies and foster collaboration between institutions so as to produce a set of consistent and reliable data.

Some problem areas in the current IFPRI-BIDS SAM are listed below:

- Production structure of the knitwear sector. This sector is currently represented as not employing any female labor. Evidence suggests at least 20 percent of the

labor force is female. Hence there is the need to correct the share of each factor of production in value added and to include female labor among these factors.

- Need to revise the household types and their factor endowments. It would be useful, for example, to distinguish between households with dependents and households without dependents. There is the need to update sources of income for each household type and to report them more accurately. For instance, it appears odd that poor female-headed households derive almost half of their income from capital. This is probably a problem arising from missing data and calibration requirements.
- Need for better data on wages, not only by sex but also by education levels, for as many sub-sectors as possible.
- An estimation of employment elasticities of various sectors, both in agriculture and manufacturing, would greatly help model parameter calibration.
- Need for better time use data. A major survey like the Labour Force Survey should have a properly developed time use module. At the moment there are several problems with the way the LFS reports time use. For example, time spent engaged in housework is recorded only for those people that are classified as full-time house workers. This is based on the unlikely assumption that if one person is engaged in market activities she does not do any housework at all. Additionally, no attempt is made to estimate idle time as different from voluntary leisure. This is critical in a country where both under-employment and unemployment significantly limit the extent to which an individual can sell their labor in the market. A detailed and more accurate time use model could also help in better understanding and documenting women's roles and tasks in agriculture. Women are heavily involved in many tasks, often unpaid and invisible. Moreover, there is a marked gender division of labor but no detailed study on these aspects exists to date. There is a need for a time use module that is disaggregated by sex, age, income, and location or proximity to infrastructure (the latter, for instance, is critical if the data is to link to poverty and policy).
- Need to break down social reproduction in several sub-sectors. The model used in this report has provided a representation of the household sector as producing just one type of output: social reproduction. However, services included in household work do not all have the same characteristics. Some activities, such as looking after one's children, are leisure up to a point and then become work. Parents derive intrinsic satisfaction from much of the care they provide but after a certain limit they are willing to buy substitutes for it. Other activities, for example washing dishes, could be presumed to bring little direct utility to the individuals performing them. Most household activities—emotional care as well as laundry or cooking—have both a consumption and investment component: they are critical both to the day-to-day and to the long-run reproduction of the labor force. Distinguishing among these activities is important from a policy perspective, since each of them involves different ways of organizing production, as well as having input mix requirements which are gender differentiated, and each has different repercussions on well-being. Some are more likely to have market substitutes than others.

- Poor quality of data. Generally, there is a problem with the poor quality of the data. Enumerators and data entry personnel need to be better trained to ensure that they preserve as much information as possible. There is a need for women enumerators and data entry technicians, as well as gender analysts who are engaged from the initial stages of survey design.

ANNEX 1

ACCOUNTS IN THE NEW BANGLADESH 2000 SAM

Market activities (30)		
Agriculture (9)	Industry (14)	Services (7)
Rice and grains	Rice and grain processing	Infrastructure (construction and utilities)
Jute	Edible oil	Trade services and hotels
Sugarcane	Sugar	Transportation services
Commercial crops	Other food	Public sector
Vegetables	Leather	Financial services
Livestock	Jute textiles	Communications
Poultry	Yarn	Domestic services
Shrimp	Mill cloth	
Fish	Other cloth	
	Ready-made garments	
	Knitwear	
	Other textiles	
	Tobacco products	
	Other industries	
Non-market activities (18)		
Social reproduction (9)	Leisure (9)	
Landless farmers	Landless farmers	
Small farmers	Small farmers	
Large farmers	Large farmers	
Non ag poor female head	Non ag poor female head	
Non ag poor male head	Non ag poor male head	
Non ag rich	Non ag rich	
Urban primary education	Urban primary education	
Urban secondary education	Urban secondary education	
Urban higher education	Urban higher education	
Commodities (30): Same as market activities		
Factors of production (13)		
Female labor (4 educational levels)	Poultry capital	Land
Male labor(4 educational levels)	Cattle capital	Ponds
	Non-agricultural capital	
Households (9)		
Landless farmers	Rural non-ag poor fem head	Urban prim education
Small farmers	Rural non-ag poor male head	Urban sec education
Large farmers	Rural non-ag rich	Urban high education
Other institutions (3)		
Enterprises	Government	Rest of the world

ANNEX 2

MAPPING BETWEEN THE SAM ACTIVITIES AND THE Input-Output (IO) ACTIVITIES

Current SAM activities (30+18)	BIDS-IFPRI 52 SAM	IO 79 Activity (1993-94)
Rice & grains	Paddy Aman	Paddy
	Paddy Boro	
	Grains	Wheat
		Other grains
Jute	Jute	Jute
Sugarcane	Sugarcane	Sugarcane
Other com. crops	Other com. crops	Cotton
		Tobacco
Other crops	Other crops	Tea
		Forestry
		Potatoes
		Vegetables
		Pulses
		Oilseeds
		Fruits
		Major spices
		Other crops
Livestock	Livestock	Livestock
Poultry	Poultry	Poultry
Shrimp	Shrimp	Shrimp
Other fish	Other fish	Other fish
Rice & grains milling	Rice milling Aman	Rice milling
	Rice milling Boro	
	Ata & flour milling	Ata & flour milling
Edible oil	Edible oil	Edible oil
Sugar	Sugar	Sugar & gur
Other food	Other food	Fish & seafood processing
		Tea processing & blending)
		Salt
		Other food
Leather products	Leather products	Tanning & leather finishing
		Leather products
Jute textiles	Jute textiles	Jute baling
		Jute textiles
Yarn	Yarn	Yarn
Mill cloth	Mill cloth	Mill cloth
Cloth	Cloth	Handloom cloth
Readymade garments	Readymade garments	Readymade garments
Knitwear	Knitwear	Knitting & hosiery
Other textiles	Other textiles	Dyeing & bleaching
		Other textiles
Tobacco Products	Tobacco Products	Cigarettes
		Bidi

Current SAM (30+18)	BIDS-IFPRI 52 SAM	IO 79 Activity (1993-94)
Other industries	Wood products	Saw & planing mills
		Wooden furniture
		Pulp, paper & board
	Chemical	Drugs & pharmaceuticals
		Other chemicals
	Fertilizer	Fertilizer
	Petroleum products	Petroleum products
	Clay products	Pottery & earthenware
		China & ceramics
		Glass & glass products
		Bricks, tiles & clay products
	Steel	Iron & steel basic industry
		Fabricated metal products
	Machinery	Machinery
	Misc. industry	Transport equipment
		Printing & publishing
Misc. industry		
Cement		
Construction & utilities	Urban buildings	Urban buildings
	Rural buildings	Rural buildings
	Construction road	Construction: Rural roads
	Construction electricity	Construction: Electricity & gas
	Construction other	Construction: Other transport
	Utility electricity	Other construction
	Utility gas mfg.	Electricity
Trade & hotels	Trade service	Trade service
	Hotels	Hotels & restaurants
Transport service	Transport service	Transport service
Public sector	Housing service	Housing service
	Health service	Health service
	Education service	Education service
	Public admin. & defense	Public admin. & defense
Financial services	Financial services	Banking & insurance
Communications	Communications	Communications
Other services	Other services	Professional services
		Other services

Current SAM (30+18)	BIDS-IFPRI 52 SAM	IO 79 Activity (1993-94)
Social reproduction landless		
Social reproduction small farmers		
Social reproduction large farmers		
Social reproduction poor non ag		
female		
Social reproduction poor non ag		
male		
Social reproduction rich non ag		
Social reproduction urban low ed		
Social reproduction urban med ed		
Social reproduction urban high ed		
Leisure landless		
Leisure small farmers		
Leisure large farmers		
Leisure poor non ag female		
Leisure poor non ag male		
Leisure rich non ag		
Leisure urban low ed urban		
Leisure urban med ed urban		
Leisure urban high ed urban		

