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MODELING THE EFFECTS OF TRADE ON WOMEN, AT WORK AND AT HOME: A COMPARATIVE PERSPECTIVE

Marzia Fontana

International Food Policy Research Institute

Trade and Macroeconomics Division
International Food Policy Research Institute
2033 K Street, N.W.
Washington, D.C. 20006, U.S.A.

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ABSTRACT

The effects of trade on women vary by socio-economic characteristics, sector and country. This paper assesses how well such effects can be captured by a gendered social accounting matrix (SAM) and computable general equilibrium (CGE) model. These are applied comparatively to Bangladesh and Zambia to highlight how differences in resource endowments, labor market characteristics and socio-cultural norms shape the way in which trade expansion affects gender inequalities. The paper also compares simulation results to other approaches in the gender-and-economics literature, discusses strengths and limitations of the CGE methodology, and provides suggestions for further research.

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I. INTRODUCTION

The effects of trade expansion on women in developing countries are mixed, differing by sector, geographical region, and socio-economic characteristics. A gender-aware approach to trade expansion would measure, first, the impact on women's current material status, given existing tasks and responsibilities under the gender division of labor – what in the literature has been termed 'practical gender needs' (Moser, 1989 and Molyneux, 1985). It should also aim to assess whether trade policies and outcomes contribute to more egalitarian gender relations, by reducing the basis of women's economic disadvantage and by modifying the gender division of labor in the labor market or in the household – what Molyneux and Moser would call 'strategic gender needs'. For example, a short-term increase in female market employment might address a practical gender need by providing women with new earning opportunities. The extent to which strategic gender needs would also be met would depend on the level and quality of that employment, on whether the jobs are regular, stable and safe and whether they would widen women's options.

Understanding how both practical and strategic gender interests are affected by greater exposure to trade would thus entail giving consideration to both short and long term changes in the labor market, in the household and in a range of other institutions– and to interactions among them. One would need to examine direct and indirect employment, price and income effects and also variations in access to resources. For instance, it would be important to assess not only whether women increase their income relative to men but also whether they gain greater control over it, what effect earnings have on women's own perceptions and on their social relations within the household and in the broader community. This would require taking into

account not only objective but also subjective aspects of well being. Possible shifts in government spending and taxes resulting from trade liberalization, as well as changes in risk and vulnerability of households, should also be given attention as these are likely to have gender-differentiated outcomes (for example when a reduction in tariff revenue affects the public provision of infrastructure and social services that are more frequently used by women).[1]

A variety of tools can be used to examine these dimensions – from econometrics to modeling to qualitative methods. Few studies of the differential effects of trade liberalization on women and men employ general equilibrium models. Yet such models could be useful for gender analysis. They allow for linkages among actors and sectors and trace indirect effects under clear behavioral assumptions. Computable general equilibrium (CGE) models can be designed to include gender dimensions in various ways. Fontana and Wood (2000), for example, distinguish female from male labor and include household work and leisure as sectors in the SAM, in addition to standard market activities. This paper develops their work empirically and methodologically. The Fontana and Wood approach is applied to Bangladesh and Zambia. These two countries have different resource endowments, with abundant labor in Bangladesh and abundant natural resources in Zambia. Gender relations in each are shaped by different labor market institutions, systems of property rights and socio-cultural norms, thus making comparison interesting. The paper also compares simulation results to other approaches in the gender-and-economics literature, to identify methodological strengths and limitations.

[1] McCulloch, Winters and Cirera (2001) discuss these aspects in their chapter 4, but they do not highlight their implications for gender differences.

Section II describes how a social accounting matrix (SAM) can be made gender-aware. It illustrates this with data sets from Zambia and Bangladesh that are then used for CGE model simulations analyzed in Section III. Section IV analyses simulation results in the context of other non-modeling approaches. The paper concludes by suggesting improvements for future work.

II. COMPARISON OF SAMS

II.1. SAMs as tools for gender analysis

By describing all transactions between sectors and institutions in the economy (at one point in time), social accounting matrices are a useful tool for analysis of income distribution. The SAM framework is flexible enough to represent a wide range of socio-economic characteristics, thus allowing an understanding of diverse economic, social and cultural settings important for the design of policies.

The demand for integrated systems of social and economic statistics has been rising, and so have attempts to extend the conventional structure of the SAM to incorporate a larger number of indicators. This can be done by providing a greater level of detail for existing material contained in the traditional national accounts (for example by disaggregating further agricultural sectors into female-intensive crops and male-intensive crops, if the issue of concern is gender relations in rural settings) – what are called 'internal satellite accounts'– and/or by adding new data and extending definitions of what constitutes production or assets– what are called 'external satellite accounts'. Examples of external satellite accounts are those which estimate environmental costs of production, and those that provide a valuation of household own activities.