ANNEX 3

THE MODEL

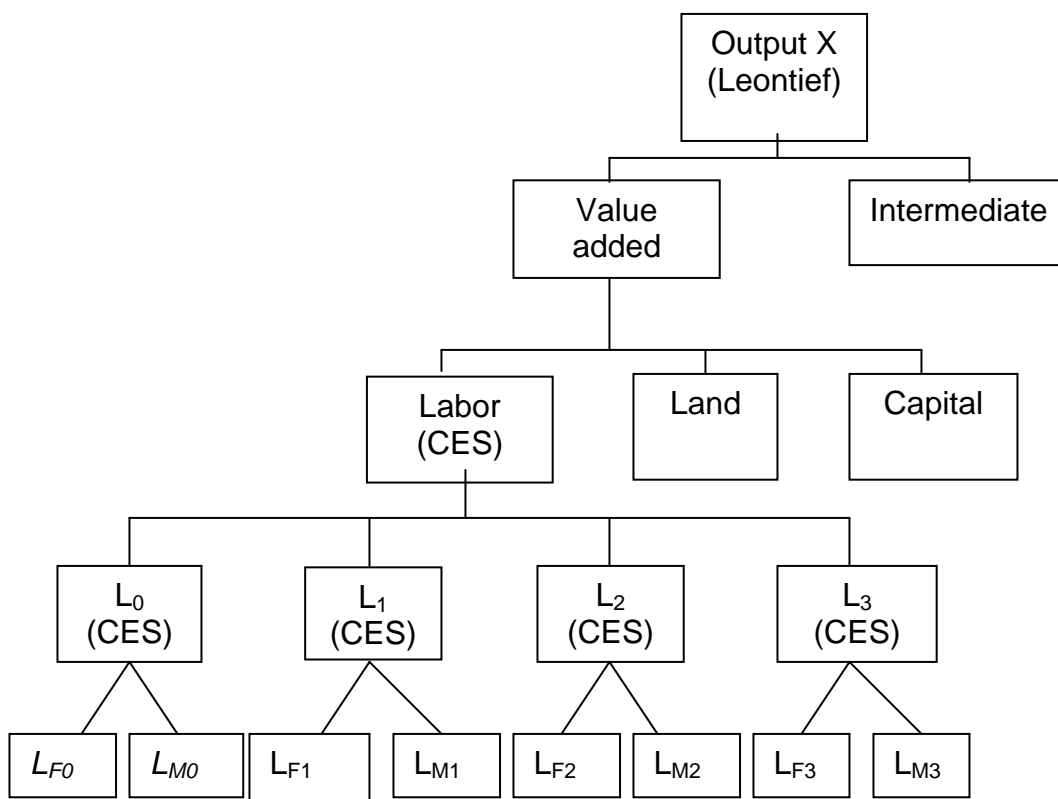
The Bangladesh model used in this report is an adaptation of the IFPRI “standard” CGE model.²⁹ Its basic framework is neoclassical, but some institutional rigidities and frictions are also included. For example, sectors are characterized by imperfect substitution on both the demand and the supply side. It is also possible to model market imperfections restricting labor mobility (through, for instance, a parameter which allows the marginal revenue product of a factor in a particular sector to deviate from the average return to that factor across the economy).

The IFPRI new standard model includes a number of new features, such as: a specification that permits any activity to produce multiple commodities and/or any commodity to be produced by multiple activities; household consumption of non-marketed commodities; and explicit treatment of transaction costs for marketed commodities. The model is designed in such a way as to allow its users to choose easily between alternative features. The General Algebraic Modeling System (GAMS) code is organized through a set of several separate but linked files that import data, check everything is balanced, run simulations, and report results, making it easy to manage large data sets.³⁰

The new features of the standard model have not been fully exploited in the current work, even though some of them have the potential to be used for an improved gender analysis. For example, it would be useful to include consideration of gender-differentiated transaction costs if the data were available.

The IFPRI standard model incorporates the “small country” assumption on both the import and the export side. The production function in the extended Bangladesh model is a three-level constant elasticity of substitution (CES) function. This is described in Figure 4 below.

Production technology in the Bangladesh CGE model



L_e = Aggregated labor by education (e)

L_{ge} = Labor by gender (g) and education (e)

Some of the elasticity values used in the model were taken from other studies on Bangladesh. When empirical estimates were not available, educated guesses had to be used, and sensitivity analysis was run to test for the robustness of the results. At the lowest level of the production function, female labor and male labor of the same skill are aggregated into composite labor. To reflect the rigidity of gender roles, female/male substitution is limited by setting the value of the elasticities to -0.5 in the market sectors and -0.25 in social reproduction and leisure. The production function here has an intermediate level that aggregates the four educational types of composite labor, with a substitution elasticity of -0.95 , into one larger labor bundle.³¹ This larger labor bundle is the “output” of the reproduction and leisure sectors, which use neither capital nor land nor intermediate inputs.

In the market sectors, the production function has an upper level that combines composite labor with capital and land to produce net output (which is then combined in fixed proportions with intermediate inputs to make gross output). The substitution elasticity at the upper level, following another model of Bangladesh,³² varies by sector, ranging from about -0.5 in some agricultural and manufacturing sectors to -0.8 in some services. These values were chosen so that the own-price elasticity of supply for each sector would be approximately equal to available empirical estimates.

As for the foreign trade parameters, the elasticity of substitution in the CES import Armington functions and in the Constant Elasticity of Transformation (CET) export functions is set at 3.5 for most agricultural sectors and 2.5 for manufacturing sectors.

Household consumption includes both marketed commodities and non-market commodities. The demand for each good consists of a subsistence minimum, plus a fixed share of the residual income after meeting all the minima. The choice was to compute the parameters of the Linear Expenditure System (LES) for each group of households, given exogenously specified average budget shares (derived from the SAM), price elasticities of demands, and the “Frisch” parameter (the parameter measuring the elasticity of marginal utility of income with respect to income).³³ The price elasticities of demand for market goods are mainly based on a 1994 study by Ahmed and Shams.³⁴ Ahmed and Shams’s consumption categories and household groups are different from the ones in the current SAM. The type of demand system that they estimate (the “almost ideal demand system,” or AIDS) is different from the one assumed in the model. Hence, reference to their values is approximate. The price elasticity for food (more specifically rice, which is the main staple in Bangladesh, and included in the food processing sector in the SAM) ranges among household types from -0.2 to -0.3 . In the absence of information on different households’ attitudes towards social reproduction, it is assumed that all households value it in the same way, and consider it a basic need. Hence the price elasticity of demand for social reproduction is set about as low as that for food, at -0.3 .³⁵ The price elasticity of demand for leisure is set approximately equal to the price elasticity of demand for services, at about -1.0 . This too is somewhat arbitrary.

As for the model macro closures, the balance of trade is fixed, and the level of exports and imports adjusts through changes in the real exchange rate. Government consumption in each sector is fixed in real terms, as is the demand for investment goods. Government savings are a residual, while all tax rates are fixed. The savings–investment balance is achieved through adjusting the household propensity to save. This means assuming that the government is able to implement policies that generate the necessary private savings to finance the fixed real investment.

Given that the model used in this report is a single-period model, a closure combining fixed foreign savings, fixed real investment, and fixed real government consumption seems preferable for simulations that explore the equilibrium welfare changes of alternative policies. A closure with flexible foreign savings or flexible investment would lead to misleading results. For example, a decline in investment would raise private consumption and hence household welfare, but the static nature of the model would not allow consideration of welfare losses that might result from a smaller capital stock in the long term.

It could be argued that a savings-driven closure would have been a more appropriate representation of low-income countries such as Bangladesh, where household savings tend to be interest rate inelastic. Experiments were also run under an alternative closure in which investment adjusts to savings. Using a savings-driven closure instead of an investment-driven closure has the only effect of changing the composition of aggregate demand. No other effects can be captured given the structure of the current model. For

example, because investment shares by sector of destination are treated as predetermined, one cannot capture the effects of government policy on the structure of investment. Moreover, the model has no specification for funds market and the banking system. Differences in simulation results under the two alternative closure rules are slight.