Many of these SAM extensions can contribute significantly to understanding the gender effects of economic reforms, by providing better insights into the different roles of women and men in the generation and distribution of income and the interactions between households and the market economy. The development of satellite time-use modules, which keep a record of how much time people spend on various tasks and impute a monetary value to non-market time, spent either on household activities or on leisure, is of particular relevance to gender analysis.

As early as 1987 Pyatt recommended extension of SAM accounts by imputing value to time which is not explicitly marketed for financial remuneration. Pyatt notes that this would make a considerable difference to the welfare profile across socio-economic groups, especially from a gender perspective: '… since the economic activities of women are disproportionately concentrated on unremunerated activities, the present proposals would go a long way towards redressing the current practice of grossly discounting their contribution' (1987:1).

To make these household services visible, beyond being important in itself, allows consideration of more constraints and interactions than with a standard accounting framework, particularly interactions between behavior inside and outside the household which are crucial to understanding issues such as the response of female labor force participation to reform of economic policies. An accurate assessment of the gendered impact of economic policy changes also requires explicit consideration of time spent on leisure. This is because there are sharp differences in the extent of personal time between women and men and because changes in the market can alter the amount of time spent on rest and recreation, thus affecting

welfare in ways that are overlooked in standard economic analysis. If two households have the same money income but in one its members have more personal time for leisure and relaxation, then there is an evident difference in their living standards, which should be taken into account in policy formulation.

Evaluations of this kind, however, are data-demanding and often methodologically difficult, which helps to explain why only a few countries to date provide satellite accounts regularly. Most are developed countries such as the Netherlands (Kazemeir et al, 1998), Australia (Ironmonger, 1999) and Canada. One notable exception among developing countries is India, for which SAMs have been constructed incorporating environmental concerns (Nugent and Sharma, 2002), the informal sector and gender disaggregation in the labor market (Sinha, 2000).

Most of the (few) available SAMs with gender features limit these to disaggregation of some sort of conventional accounts. For example, Nyanzi (2000) in a SAM for Uganda distinguishes household types not only by location and income level but also by the gender of the household's head. This allows him to assess the gender implications of changes in both direct and indirect taxation, given that female-headed households and male-headed households appear to have markedly different sources of income and consumption patterns.

Fontana and Wood (2000) take the gender disaggregation of SAMs further. They not only distinguish factors, sectors and households by gender but also add estimates of social reproduction (or household work) and leisure to the standard accounting framework. This approach is used to extend two existing SAMs of Bangladesh and Zambia, which are compared in the following section.

II.2. Bangladesh and Zambia

Sub-Saharan Africa and South Asia are markedly different in their export structure, with Africa's exports heavily concentrated on primary products and South Asia's exports consisting mainly of intensive-intensive manufactures. These differences largely reflect differences in the two regions' combination of human and natural resources relative to other regions: abundant natural resources and a low level of education in Africa and few natural resources and a low level of education relative to the supply of labor in South Asia (Wood and Mayer, 2001 and Mayer and Wood, 2001). Zambia and Bangladesh are no exception to these patterns. In Zambia the main export is copper, which constitutes almost 80 percent of total exports, while in Bangladesh the main export is ready-made garments (RMG), which provides over 60 percent of total foreign earnings. The Bangladeshi labor force is on average less educated than the Zambian one but the ratio of person-years of schooling to the country's land area is 40 times larger in Bangladesh than in Zambia. [2]

Traditionally, women's participation in market activities in Bangladesh has been low and confined to a narrow range of casual jobs on the margins of the labor market. However, since the establishment of the garment factories in the 1980s, significant changes in female labor force participation have taken place. These are documented in a rich literature (Kabeer, 2000, Sobhan and Khundker, 2001, Zohir, 1998, and many others). Women's contribution to agriculture is significant but still little studied, as women in this sector work mostly as unpaid family labor on activities carried out within the homestead.

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[2] In 1990 the ratio, with land area measured in square km, and years of schooling by average adult years of schooling multiplied by the number of adults, was 1100 for Bangladesh and 27 for Zambia: Wood and Mayer (2001) and Mayer and Wood (2001).

Much of the analysis of women's issues undertaken in Zambia is concerned with the historical evolution of gender and economic relations in the context of gradual monetization of the economy and of colonial policies which encouraged male labor migration to the cities and discouraged female migration, with a resulting increase of female-headed households in rural areas (Moore and Vaughan, 1993). Zambia has a high proportion of female-headed households, who face particular constraints as producers and are over-represented among poor small farmers. There is a strong dualism in men's and women's rights and responsibilities in Zambian agriculture. Non-staple food crops are women's sole responsibility but most crops are grown with both male and female labor. In urban areas women are heavily concentrated in informal sector occupations.

The gendered social accounting matrices for Bangladesh and Zambia described in this section both refer to a similar time period, 1993 for Bangladesh and 1995 for Zambia. They were constructed by integrating existing data sets with additional information on the gender structure of the economy, both in the labor market and at the household level. The innovative feature of these two SAMs is the addition of social reproduction and leisure activities. Social reproduction includes services provided within households for own-consumption, which the standard System of National Accounts (SNA) defines as 'economic' but not 'productive' (UN 1993), 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 (assumed to be

10 hours for both men and women).[3] The value added in the social reproduction and leisure sectors is estimated in the following way. First, the time spent by household members (of working age) on reproduction and leisure is calculated. The output in these sectors is then derived by valuing labor, for each skill and gender category, at its average market wage (considered to be the opportunity cost of each worker's time), assuming that non-market sectors use neither capital nor land nor intermediate inputs (for further details on the SAMs and the limitations of this approach see Fontana, 2001 and Fontana, 2002).

Table 1 – Export composition and gender structure of the labor force in Bangladesh and Zambia (%)

	Bangladesh		Zambia	
	Total exports	**Female market employment**	**Total exports**	**Female market employment**
Primary products*	8.1	68.9	81.2	64.4
of which copper	0.0	0.0	78.4	0.3
Manufactures	91.9	11.2	8.6	6.3
of which garments	60.8	6.4	n.a.	n.a
Services	0.0	19.9	10.2	29.3
Total	100.0	100.0	100.0	100.0

Source: 1993 Bangladesh and 1995 Zambia gendered SAMs
Notes: * SITC definition (includes processed primary)

Table 1 compares the export structure and the employment distribution of the female labor force in the two SAMs. It shows that exports are quite concentrated in both countries and that the proportion of the female labor force employed by the export sectors is higher in Bangladesh than in Zambia. Manufactures constitute about 92 per cent of total exports in Bangladesh and account for about 11 per cent of female market employment. In Zambia, copper constitutes about 78 per cent of exports but employs less than one per cent of the female labor force. In both Bangladesh and

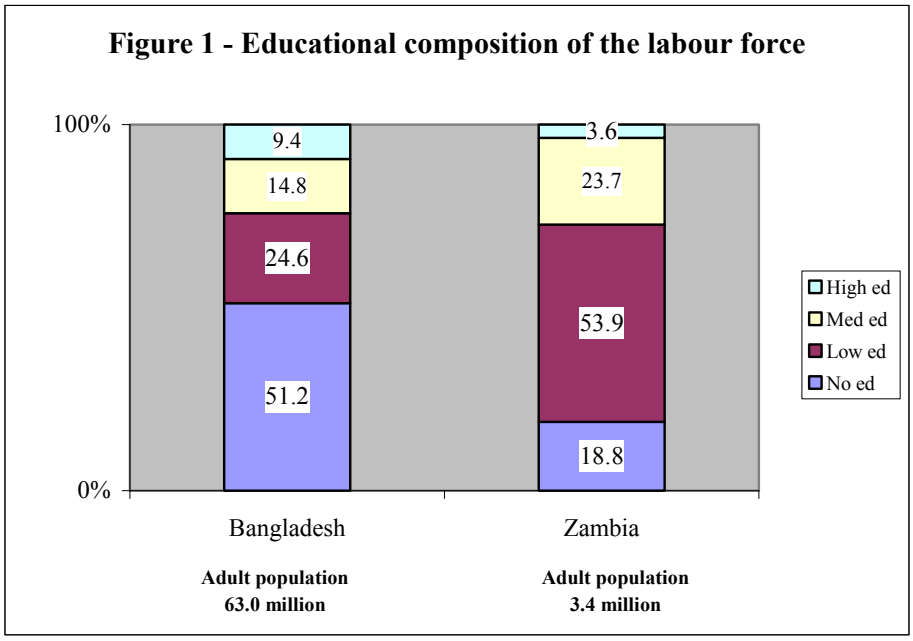
[3] Some studies, such as Zaman (1995) on Bangladesh, suggest that time spent eating and sleeping might also vary by gender. In these SAMs, however, for simplicity, differences in time spent on personal care by men and women are all captured by differences in leisure time.

Zambia more than 60 per cent of women work in agriculture, a sector with few exports (and probably, in both countries, with few prospects of becoming a leading export sector).[4] Women work also in services (30 per cent of the female labor force is in services in Zambia and 20 per cent in Bangladesh) but are mostly concentrated in sectors which are non-traded (trade and transport in Zambia and domestic services in Bangladesh).