As for the factor market closures, the assumption is that the supply of capital, land, water, and other agricultural capital in each sector is fixed, but labor is mobile, so that supply to each sector responds freely to demand, within limits set by the fixed total supplies of female and male labor. Alternative rules in the labor market could be also modeled. This would be very important to consider in future work. The implications of alternative labor market features will be examined in future work.

ANNEX 4

MODEL EQUATIONS

SETS			
Symbol	Explanation	Symbol	Explanation
$a \in A$	activities	$c \in CMN(\subset C)$	commodities not in CM
$a \in ACES(\subset A)$	activities with a CES function at the top of the technology nest	$c \in CT(\subset C)$	transaction service commodities
$a \in ALEO(\subset A)$	activities with a Leontief function at the top of the technology nest	$c \in CX(\subset C)$	commodities with domestic production
$c \in C$	commodities	$f \in F$	factors
$c \in CD(\subset C)$	commodities with domestic sales of domestic output	$f \in FDIS(\subset F)$	disaggregated factors
$c \in CDN(\subset C)$	commodities not in CD	$f \in FAGG(\subset F)$	aggregated factors
$c \in CE(\subset C)$	exported commodities	$i \in INS$	institutions (domestic and rest of world)
$c \in CEN(\subset C)$	commodities not in CE	$i \in INSD(\subset INS)$	domestic institutions
$c \in CM(\subset C)$	imported commodities	$i \in INSDNG(\subset INSD)$	domestic non-government institutions
		$h \in H(\subset INSDNG)$	households
PARAMETERS			
$cwts_c$	weight of commodity c in the CPI	\overline{qg}_c	base-year quantity of government demand
$dwts_c$	weight of commodity c in the producer price index	\overline{qinv}_c	base-year quantity of private investment demand
ica_{ca}	quantity of c as intermediate input per unit of activity a	$shif_{if}$	share for domestic institution i in income of factor f
$icd_{cc'}$	quantity of commodity c as trade input per unit of c' produced and sold domestically	$shii_{ii'}$	share of net income of i' to i ($i' \in INSDNG$; $i \in INSDNG$)
$ice_{cc'}$	quantity of commodity c as trade input per exported unit of c'	ta_a	tax rate for activity a
$icm_{cc'}$	quantity of commodity c as trade input per imported unit of c'	te_c	export tax rate
$inta_a$	quantity of aggregate intermediate input per activity unit	tf_f	direct tax rate for factor f
iva_a	quantity of aggregate intermediate input per activity unit	\overline{tins}_i	exogenous direct tax rate for domestic institution i
\overline{mps}_i	base savings rate for domestic institution i	$tins0I_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
$mps0I_i$	0-1 parameter with 1 for institutions	tm_c	import tariff rate

pwe_c	with potentially flexed direct tax rates export price (foreign currency)	tq_c	rate of sales tax
pwm_c	import price (foreign currency)	$trnsfr_{i,f}$	transfer from factor f to institution i
$qdst_c$	quantity of stock change	tva_a	rate of value-added tax for activity a

ENDOGENOUS VARIABLES			
$DMPS$	change in domestic institution savings rates (= 0 for base; exogenous variable)	QF_{fa}	quantity demanded of factor f from activity a
DPI	producer price index for domestically marketed output	QG_c	government consumption demand for commodity
EG	government expenditures	QH_{ch}	quantity consumed of commodity c by household h

GREEK LETTERS			
α_a^a	efficiency parameter in the CES activity function	δ_c^t	CET function share parameter
α_a^{va}	efficiency parameter in the CES value-added function	$\delta_{fagg,a}^{va}$	CES value-added function share parameter for aggregated factor <i>fagg</i> in activity <i>a</i>
$\alpha_{fagg,a}^{va2}$	efficiency parameter in the CES lower level value-added function	$\delta_{fdis,a}^{va2}$	CES lower level value-added function share parameter for disaggregated factor <i>f</i> in activity <i>a</i>
α_c^{ac}	shift parameter for domestic commodity aggregation function	γ_{ch}^m	subsistence consumption of marketed commodity c for household h
α_c^q	Armington function shift parameter	γ_{ach}^h	subsistence consumption of home commodity c from activity a for household h
α_c^t	CET function shift parameter	θ_{ac}	yield of output c per unit of activity a
β_{ach}^h	marginal share of consumption spending on home commodity c from activity a for household h	ρ_a^a	CES production function exponent
β_{ch}^m	marginal share of consumption spending on marketed commodity c for household h	ρ_a^{va}	CES value-added function exponent
δ_a^a	CES activity function share parameter	$\rho_{fdis,a}^{va2}$	CES lower level value-added function exponent
δ_{ac}^{ac}	share parameter for domestic commodity aggregation function	ρ_c^{ac}	domestic commodity aggregation function exponent
δ_c^q	Armington function share parameter	ρ_c^q	Armington function exponent
		ρ_c^t	CET function exponent

EXOGENOUS VARIABLES			
\overline{CPI}	consumer price index	\overline{MPSADJ}	savings rate scaling factor (= 0 for base)
\overline{DTINS}	change in domestic institution tax share (= 0 for base; exogenous variable)	\overline{QFS}_f	quantity supplied of factor
\overline{FSAV}	foreign savings (FCU)	$\overline{TINSADJ}$	direct tax scaling factor (= 0 for base; exogenous variable)
\overline{GADJ}	government consumption adjustment factor	\overline{WFDIST}_{fa}	wage distortion factor for factor f in activity a
\overline{IADJ}	investment adjustment factor		

EH_h	consumption spending for household	QHA_{ach}	quantity of household home consumption of commodity c from activity a for household h
EXR	exchange rate (LCU per unit of FCU)	$QINTA_a$	quantity of aggregate intermediate input
$GOVSHR$	government consumption share in nominal absorption	$QINT_{ca}$	quantity of commodity c as intermediate input to activity a
$GSAV$	government savings	$QINV_c$	quantity of investment demand for commodity
$INVSHR$	investment share in nominal absorption	QM_c	quantity of imports of commodity
MPS_i	marginal propensity to save for domestic non-government institution (exogenous variable)	QQ_c	quantity of goods supplied to domestic market (composite supply)
PA_a	activity price (unit gross revenue)	QT_c	quantity of commodity demanded as trade input
PDD_c	demand price for commodity produced and sold domestically	QVA_a	quantity of (aggregate) value added
PDS_c	supply price for commodity produced and sold domestically	QX_c	aggregated quantity of domestic output of commodity
PE_c	export price (domestic currency)	$QXAC_{ac}$	quantity of output of commodity c from activity a
$PINTA_a$	aggregate intermediate input price for activity a	$TABS$	total nominal absorption
PM_c	import price (domestic currency)	$TINS_i$	direct tax rate for institution i ($i \in INSDNG$)
PQ_c	composite commodity price	$TRII_{ii'}$	transfers from institution i' to i (both in the set INSDNG)
PVA_a	value-added price (factor income per unit of activity)	WF_f	average price of factor
PX_c	aggregate producer price for commodity	YF_f	income of factor f
$PXAC_{ac}$	producer price of commodity c for activity a	YG	government revenue
QA_a	quantity (level) of activity	YI_i	income of domestic non-government institution
QD_c	quantity sold domestically of domestic output	YIF_{if}	income to domestic institution i from factor f
QE_c	quantity of exports		