Bangladesh is far more populous than Zambia, with an adult population of about 63 million compared with 3 million in Zambia. This big difference in the size of the two countries is reflected in their different degree of openness. The share of exports and imports in GDP is higher in Zambia (77 per cent) than in Bangladesh (20 per cent). Hence one would expect the impact of changes in trade policies on the domestic labor market to be smaller in Bangladesh than in Zambia.

On average the adult population is better educated in Zambia than in Bangladesh. More than 50 per cent of the working population has no education in Bangladesh while in Zambia the share of illiterates is only 19 percent, as illustrated in figure 1.

[4] Some studies indicate that Zambia might have some advantage in the production of non-traditional agriculture and that women could benefit from it. However none of the experiments in this paper suggests the possibility of a significant expansion of female intensive agriculture, unless something drastic happens to the structure of the country.

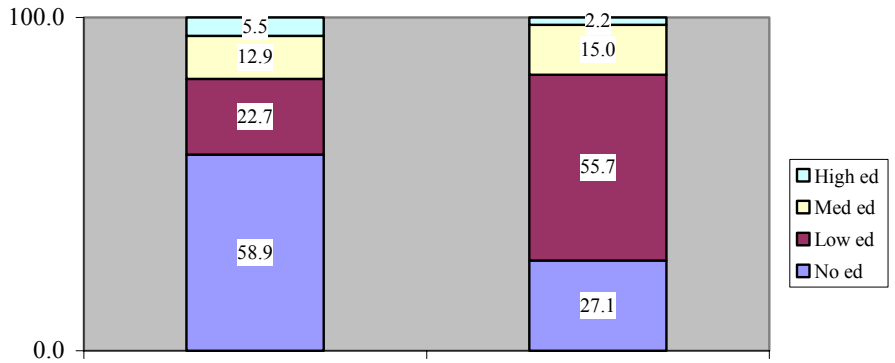


Source: 1993 Bangladesh and 1995 Zambia gendered SAMs

The proportion of the workforce with primary or secondary education is 77 per cent in Zambia and 39 per cent in Bangladesh. The level of education of women is lower than that of the total population in both countries, as shown in figure 2. Although Bangladesh has a much larger share of its adult population with no schooling than Zambia, it also has a higher proportion of highly educated workers (9 per cent compared with 3 per cent in Zambia). For both reasons the Gini coefficient for educational distribution reveals greater inequality in Bangladesh (57.9) than in Zambia (27.4). The Gini coefficient for income distribution is however higher in Zambia (52.4) than in Bangladesh (28.3).[5] In Bangladesh the educational distribution of the adult population is more unequal not only across educational categories but also (though to a lesser extent) across genders: average years of schooling for women are about 66 percent of average years for men in Bangladesh, and 74 percent in Zambia.

[5] Gini coefficients for educational distribution were calculated by the author (the illiterate were included in the calculations and assumed to have an average of three months of schooling) and Gini coefficients for income distribution are taken from Deininger and Squire (1998).

Figure 2 - Educational composition of the female labour force



Source: 1993 Bangladesh and 1995 Zambia gendered SAMs

Gender inequality is larger in Bangladesh than in Zambia also as far as wages are concerned. This is described in table 2. Women with no education, for example, earn less than 50 per cent of what men of the same group earn in Bangladesh compared with 65 per cent in Zambia. The gender wage gap narrows with tertiary education in both Bangladesh and Zambia, to 70 per cent and 95 per cent respectively. This information should however be taken with caution as reliable data on wages are not available. Wage estimates from various labor force surveys had to be adjusted in both SAMs to correct for discrepancies between value added data and employment data.[6] Other data (for example WISTAT data, UN, 1995) however seem also to indicate that gender wage inequalities are wider in Bangladesh than in Zambia. The smaller gap in earnings between female and male workers with university education can be explained by the fact that most highly educated women in both countries are

[6] This is a common problem when constructing SAMs, since information for different accounts is derived from various sources which do not always use same definitions and measurements.

employed by the public sector, where gender disparities in wages are less marked than in other sectors.