EQUATIONS			
#	Equation	Domain	Description
PRICE BLOCK			
1	$PM_c = pwm_c \cdot (1 + tm_c) \cdot EXR + \sum_{c' \in CT} PQ_{c'} \cdot icm_{c'c}$ $\begin{bmatrix} \text{import price} \\ \text{(LCU)} \end{bmatrix} = \begin{bmatrix} \text{import price} \\ \text{(FCU)} \end{bmatrix} \cdot \begin{bmatrix} \text{tariff} \\ \text{adjust -} \\ \text{ment} \end{bmatrix} \cdot \begin{bmatrix} \text{exchange rate} \\ \text{(LCU per} \\ \text{FCU)} \end{bmatrix} + \begin{bmatrix} \text{cost of trade} \\ \text{inputs per} \\ \text{import unit} \end{bmatrix}$	$c \in CM$	Import price
2	$PE_c = pwe_c \cdot (1 - te_c) \cdot EXR - \sum_{c' \in CT} PQ_{c'} \cdot ice_{c'c}$ $\begin{bmatrix} \text{export price} \\ \text{(LCU)} \end{bmatrix} = \begin{bmatrix} \text{export price} \\ \text{(FCU)} \end{bmatrix} \cdot \begin{bmatrix} \text{tariff} \\ \text{adjust -} \\ \text{ment} \end{bmatrix} \cdot \begin{bmatrix} \text{exchange rate} \\ \text{(LCU per} \\ \text{FCU)} \end{bmatrix} - \begin{bmatrix} \text{cost of trade} \\ \text{inputs per} \\ \text{export unit} \end{bmatrix}$	$c \in CE$	Export price
3	$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c}$ $\begin{bmatrix} \text{domestic} \\ \text{demand} \\ \text{price} \end{bmatrix} = \begin{bmatrix} \text{domestic} \\ \text{supply} \\ \text{price} \end{bmatrix} + \begin{bmatrix} \text{cost of trade} \\ \text{inputs per} \\ \text{unit of} \\ \text{domestic sales} \end{bmatrix}$	$c \in CD$	Demand price of domestic non-traded goods
4	$PQ_c \cdot (1 - tq_c) \cdot QQ_c = PDD_c \cdot QD_c + PM_c \cdot QM_c$ $\begin{bmatrix} \text{absorption} \\ \text{(at demand} \\ \text{prices net of} \\ \text{sales tax)} \end{bmatrix} = \begin{bmatrix} \text{domestic demand price} \\ \text{times} \\ \text{domestic sales quantity} \end{bmatrix} + \begin{bmatrix} \text{import price} \\ \text{times} \\ \text{import quantity} \end{bmatrix}$	$c \in (CD \cup CM)$	Absorption
5	$PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_c \cdot QE_c$ $\begin{bmatrix} \text{producer price} \\ \text{times marketed} \\ \text{output quantity} \end{bmatrix} = \begin{bmatrix} \text{domestic supply price} \\ \text{times} \\ \text{domestic sales quantity} \end{bmatrix} + \begin{bmatrix} \text{export price} \\ \text{times} \\ \text{export quantity} \end{bmatrix}$	$c \in CX$	Marketed output value
6	$PA_a = \sum_{c \in C} PXAC_{ac} \cdot \theta_{ac}$ $\begin{bmatrix} \text{activity} \\ \text{price} \end{bmatrix} = \begin{bmatrix} \text{producer prices} \\ \text{times yields} \end{bmatrix}$	$a \in A$	Activity price
7	$PINTA_a = \sum_{c \in C} PQ_c \cdot ica_{ca}$ $\begin{bmatrix} \text{aggregate} \\ \text{intermediate} \\ \text{input price} \end{bmatrix} = \begin{bmatrix} \text{intermediate input cost} \\ \text{per unit of aggregate} \\ \text{intermediate input} \end{bmatrix}$	$a \in A$	Aggregate intermediate input price

8	$PA_a \cdot (1 - ta_a) \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a$ $\left[\begin{array}{l} \text{activity price} \\ \text{(net of taxes)} \\ \text{times activity level} \end{array} \right] = \left[\begin{array}{l} \text{value-added} \\ \text{price times} \\ \text{quantity} \end{array} \right] + \left[\begin{array}{l} \text{aggregate} \\ \text{intermediate} \\ \text{input price times} \\ \text{quantity} \end{array} \right]$	$a \in A$	Activity revenue and costs
9	$\overline{CPI} = \sum_{c \in C} PQ_c \cdot cwts_c$ $\left[\begin{array}{l} \text{CPI} \end{array} \right] = \left[\begin{array}{l} \text{prices times} \\ \text{weights} \end{array} \right]$		Consumer price index
10	$DPI = \sum_{c \in C} PDS_c \cdot dwts_c$ $\left[\begin{array}{l} \text{Producer price index} \\ \text{for non-traded outputs} \end{array} \right] = \left[\begin{array}{l} \text{prices times} \\ \text{weights} \end{array} \right]$		Producer price index for non-traded market output
PRODUCTION AND COMMODITY BLOCK			
11	$QA_a = \alpha_a^a \cdot \left(\delta_a^a \cdot QVA_a^{-\rho_a^a} + (1 - \delta_a^a) \cdot QINTA_a^{-\rho_a^a} \right)^{\frac{1}{\rho_a^a}}$ $\left[\begin{array}{l} \text{activity} \\ \text{level} \end{array} \right] = CES \left[\begin{array}{l} \text{quantity of aggregate value-added,} \\ \text{quantity aggregate intermediate input} \end{array} \right]$	$a \in ACE$	CES technology: activity production function
12	$\frac{QVA_a}{QINTA_a} = \left(\frac{PINTA_a}{PVA_a} \cdot \frac{\delta_a^a}{1 - \delta_a^a} \right)^{\frac{1}{1 + \rho_a^a}}$ $\left[\begin{array}{l} \text{value-added -} \\ \text{intermediate-} \\ \text{input quantity} \\ \text{ratio} \end{array} \right] = f \left[\begin{array}{l} \text{intermediate-input} \\ \text{- value-added} \\ \text{price ratio} \end{array} \right]$	$a \in ACE$	CES technology: value added–intermediate–input ratio
13	$QVA_a = iva_a \cdot QA_a$ $\left[\begin{array}{l} \text{demand for} \\ \text{value-added} \end{array} \right] = f \left[\begin{array}{l} \text{activity} \\ \text{level} \end{array} \right]$	$a \in ALE$	Leontief technology: demand for aggregate value added
14	$QINTA_a = inta_a \cdot QA_a$ $\left[\begin{array}{l} \text{demand for aggregate} \\ \text{intermediate input} \end{array} \right] = f \left[\begin{array}{l} \text{activity} \\ \text{level} \end{array} \right]$	$a \in ALE$	Leontief technology: demand for aggregate intermediate input
15	$QVA_a = \alpha_a^{va} \cdot \left(\sum_{fagg \in F} \delta_{fagg a}^{va} \cdot QF_{fagg a}^{-\rho_a^{va}} \right)^{\frac{1}{\rho_a^{va}}}$ $\left[\begin{array}{l} \text{quantity of aggregate} \\ \text{value-added} \end{array} \right] = CES \left[\begin{array}{l} \text{aggregated factor} \\ \text{inputs} \end{array} \right]$	$a \in A$	Value added and aggregated factor demands

16	$W_{fagg} \cdot \overline{WFDIST}_{fagg,a} = PVA_a \cdot (1 - tva_a) \cdot QVA_a \cdot \left(\sum_{fagg \in F} \delta_{fagg,a}^{va} \cdot QF_{fagg,a}^{-\rho_a^{va}} \right)^{-1} \cdot \delta_{fagg,a}^{va} \cdot QF_{fagg,a}$ $\left[\begin{array}{c} \text{marginal cost of} \\ \text{aggregated factor fagg in activity a} \end{array} \right] = \left[\begin{array}{c} \text{marginal revenue product} \\ \text{of aggregated factor fagg in activity a} \end{array} \right]$	$a \in A$ $f \in F$	Aggregated factor demand
17	$QF_{fagg,a} = \alpha_{fagg,a}^{va2} \cdot \left(\sum_{fdis \in F} \delta_{fdis,a}^{va2} \cdot QF_{fdis,a}^{-\rho_{fagg,a}^{va2}} \right)^{\frac{1}{\rho_{fagg,a}^{va2}}}$ $\left[\begin{array}{c} \text{quantity of aggregate} \\ \text{factor} \end{array} \right] = CES \left[\begin{array}{c} \text{disaggregated factor} \\ \text{inputs} \end{array} \right]$	$a \in A$	Lower level factor aggregation
18	$W_{fdis} \cdot \overline{WFDIST}_{fdis,a} = W_{fagg} \cdot \overline{WFDIST}_{fagg,a} \cdot QF_{fagg,a} \cdot \left(\sum_{f \in F} \delta_{fdis,a}^{va2} \cdot QF_{fdis,a}^{-\rho_{fdis,a}^{va2}} \right)^{-1} \cdot \delta_{fagg,a}^{va2} \cdot QF_{fdis,a}^{-\rho_{fdis,a}^{va2}-1}$ $\left[\begin{array}{c} \text{marginal cost of} \\ \text{disaggregated factor fdis in activity a} \end{array} \right] = \left[\begin{array}{c} \text{marginal revenue product} \\ \text{of factor f in activity a} \end{array} \right]$	$a \in A$ $f \in F$	Disaggregated factor demand
19	$QINT_{c,a} = ica_{c,a} \cdot QINTA_a$ $\left[\begin{array}{c} \text{intermediate demand} \\ \text{for commodity c} \\ \text{from activity a} \end{array} \right] = f \left[\begin{array}{c} \text{aggregate intermediate} \\ \text{input quantity} \\ \text{for activity a} \end{array} \right]$	$a \in A$ $c \in C$	Disaggregated intermediate input demand
20	$QXAC_{a,c} + \sum_{h \in H} QHA_{ach} = \theta_{a,c} \cdot QA_a$ $\left[\begin{array}{c} \text{marketed quantity} \\ \text{of commodity c} \\ \text{from activity a} \end{array} \right] + \left[\begin{array}{c} \text{household home} \\ \text{consumption} \\ \text{of commodity c} \\ \text{from activity a} \end{array} \right] = \left[\begin{array}{c} \text{production} \\ \text{of commodity c} \\ \text{from activity a} \end{array} \right]$	$a \in A$ $c \in CX$	Commodity production and allocation
21	$QX_c = \alpha_c^{ac} \cdot \left(\sum_{a \in A} \delta_{a,c}^{ac} \cdot QXAC_{a,c}^{-\rho_c^{ac}} \right)^{\frac{1}{\rho_c^{ac}-1}}$ $\left[\begin{array}{c} \text{aggregate} \\ \text{marketed} \\ \text{production of} \\ \text{commodity c} \end{array} \right] = CES \left[\begin{array}{c} \text{activity-specific} \\ \text{marketed} \\ \text{production of} \\ \text{commodity c} \end{array} \right]$	$c \in CX$	Output aggregation function
22	$PXAC_{a,c} = PX_c \cdot QX_c \left(\sum_{a \in A'} \delta_{a,c}^{ac} \cdot QXAC_{a,c}^{-\rho_c^{ac}} \right)^{-1} \cdot \delta_{a,c}^{ac} \cdot QXAC_{a,c}^{-\rho_c^{ac}-1}$ $\left[\begin{array}{c} \text{marginal cost of com-} \\ \text{modity c from activity a} \end{array} \right] = \left[\begin{array}{c} \text{marginal revenue product of} \\ \text{commodity c from activity a} \end{array} \right]$	$a \in A$ $c \in CX$	First-order condition for output aggregation function
23	$QX_c = \alpha_c^t \cdot \left(\delta_c^t \cdot QE_c^{\rho_c^t} + (1 - \delta_c^t) \cdot QD_c^{\rho_c^t} \right)^{\frac{1}{\rho_c^t}}$ $\left[\begin{array}{c} \text{aggregate marketed} \\ \text{domestic output} \end{array} \right] = CET \left[\begin{array}{c} \text{export quantity, domestic} \\ \text{sales of domestic output} \end{array} \right]$	$c \in (CE \cap C)$	Output transformation (CET) function

24	$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1 - \delta_c^t}{\delta_c^t} \right)^{\frac{1}{\rho_c^t - 1}}$ $\left[\begin{array}{c} \text{export-domestic} \\ \text{supply ratio} \end{array} \right] = f \left[\begin{array}{c} \text{export-domestic} \\ \text{price ratio} \end{array} \right]$	$c \in (CE \cap C)$	Export-domestic supply ratio
25	$QX_c = QD_c + QE_c$ $\left[\begin{array}{c} \text{aggregate} \\ \text{marketed} \\ \text{domestic output} \end{array} \right] = \left[\begin{array}{c} \text{domestic market} \\ \text{sales of domestic} \\ \text{output [for} \\ c \in (CD \cap CEN)] \end{array} \right] + \left[\begin{array}{c} \text{exports [for} \\ c \in (CE \cap CDN)] \end{array} \right]$	$c \in$ $(CD \cap CEN)$ \cup $(CE \cap CDN)$	Output transformation for non-exported commodities
26	$QQ_c = \alpha_c^q \cdot \left(\delta_c^q \cdot QM_c^{-\rho_c^q} + (1 - \delta_c^q) \cdot QD_c^{-\rho_c^q} \right)^{-\frac{1}{\rho_c^q}}$ $\left[\begin{array}{c} \text{composite} \\ \text{supply} \end{array} \right] = f \left[\begin{array}{c} \text{import quantity, domestic} \\ \text{use of domestic output} \end{array} \right]$	$c \in (CM \cap C)$	Composite supply (Armington) function
27	$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \cdot \frac{\delta_c^q}{1 - \delta_c^q} \right)^{\frac{1}{1 + \rho_c^q}}$ $\left[\begin{array}{c} \text{import-domestic} \\ \text{demand ratio} \end{array} \right] = f \left[\begin{array}{c} \text{domestic-import} \\ \text{price ratio} \end{array} \right]$	$c \in (CM \cap C)$	Import-domestic demand ratio
28	$QQ_c = QD_c + QM_c$ $\left[\begin{array}{c} \text{composite} \\ \text{supply} \end{array} \right] = \left[\begin{array}{c} \text{domestic use of} \\ \text{marketed domestic} \\ \text{output [for} \\ c \in (CD \cap CMN)] \end{array} \right] + \left[\begin{array}{c} \text{imports [for} \\ c \in (CM \cap CDN)] \end{array} \right]$	$c \in$ $(CD \cap CMN)$ \cup $(CM \cap CDN)$	Composite supply for non-imported outputs and non-produced imports
29	$QT_c = \sum_{c' \in C'} (icm_{c,c'} \cdot QM_{c'} + ice_{c,c'} \cdot QE_{c'} + icd_{c,c'} \cdot QD_{c'})$ $\left[\begin{array}{c} \text{demand for} \\ \text{transactions} \\ \text{services} \end{array} \right] = \left[\begin{array}{c} \text{sum of demands} \\ \text{for imports, exports,} \\ \text{and domestic sales} \end{array} \right]$	$c \in CT$	Demand for transactions services
INSTITUTION BLOCK			
30	$YF_f = \sum_{a \in A} WF_f \cdot \overline{WFDIST}_{fa} \cdot QF_{fa}$ $\left[\begin{array}{c} \text{income of} \\ \text{factor } f \end{array} \right] = \left[\begin{array}{c} \text{sum of activity payments} \\ \text{(activity-specific wages} \\ \text{times employment levels)} \end{array} \right]$	$f \in F$	Factor income
31	$YIF_{if} = shif_{if} \cdot \left[(1 - tf_f) \cdot YF_f - trnsfr_{row f} \cdot EXR \right]$ $\left[\begin{array}{c} \text{income of} \\ \text{institution } i \\ \text{from factor } f \end{array} \right] = \left[\begin{array}{c} \text{share of income} \\ \text{of factor } f \text{ to} \\ \text{institution } i \end{array} \right] \cdot \left[\begin{array}{c} \text{income of factor } f \\ \text{(net of tax and} \\ \text{transfer to RoW)} \end{array} \right]$	$i \in INSD$ $f \in F$	Institutional factor incomes