Table 2 – Female/male wage gap by educational level

	No ed	Low ed	Med ed	High ed
Bangladesh				
Average female hourly wages as percentage of male wages	48	54	45	70
Market employment (million hours per year)				
Female	133	47	22	11
Male	302	184	113	84
Zambia				
Average female hourly wages as percentage of male wages	65	59	95	95
Market employment (million hours per year)				
Female	906	2471	232	36
Male	557	2365	814	106

Source: 1993 Bangladesh and 1995 Zambia gendered SAMs

As shown in table 3, on average, the adult population of both Bangladesh and Zambia spend about 38 per cent of time on leisure and 62 per cent working. There are however differences between the two countries in how the work is distributed between the market and the household, with people in Bangladesh spending 28 per cent of the time on market work compared with 43 per cent in Zambia, and 34 per cent on social reproduction compared with 19 per cent in Zambia. These different patterns mainly reflect women's lower market participation in Bangladesh, which results in more time overall being devoted to household work. Men spend the same share of time on market work in the two countries (42 per cent) but enjoy more leisure in Zambia (52 per cent of total time compared with 42 per cent in Bangladesh). A possible interpretation is that, because of rigid socio-cultural norms that encourage women to stay within the homestead, in Bangladesh men are more likely to get involved in household tasks such as food shopping, or anything else that involves 'being seen'. Fafchamps and Quisumbing (1999) find this type of specialization in

rural Pakistan, where men dominate in 'outside' housekeeping tasks such as firewood collection or visiting the market.

Table 3 – Allocation of time between market and non-market activities (%)

Bangladesh	**Total**	**Female**	**Male**
Market	27.8	13.3	42.0
Social reproduction	34.4	53.2	16.1
Leisure	37.8	33.6	41.9
Total	100.0	100.0	100.0
Zambia	**Total**	**Female**	**Male**
Market	43.4	44.9	42.0
Social reproduction	18.5	32.9	5.7
Leisure	38.1	22.2	52.3
Total	100.0	100.0	100.0

Source: 1993 Bangladesh and 1995 Zambia gendered SAMs

It is not certain whether the time allocation surveys for the two countries adopt the same definition of household work.[7] These different patterns, however, are consistent with other evidence on time allocation in South Asia and Sub-Saharan Africa. Studies reviewed in Ilahi (2000) show that in Africa women spend longer hours in both agricultural and non-agricultural activities than do men, while in Asia (and Latin America) the picture is one of a more marked gender division of labor, with men concentrating on income-generating work and women on housework.

Comparison of table 3 with table 2 reveals another pattern: lower women's participation in market activities relative to men's is associated with a wider gender wage gap. It is not clear what is the direction of causation between these two facts -

[7] Estimating the allocation of women's and men's time between market and non-market activities was not easy, as data on time-use, in both Bangladesh and Zambia, are sparse and cover neither all tasks nor all geographical areas (no detailed time-use study was available for the urban areas, for example). Subsistence agriculture is included in market work.

whether women spend more time on household work in Bangladesh because of higher wage discrimination in the labor market (which makes it less attractive for them to work outside their home), or whether the gender wage gap reflects stronger family norms that require women to perform more burdensome work at home, hence reducing their energy and flexibility in the job. Even if it were possible to determine that the initial reason for the wage differential was more on the supply side than the demand side, or vice versa, the observed differential is most likely to be a mixture of the two. Research on interactions between the household and the labor market is growing, but mostly limited to developed countries (for example Bonke, Gupta and Smith, 2002 on Denmark, Lazaro, Molto and Sanchez, 2002 on Spain and Anxo and Carlin, 2002 on France) where richer data on time use are available. These studies vary in their findings but, overall, suggest that, despite significant increases in female market participation, the gender division of labor within the household remains fairly unequal. Women's level of education and the availability of market substitutes for household goods and services (such as utilities and child care) seem to be important determinants of the gender allocation of time.

Tables 4 and 5 show that the skill and gender composition of both market and non-market sectors varies between Bangladesh and Zambia. Of the two non-market sectors, social reproduction is somewhat more female intensive in Zambia (female time is 84 per cent of total labor time) than in Bangladesh (76 per cent of total). Moreover, while in Zambia social reproduction is more female intensive than any market sector, in Bangladesh there is one market sector, garments, which is more female intensive than social reproduction (83 per cent of total time is female).[8] The

[8] This is true also when social reproduction is considered by household type, with the sole exception of social reproduction in rural female-headed households, in which female time is 92 per cent of the total.

garment sector is also the most export oriented sector (88 per cent of its output is exported, as indicated in the third column of table 6) and one of the most intensive-intensive sectors (labor accounts for 77 per cent of total value added as shown in the second column of table 6).