32	$YI_i = \sum_{f \in F} YIF_{if} + \sum_{i' \in INSDNG'} TRII_{ii'} + trnsfr_{i \text{ gov}} \cdot \overline{CPI} + trnsfr_{i \text{ row}} \cdot EXR$ $\left[\begin{array}{l} \text{income of} \\ \text{institution } i \end{array} \right] = \left[\begin{array}{l} \text{factor} \\ \text{income} \end{array} \right] + \left[\begin{array}{l} \text{transfers} \\ \text{from other domestic} \\ \text{non-government} \\ \text{institutions} \end{array} \right] + \left[\begin{array}{l} \text{transfers} \\ \text{from} \\ \text{government} \end{array} \right] + \left[\begin{array}{l} \text{transfers} \\ \text{from} \\ \text{RoW} \end{array} \right]$	$i \in INSDNG$	Income of domestic, non-government institutions
33	$TRII_{ii'} = shii_{ii'} \cdot (1 - MPS_{i'}) \cdot (1 - TINS_{i'}) \cdot YI_{i'}$ $\left[\begin{array}{l} \text{transfer from} \\ \text{institution } i' \text{ to } i \end{array} \right] = \left[\begin{array}{l} \text{share of net income} \\ \text{of institution } i' \\ \text{transferred to } i \end{array} \right] \cdot \left[\begin{array}{l} \text{income of institution} \\ i', \text{ net of savings and} \\ \text{direct taxes} \end{array} \right]$	$i \in INSDNG$ $i' \in INSDNG$	Intra-institutional transfers
34	$EH_h = \left(1 - \sum_{i \in INSDNG} shii_{ih} \right) \cdot (1 - MPS_h) \cdot (1 - TINS_h) \cdot YI_h$ $\left[\begin{array}{l} \text{household income} \\ \text{disposable for} \\ \text{consumption} \end{array} \right] = \left[\begin{array}{l} \text{household income, net of direct} \\ \text{taxes, savings, and transfers to} \\ \text{other non-government institutions} \end{array} \right]$	$h \in H$	Household consumption expenditure
35	$QH_{ch} = \gamma_{ch} + \frac{\beta_{ch}^m \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma_{c'h}^m - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma_{ac'h}^h \right)}{PQ_c}$ $\left[\begin{array}{l} \text{quantity of} \\ \text{household demand} \\ \text{for commodity } c \end{array} \right] = f \left[\begin{array}{l} \text{household} \\ \text{consumption} \\ \text{spending,} \\ \text{market price} \end{array} \right]$	$c \in C$ $h \in H$	Household consumption demand for marketed commodities
36	$QHA_{ach} = \gamma_{ach}^h + \frac{\beta_{ach}^h \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma_{c'h}^m - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma_{ac'h}^h \right)}{PXAC_{ac}}$ $\left[\begin{array}{l} \text{quantity of} \\ \text{household demand} \\ \text{for home commodity } c \\ \text{from activity } a \end{array} \right] = f \left[\begin{array}{l} \text{household} \\ \text{disposable} \\ \text{income,} \\ \text{producer price} \end{array} \right]$	$a \in A$ $c \in C$ $h \in H$	Household consumption demand for home commodities
37	$QINV_c = \overline{IADJ} \cdot \overline{qinv}_c$ $\left[\begin{array}{l} \text{fixed investment} \\ \text{demand for} \\ \text{commodity } c \end{array} \right] = \left[\begin{array}{l} \text{adjustment factor} \\ \text{times} \\ \text{base-year fixed} \\ \text{investment} \end{array} \right]$	$c \in CIN$	Investment demand
38	$QG_c = \overline{GADJ} \cdot \overline{qg}_c$ $\left[\begin{array}{l} \text{government} \\ \text{consumption} \\ \text{demand for} \\ \text{commodity } c \end{array} \right] = \left[\begin{array}{l} \text{adjustment factor} \\ \text{times} \\ \text{base-year government} \\ \text{consumption} \end{array} \right]$	$c \in C$	Government consumption demand

39	$YG = \sum_{i \in INSDNG} TINS_i \cdot YI_i + \sum_{f \in F} tf_f \cdot YF_f + \sum_{a \in A} rva_a \cdot PVA_a \cdot QVA_a$ $+ \sum_{a \in A} ta_a \cdot PA_a \cdot QA_a + \sum_{c \in CM} tm_c \cdot pwm_c \cdot QM_c \cdot EXR + \sum_{c \in CE} te_c \cdot pwe_c \cdot QE_c \cdot EXR$ $+ \sum_{c \in C} tq_c \cdot PQ_c \cdot QQ_c + \sum_{f \in F} YF_{gov_f} + trnsfr_{gov_{row}} \cdot EXR$ $\left[\begin{array}{l} \text{government} \\ \text{revenue} \end{array} \right] = \left[\begin{array}{l} \text{direct taxes} \\ \text{from} \\ \text{institutions} \end{array} \right] + \left[\begin{array}{l} \text{direct taxes} \\ \text{from} \\ \text{factors} \end{array} \right] + \left[\begin{array}{l} \text{value-} \\ \text{added} \\ \text{tax} \end{array} \right] + \left[\begin{array}{l} \text{activity} \\ \text{tax} \end{array} \right]$ $+ \left[\begin{array}{l} \text{import} \\ \text{tariffs} \end{array} \right] + \left[\begin{array}{l} \text{export} \\ \text{taxes} \end{array} \right] + \left[\begin{array}{l} \text{sales} \\ \text{tax} \end{array} \right] + \left[\begin{array}{l} \text{factor} \\ \text{income} \end{array} \right] + \left[\begin{array}{l} \text{transfers} \\ \text{from} \\ \text{RoW} \end{array} \right]$		Government revenue
40	$EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{i \in INSDNG} trnsfr_{i_{gov}} \cdot \overline{CPI}$ $\left[\begin{array}{l} \text{government} \\ \text{spending} \end{array} \right] = \left[\begin{array}{l} \text{government} \\ \text{consumption} \end{array} \right] + \left[\begin{array}{l} \text{transfers to domestic} \\ \text{non-government} \\ \text{institutions} \end{array} \right]$		Government expenditures
SYSTEM CONSTRAINT BLOCK			
41	$\sum_{a \in A} QF_{fa} = \overline{QFS}_f$ $\left[\begin{array}{l} \text{demand for} \\ \text{factor } f \end{array} \right] = \left[\begin{array}{l} \text{supply of} \\ \text{factor } f \end{array} \right]$	$f \in F$	Factor market
42	$QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c$ $+ QINV_c + qdst_c + QT_c$ $\left[\begin{array}{l} \text{composite} \\ \text{supply} \end{array} \right] = \left[\begin{array}{l} \text{intermediate} \\ \text{use} \end{array} \right] + \left[\begin{array}{l} \text{household} \\ \text{consumption} \end{array} \right] + \left[\begin{array}{l} \text{government} \\ \text{consumption} \end{array} \right]$ $+ \left[\begin{array}{l} \text{fixed} \\ \text{investment} \end{array} \right] + \left[\begin{array}{l} \text{stock} \\ \text{change} \end{array} \right] + \left[\begin{array}{l} \text{trade} \\ \text{input use} \end{array} \right]$	$c \in C$	Composite commodity markets
43	$\sum_{c \in CM} pwm_c \cdot QM_c + \sum_{f \in F} trnsfr_{row_f} = \sum_{c \in CE} pwe_c \cdot QE_c + \sum_{i \in INSD} trnsfr_{i_{row}} + \overline{FSAV}$ $\left[\begin{array}{l} \text{import} \\ \text{spending} \end{array} \right] + \left[\begin{array}{l} \text{factor} \\ \text{transfers} \\ \text{to RoW} \end{array} \right] = \left[\begin{array}{l} \text{export} \\ \text{revenue} \end{array} \right] + \left[\begin{array}{l} \text{institutional} \\ \text{transfers} \\ \text{from RoW} \end{array} \right] + \left[\begin{array}{l} \text{foreign} \\ \text{savings} \end{array} \right]$		Current account balance for RoW (in foreign currency)
44	$YG = EG + GSAV$ $\left[\begin{array}{l} \text{government} \\ \text{revenue} \end{array} \right] = \left[\begin{array}{l} \text{government} \\ \text{expenditures} \end{array} \right] + \left[\begin{array}{l} \text{government} \\ \text{savings} \end{array} \right]$		Government balance
45	$TINS_i = \overline{tins}_i \cdot \left(1 + \overline{TINSADJ} \cdot \overline{tins01}_i \right) + \overline{DTINS} \cdot \overline{tins01}_i$ $\left[\begin{array}{l} \text{direct tax} \\ \text{rate for} \\ \text{institution } i \end{array} \right] = \left[\begin{array}{l} \text{base rate adjusted} \\ \text{for scaling for} \\ \text{selected institutions} \end{array} \right] + \left[\begin{array}{l} \text{point change} \\ \text{for selected} \\ \text{institutions} \end{array} \right]$	$i \in INSDNG$	Direct institutional tax rates

46	$MPS_i = \overline{mps}_i \cdot \left(1 + \overline{MPSADJ} \cdot mps01_i\right) + DMPS \cdot mps01_i$ $\left[\begin{array}{c} \text{savings} \\ \text{rate for} \\ \text{institution } i \end{array} \right] = \left[\begin{array}{c} \text{base rate adjusted} \\ \text{for scaling for} \\ \text{selected institutions} \end{array} \right] + \left[\begin{array}{c} \text{point change} \\ \text{for selected} \\ \text{institutions} \end{array} \right]$	$i \in INSDNG$	Institutional savings rates
46	$\sum_{i \in INSDNG} MPS_i \cdot (1 - TINS_i) \cdot YI_i + GSAV + EXR \cdot FSAV =$ $\sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$ $\left[\begin{array}{c} \text{non-govern-} \\ \text{ment savings} \end{array} \right] + \left[\begin{array}{c} \text{government} \\ \text{savings} \end{array} \right] + \left[\begin{array}{c} \text{foreign} \\ \text{savings} \end{array} \right] = \left[\begin{array}{c} \text{fixed} \\ \text{investment} \end{array} \right] + \left[\begin{array}{c} \text{stock} \\ \text{change} \end{array} \right]$		Savings–investment balance
47	$TABS = \sum_{h \in H} \sum_{c \in C} PQ_c \cdot QH_{ch} + \sum_{a \in A} \sum_{c \in C} \sum_{h \in H} PXAC_{ac} \cdot QHA_{ach}$ $+ \sum_{c \in C} PQ_c \cdot QG_c + \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$ $\left[\begin{array}{c} \text{total} \\ \text{absorption} \end{array} \right] = \left[\begin{array}{c} \text{household} \\ \text{market} \\ \text{consumption} \end{array} \right] + \left[\begin{array}{c} \text{household} \\ \text{home} \\ \text{consumption} \end{array} \right]$ $+ \left[\begin{array}{c} \text{government} \\ \text{consumption} \end{array} \right] + \left[\begin{array}{c} \text{fixed} \\ \text{investment} \end{array} \right] + \left[\begin{array}{c} \text{stock} \\ \text{change} \end{array} \right]$		Total absorption
48	$INVSHR \cdot TABS = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$ $\left[\begin{array}{c} \text{investment-} \\ \text{absorption} \\ \text{ratio} \end{array} \right] \cdot \left[\begin{array}{c} \text{total} \\ \text{absorption} \end{array} \right] = \left[\begin{array}{c} \text{fixed} \\ \text{investment} \end{array} \right] + \left[\begin{array}{c} \text{stock} \\ \text{change} \end{array} \right]$		Ratio of investment to absorption
49	$GOVSHR \cdot TABS = \sum_{c \in C} PQ_c \cdot QG_c$ $\left[\begin{array}{c} \text{government} \\ \text{consumption-} \\ \text{absorption} \\ \text{ratio} \end{array} \right] \cdot \left[\begin{array}{c} \text{total} \\ \text{absorption} \end{array} \right] = \left[\begin{array}{c} \text{government} \\ \text{consumption} \end{array} \right]$		Ratio of government consumption to absorption

NOTES

1. Bhattacharya and Rahman, "Prospects for Internalising Global Opportunities"; Kabeer and Mahmud, "Rags Riches and Women Workers"; Khondker, *Potential Human Development Implications of MFA Phase-Out*; Mlachila and Yang, *The End of Textile Quotas*; and World Bank "End of MFA Quotas: Key Issues and Strategic Options for Bangladesh Readymade Garment Industry".
2. Arndt et al, "Opportunities and Challenges in Agriculture and Garments"; Fontana, "Gender Impact of Trade Liberalisation"; and Fontana and Wobst, "Gendered 1993–94 Social Accounting Matrix for Bangladesh".
3. Arndt et al, "Opportunities and Challenges in Agriculture and Garments"; Fontana, "Gender Impact of Trade Liberalisation"; and Fontana and Wobst, "Gendered 1993–94 Social Accounting Matrix for Bangladesh".
4. Annabi, N., B. Khondker, S. Raihan, J. Cockburn, and B. Decaluwe "Implications of WTO Agreements and Unilateral Trade Policy Reforms for Poverty in Bangladesh: Short vs. Long Run Impacts" Plans to develop a dynamic gender-augmented computable general equilibrium model based on such SAMs are under way.
5. A typical problem in SAM estimation is one of updating an input–output matrix when one has new information on the row and column sums but does not have new information on the input–output flows. One method commonly used for such estimation is called RAS (see Bacharach, *Biproportional Matrices and Input–Output Change*). This approach consists in calculating a new A matrix from the old A matrix by means of "biproportional" row and column operations to generate the new row and column sums. The entropy method allows more precision and flexibility in the estimation of the new A matrix. For further details see Robinson, Cattaneo, and El-Said, "Updating and Estimating a Social Accounting Matrix."
6. The definition of unpaid labor follows the 2000 LFS definition, which conforms to the revised 1993 SNA, and includes unremunerated family labor in activities such as: crop production; livestock, poultry, milk, and vegetable production; collection, processing, and preservation of food; collection of firewood; and construction and repairing. Including unpaid workers in the SAM has implications for how wages are calculated. The approach followed here was to keep the total wage bill in each sector constant, and lower all wages in each sector in proportion to the ratio of total unpaid workers to total paid workers over total paid workers in that sector. This procedure assumes that the recorded earnings of paid workers are shared with (or redistributed to) unpaid workers in a particular way (and that unpaid workers are not remunerated out of non-labor value added).
7. The original SAM had twelve types of households, but they are aggregated here to make the analysis more tractable.
8. The issue of the usefulness of male/female comparisons that rely on headship is quite controversial. A recent study, however, shows that (rural) Bangladesh is one of the few countries in which differences in poverty between male-headed and female-headed households are indeed significant, and females are consistently worse off (see Quisumbing, Haddad, and Pena, "Are Women Overrepresented Among the Poor?"). There is no indication from other sources that urban female-headed households in Bangladesh are a disadvantaged group, which is why only the rural female-headed households, with no or little land, were singled out as a household type in the SAM.
9. It is not clear from the data whether the activities accounted for in the shrimp sector are just cultivation or include some processing. In any case, it is likely that female employment measured in hours would be lower than female employment measured in persons, since such a high proportion of women working in this sector are temporary labor.
10. United Nations, "System of National Accounts 1993."
11. Zaman, "Patterns of Activity and Use of Time."
12. Hamid, *Why Women Count* and [Khondhaker Hamid's estimates of household work in the rural areas of Bangladesh suggest the following: men spend much less time than women on social reproduction, across all household types; there is variation across socio-economic groups (i.e., household types) in the amount of time spent on social reproduction among women, but not among men; women in relatively well-off households spend less time on social reproduction than women in other households. Khondhaker's survey is more recent than Hamid's, it is nationally representative, and covers a wider range of characteristics, but the full data have not been released to the public yet. http://www.idrc.ca/en/ev-73363-201-1-DO_TOPIC.html
13. See Goldschmidt-Clermont, *Economic Evaluations of Unpaid Household Work*. The estimated outputs of reproduction and leisure appear in the SAM both in the production accounts and in final demand (as part of household consumption).
14. Bangladesh Labour Force Survey 2000 and Salma Zohir, "Gender Implications of Industrial Reforms."
15. These are documented in Fontana, "Gender Impact of Trade Liberalisation in Developing Countries."
16. Data from other sources (for example WISTAT data, United Nations, 1995) seem to indicate similar patterns in gender wage inequalities.
17. See for example Bhattacharya and Rahman, "Prospects for Internalising Global Opportunities" and Arndt et al, "Opportunities and Challenges in Agriculture and Garments."
18. Tariffs in the SAM were estimated from several sources. Total government revenue was calculated from *Bangladesh Arthonoithic Samishaka, 2001*. This was then disaggregated into tax categories based on shares from

IMF Table 14 IMF Staff Country report 98/131. Finally, total tariff revenue was allocated to commodities applying the same average tariff rates as in 1993–94 BIDS I/O.