Table 4 – Educational and gender structure of SAM sectors, Bangladesh

	Shares of sectoral employment (% of female labor)				Females (%of total labor)
	No ed	Low ed	Med ed	High ed	
Grains	59	26	12	4	17
Commercial crops	57	28	11	4	3
Livestock&horticulture	61	25	11	3	47
Fishing	36	17	28	19	29
Food processing	48	26	18	9	30
Garments	43	34	17	7	83
Other textiles	31	35	20	14	12
Other manufacturing	37	31	20	12	16
Infrastructure	48	27	12	13	5
Trade	30	29	24	18	5
Transport	56	26	11	7	1
Public services	5	8	17	70	20
Financial services	3	9	13	75	6
Domestic services	48	25	17	9	43
All market sectors	49	26	15	11	24
All social reproduction	55	23	14	8	76
All leisure	50	25	15	10	44
ALL	51	25	15	9	49

Source: 1993 Bangladesh gendered SAM

Table 5 – Educational and gender structure of the SAM sectors, Zambia

	Shares of sectoral employment (% of female labor)				Females (%of total labor)
	No ed	Low ed	Med ed	High ed	
Maize	7	88	5	0	54
Commercial crops	6	94	0	0	41
Horticulture and groundnuts	19	54	24	4	60
Food and livestock	60	40	0	0	70
Fishing and forestry	12	78	10	0	7
Mining	10	45	41	4	7
Intensive-intensive mfg	7	31	57	5	43
Capital-intensive mfg	43	49	7	1	4
Construction and utilities	20	80	0	0	3
Trade and transport	18	46	33	4	51
Public services	35	49	15	1	29
Market services	6	36	52	6	32
All market sectors	7	22	53	18	49
All social reproduction	20	65	14	2	84
All leisure	25	55	18	3	27
ALL	19	54	24	4	47

Source: 1995 Zambia gendered SAM

Leisure is more male intensive in Zambia (only 27 percent of total leisure time is female) than in Bangladesh (female share is 44 per cent). Indeed, in Bangladesh leisure is more female intensive than most market sectors (with the exception of livestock and horticulture and, of course, garments). Conversely, in Zambia, most market sectors (except for mining, capital-intensive manufacturing, infrastructure and forestry) are more female intensive than leisure. The most female-intensive sectors in Zambia are the agricultural sectors, especially food and livestock (in which 70 per cent of total time is female) and horticulture and groundnuts (60 per cent). These sectors are the least skill-intensive sectors in the market economy in Zambia (although on average they are more skill-intensive than similar sectors in Bangladesh, reflecting the higher average educational level of the workforce in Zambia). Other relatively female-intensive sectors in Zambia are trade and transport, with female time being 51 per cent of total time. The same sectors in Bangladesh are very male intensive (less than 5 per cent of total time is female). Mining, which is by far the most open sector in Zambia (more than 93 per cent of its output is exported), is highly male intensive, with a female share in total time of only 7 percent. Mining is also the most capital-intensive sector (capital contributes 86 percent of total value added).

Table 6 – Sectoral structure of Bangladesh and Zambia					
	Net output (% of GDP)	**Labor as shr of VA (%)**	**Export intensity***	**Import penetration***	**Tariffs as shr of imports (%)**
Bangladesh					
Grains	8.8	54.8	-	2.3	12.5
Commercial crops	3.6	33.2	0.1	6.6	2.0
Livestock and horticulture	6.9	44.5	0.2	1.9	8.5
Fishing	2.8	6.3	10.0	-	-
Food processing	4.5	13.1	1.4	1.8	61.4
Garments	1.5	84.9	87.5	8.2	4.1
Other textiles	2.7	72.2	18.5	28.3	11.8
Other manufacturing	3.9	42.2	1.9	45.8	20.8
Infrastructure	12.2	17.5	-	-	-
Trade	16.7	76.6	-	-	-
Transport	14.5	35.4	-	-	-
Public services	12.2	32.2	-	-	-
Financial services	5.5	20.4	-	-	-
Domestic services	3.9	92.7	-	-	-
All market sectors	100.0	43.6	11.4	19.6	18.4
All social reproduction	36.6	100.0	-	-	-
All leisure	52.6	100.0	-	-	-
Total	189.2				-
Zambia					
Maize	4.3	69.5	4.3	15.0	3.1
Commercial crops	1.4	55.6	15.6	16.9	0.4
Horticulture and groundnuts	5.6	90.6	2.9	2.7	21.0
Food and livestock	6.7	80.7	1.9	4.7	18.6
Fishing and forestry	4.8	55.7	-	0.2	15.9
Mining	17.3	13.9	93.3	23.3	20.3
Intensive-intensive manufacturing	9.6	51.7	4.0	13.0	11.8
Capital-intensive manufacturing	3.1	35.2	9.1	65.0	14.1
Construction and utilities	6.4	17.7	10.1	0.2	19.5
Trade and transport	20.6	57.9	-	7.7	13.4
Public services	7.3	77.1	-	-	-
Market services	13.0	52.8	8.6	25.2	13.4
All market	100.0	50.9	16.5	20.3	13.4
All social reproduction	20.8	100.0			
All leisure	67.8	100.0			
Total	188.6				

Source: 1993 Bangladesh and 1995 Zambia gendered SAMs.

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.

III. COMPARISON OF SIMULATIONS

The previous section has highlighted several differences between Zambia and Bangladesh. Although the two countries have similar production structures (particularly the shares of both agriculture and manufacturing in GDP, as can be seen in table 6), they differ in the sectoral composition of their foreign trade. The degree of their integration into world markets varies – with Zambia being more open than Bangladesh[9] (as shown in table 7, exports plus imports are 77 per cent of GDP in Zambia and 20 percent of GDP in Bangladesh) – and so does the female intensity of their traded sectors – with export sectors employing more women in Bangladesh than in Zambia. This mixture of human and natural resources are significantly different, and so are their patterns of distribution – with wealth inequalities being more marked in Zambia but gender inequalities in education and wages being higher in Bangladesh. It is to be expected therefore that same trade policies or shocks would have different gendered outcomes in the two countries.

Table 7 – Tariffs and openness (%)

	Bangladesh	**Zambia**
Average tariff rate	18.4	13.4
Tariffs as share of government revenue	30.7	30.0
Imports as share of GDP m.p.	12.1	41.0
Exports as share of GDP m.p.	7.5	36.1

Source: 1993 Bangladesh and 1995 Zambia gendered SAMs

A computable general equilibrium model applied to the Bangladesh and Zambia SAMs is used to analyze the effects of changes in trade policies. The main experiment described in the first part of this section simulates the abolition of all

[9] As noted in the previous section, this difference in openness is likely to be the result of 'natural' differences, such as population size, and might not be policy-driven.

tariffs. Both Bangladesh and Zambia have, on average, moderate levels of protection. As shown in table 7, the average tariff rate, measured by the ratio of total tariff revenue to total imports, is about 18 percent in Bangladesh and about 13 percent in Zambia. The same table also shows that tariffs constitute approximately 30 percent of total government revenue in both countries. However, as indicated in the last column of table 6, the degree of tariff dispersion is higher in Bangladesh, ranging from 2 per cent in commercial crops (which in Bangladesh are mainly jute, sugar and tea) to more than 61 percent for food processing (due to very high protection in the edible oil sector). In Zambia the tariff ranges from almost zero in commercial crops (cotton, sugar, tobacco and coffee) to 21 percent in horticulture and groundnuts.

In the second part of this section the simulation of tariff abolition is re-run with alternative parameter values to test the sensitivity of the results to different degrees of responsiveness of gendered aspects of the division of labor to economic change. Two other trade experiments are also analyzed: the introduction of a uniform tariff and a higher import price of food grains.

The model used is the same as in Lofgren et al. (2002). It follows the 'neoclassical structuralist' approach developed by Dervis, de Melo and Robinson (1982). Its gendered application are discussed in Fontana and Wood (2000). A brief description of closures and exogenously specified elasticity parameters is provided in the following paragraphs.

The macro closures and the factor market closures, as well as the elasticities for factor substitution and foreign trade, are set the same for both Bangladesh and Zambia. This might not be 'realistic' but ensures that experiment outcomes are driven

exclusively by differences in the initial socio-economic structure of the two countries (including their tariff system), rather than by differences in behavioral parameters.

It could be argued that behavioral parameters, by describing the ease with which systems adjust to change, are indeed an important component of a country's socio-economic structure. The aim of this paper is however to isolate the effects deriving from differences in sectoral composition of production and trade, and in factor distribution. Two other papers (Fontana, 2001 and Fontana, 2002) analyze experiments in which production, trade and consumption elasticities vary between Bangladesh and Zambia. Sensitivity analysis shows that initial shares are most important and that changes in elasticity values do not affect significantly simulation results.

The production function in the model is a three-level constant elasticity of substitution (CES) function. The substitution elasticity values for each level are listed in table 8. At the lowest level, for each educational category, female labor and male labor of the same skill are aggregated into composite labor. The ratio of female to male labor depends on the share parameter of this aggregation function, which differs across sectors, and varies with the wage rate of women relative to men, which induces substitution between them. To reflect the rigidity of gender roles, particularly within the household, 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 has an intermediate level which aggregates the four educational types of composite labor, with a substitution elasticity of –0.5, into one larger labor bundle. This larger labor bundle is the 'output' of the reproduction and leisure sectors, which in the SAM use neither capital nor land nor intermediate inputs.

In the market sectors, however, the production function has an upper level which 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 value of the substitution elasticity at the upper level varies by sector, ranging from –0.5 in agriculture to –0.8 in manufacturing and services.