19. Bhattacharya, “Post-MFA Challenges to the Bangladesh Textile and Clothing Sector”.

20. Zohir, “Gender Implications of Industrial Reforms” and Bhattacharya and Rahman, “Prospects for Internalising Global Opportunities.”

21. Afsar, “Sociological Implications of Female Labour Migration in Bangladesh.”

22. Kabeer and Mahmud, “Rags, Riches and Women Workers.”

23. See note 19 above.

24. This evidence is reviewed in Joeques, “Gender-Analytical Perspective on Trade”; Kusago and Tzannatos, “Export Processing Zones”; and Fontana, “Gender Impact of Trade Liberalisation.”

25. See note 19 above.

26. The increase in jute production might be only slight if the price elasticity of its supply is lower in reality than assumed in the model (the elasticity of substitution for this sector was chosen such as to target a 0.5 price supply response). “Medium-term prospects for agricultural commodities: Projection to the Year 2010” Food and Agriculture Organization of the United Nations: Rome; 2003.

Recent work from FAO, for example, suggests that jute production might decline.

27. This decline is substantial. There might be the need to recalibrate the employment elasticities based on more recent data for the sector.

28. It would be very important to update the structure of the shrimp sector using the detailed information contained in the recent shrimp value chain study.

29. Lofgren et al (2001).

30. The IFPRI standard model is formulated as a mixed-complementarity problem—that is, as a set of simultaneous equations that can include inequalities as well as equalities.

31. Estimates of the elasticity of substitution between different labor types are not available, and the choice of nearly unity is simply an assumption.

32. Fontana and Wobst, “Gendered 1993–94 Social Accounting Matrix for Bangladesh”.

33. Estimates of the Frisch parameter are based on Lluch et al, *Patterns in Household Demand and Savings*.

34. Ahmed and Shams (1994).

35. In reality, how much households alter the amount of time spent on social reproduction activities in response to changes in market wages varies with their composition and circumstances. It is plausible to think that some households, for example the poorest families, both in rural and urban areas, and the urban elite, would allow women’s involvement in market activities more easily than other households (although for different reasons—the former out of need and the latter out of choice). Hence they are also likely to have a higher propensity to use market substitutes for social reproduction (to save time on child care, for example).

BIBLIOGRAPHY

- Afsar, R. "Sociological Implications of Female Labour Migration in Bangladesh." In *Globalisation and Gender: Changing Patterns of Women's Employment in Bangladesh*, edited by R. Sobhan and N. Khundker. Dhaka: The University Press, 2001.
- Annabi, N., B. Khondker, S. Raihan, J. Cockburn, and B. Decaluwe "Implications of WTO Agreements and Unilateral Trade Policy Reforms for Poverty in Bangladesh: Short vs. Long Run Impacts" in *Putting Development Back into the Doha Agenda: Poverty Impacts of a WTO Agreement* edited by T. Hertel and L. Alan Winters, World Bank, Washington DC (forthcoming).
- Arndt, C., P. Dorosh, M. Fontana, and S. Zohir. "Opportunities and Challenges in Agriculture and Garments: A General Equilibrium Analysis of the Bangladesh Economy." *Trade and Macroeconomics Division Discussion Paper 107*, Washington, DC: International Food Policy Research Institute, 2002.
- Bacharach, M. *Biproportional Matrices and Input–Output Change*. Cambridge: Cambridge University Press, 1970.
- Bangladesh Labor Force Survey, 2000
- Bhattacharya, D. "The Post-MFA Challenges to the Bangladesh Textile and Clothing Sector." In *Trade, Sustainable Development and Gender*, 197–232. Geneva: United Nations Conference on Trade and Development, 1999.
- Bhattacharya, D., and M. Rahman. "Prospects for Internalising Global Opportunities in the Apparel Sector in Bangladesh." In *Globalisation and Gender: Changing Patterns of Women's Employment in Bangladesh*, edited by R. Sobhan and N. Khundker, 219–267. Dhaka: Centre for Policy Dialogue, University Press Limited, 2001.
- Food and Agriculture Organization of the United Nations. "Medium-term prospects for agricultural commodities: Projects to the Year 2010": Rome; 2003.
- Fontana, M. "The Gender Impact of Trade Liberalisation in Developing Countries." DPhil diss., University of Sussex, 2003.
- Fontana, M., and P. Wobst. "A Gendered 1993–94 Social Accounting Matrix for Bangladesh." *Trade and Macroeconomics Division Discussion Paper 74*, Washington, DC: International Food Policy Research Institute, 2001.

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- Goldschmidt-Clermont, L. *Economic Evaluations of Unpaid Household Work: Africa, Asia, Latin America and Oceania*. Geneva: International Labour Office, 1987.
- Hamid, S. *Why Women Count*. Dhaka: University Press Limited, 1996.
- Joekes, S. "A Gender-Analytical Perspective on Trade and Sustainable Development." In *Trade, Sustainable Development and Gender*. Geneva: United Nations Conference on Trade and Development, 1999.
- Kabeer, N., and S. Mahmud. "Rags, Riches and Women Workers: Export-Oriented Garment Manufacturing in Bangladesh." In *Chains of Fortune: Linking Women Producers and Workers with Global Markets*, edited by M. Carr. London: Commonwealth Secretariat, 2004.
- Khondker, B. H. "Potential Human Development Implications of MFA Phase-Out: The Case of Bangladesh, Estimates from an Integrated Modeling Approach." Preparatory Assistance Project on Sustainable Employment Policy Options in the Post-MFA Era. Dhaka: United Nations Development Program, May 2005.
- Khondker, B.H. "Capturing Intra-Household Distribution and Poverty Incidence: A Study of Bangladesh" working document, IDRC http://www.idrc.ca/en/ev-73363-201-1-DO_TOPIC.html
- Kusago, T., and T. Tzannatos. "Export Processing Zones: A Review in Need of Update." *HDDSP Discussion Paper 9802*, Washington, DC: The World Bank, 1998.
- Lluch, C. A., A. Powell, and R. A. Williams. *Patterns in Household Demand and Savings*. New York: Oxford University Press, 1977.
- Mlachila, Montfort, and Yongzheng Yang. "The End of Textile Quotas: A Case Study of the Impact on Bangladesh." IMF Working Paper 04/108. Washington, DC: International Monetary Fund, 2004.
- Quisumbing, A., L. Haddad, and C. Pena. "Are Women Overrepresented Among the Poor? An Analysis of Poverty in 10 Developing Countries." *Journal of Development Economics* 66, no. 1 (2001): 225–69.
- Robinson, Sherman, Andrea Cattaneo, and Moataz El-Said. "Updating and Estimating a Social Accounting Matrix Using Cross Entropy Methods." *Economic Systems Research*, 13, no 1 (2001): 47–64.
- United Nations. "System of National Accounts 1993." *Studies in Methods, Series F 2/Rev 4*, New York: UN Statistical Division, 1993.
- World Bank. *Bangladesh Growth and Export Competitiveness*. Washington, DC: The

World Bank, 2004.

World Bank, Bangladesh Development Series “End of MFA Quotas Key Issues and Strategic Options for Bangladesh Readymade Garment Industry”, Dhaka, Bangladesh: The World Bank, 2005.

Zaman, H. "Patterns of Activity and Use of Time in Rural Bangladesh: Class, Gender, and Seasonal Variations." *The Journal of Developing Areas* 29, no. 3 (1995).

Zohir, S. C."Gender Implications of Industrial Reforms and Adjustment in the Manufacturing Sector of Bangladesh." PhD. thesis, University of Manchester, 1998.