Table 8 – Values of substitution elasticities in the CES production function

	Market			**Non-market**
Lower level (Labor by gender for each educational group)	0.5			0.25
Intermediate level (Labor by education)	0.5			0.5
	Ag	**Mfg**	**Sv**	
Upper level (Labor and non-labor factors)	0.5	0.8	0.8	-

The treatment of foreign trade in the model is such that buyers in each sector divide their expenditure between imports and domestically produced goods in shares which vary in response to changes in the ratio of domestic to import prices. Likewise, producers in each sector divide their output between the home and the export markets in shares which vary with the ratio of domestic prices to export prices. These CES import Armington functions and export CET functions partially insulate domestic prices from world prices, unlike more standard trade models in which the domestic prices of traded goods are strictly determined by world prices. As shown in table 9, the elasticity of substitution in both these functions is set at –2.0 in agriculture, –1.5 in manufacturing and –0.8 in services. [10]

[10] Elasticity values of –0.8 are considered 'medium low', -1.5 'medium high' and –3.0 'very high' (Sadoulet and de Janvry, 1995).

Table 9 – Values of trade elasticities

	CET	Armington
Agriculture	2.0	2.0
Manufacturing	1.5	1.5
Services	0.8	0.8

As for the macro closures, the balance of trade is fixed and the level of exports and imports adjust through changes in the real exchange rate. Government consumption in each sector is fixed in real terms, as is the demand for investment goods. The savings-investment balance is achieved through adjusting the household propensity to save. The government account balance is achieved through adjusting direct tax rates. It is assumed that loss of revenue from imports is fully recovered by introducing higher direct taxes. In the simulations described in this paper the government increases the income tax rate by a uniform number of percentage points for all income recipients, hence spreading the burden uniformly across households and enterprises. Alternative government account closure rules would be possible. For example, assuming increases in indirect taxes (as often recommended to developing countries by the international financial institutions), or flexible government consumption, would lead to important differences in the distributional effects of trade liberalization, in terms of both income and gender. [11]

As for the factor market closures, the assumption is that the supply of capital and land in each sector is fixed, but labor is mobile, so that supply to each sector

[11] Given that the model used in this paper is a single-period model, a closure combining fixed foreign savings, fixed real investment and fixed real government consumption seemed to be preferable for simulations that explore the equilibrium welfare changes of alternative policies. A closure with flexible foreign savings or flexible investment would lead in this context to misleading results. For example, decreases in investment would raise household welfare, but the short-term static nature of the model would not allow consideration of welfare losses in later periods that might arise from a smaller capital stock.

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. For instance, wage determination mechanisms that reflect bargaining between workers and employers (Taylor, 1989)–-with differences in power between male and female workers–- or various kinds of rationing could be relevant for gender analysis. The implications of alternative closures for simulation results will be examined in future work. Other features of the Bangladesh and Zambia models used in this paper are the same as in the models described in Fontana (2001) and Fontana (2002) respectively.

The simulation results described in the following pages are analyzed with particular attention to: (i) changes in the allocation of female labor between 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. While the labor categories are identical in the two countries, the classification of production sectors and household types differs between them. To make comparison of results easier, changes are often reported for aggregated categories.

III.1. Abolition of tariffs

When all tariffs are removed, the total volume of imports increases by 3.5 per cent in Zambia and by 14.7 per cent in Bangladesh. Imports increase the most in manufacturing, but also in female-intensive agriculture in Zambia, and in manufacturing other than garments in Bangladesh, as these were previously the most protected sectors. In both cases the trade balance is restored by a depreciation of the exchange rate, which is greater in Zambia (7.6 percent) than in Bangladesh (0.6 percent). This has partly to do with the supply elasticity of the export sectors, which is

greater in Bangladesh than in Zambia because of the much larger share of labor value added in garments as compared with mining. Since the assumption in the model is that labor is a mobile factor while the supply of capital and land in each sector is fixed, a sector that uses large inputs of labor relative to land and capital is able to increase more easily its output in response to price changes.[12]

As a result of the exchange rate depreciation, exports rise in both countries, mainly in garments in Bangladesh, and in mining and in male-intensive agriculture in Zambia. These changes in exports and imports cause domestic market output to increase in both countries by about 0.5 percent. The results by sector are presented in table 10. The sectors which expand the most are manufacturing in Bangladesh and mining in Zambia. Within the Bangladesh manufacturing sector, it is garments that rise while food, beverages and tobacco, and other manufacturing decline. Manufacturing in Zambia is unchanged, because of offsetting changes in the capital-intensive sector, which declines, and in the intensive-intensive sector, which slightly increases. Agriculture (mainly grains) declines marginally in Bangladesh while it increases in Zambia, due to higher production of male-intensive commercial crops and maize, while output in both female-intensive sectors - food staples and horticulture – falls.

[12] The sectoral price elasticity of supply is given by $\varepsilon_i = \sigma_i * \theta_{iL}/\theta_{iK,}$ where σ_i is the elasticity of substitution in production between factors and θ_{iL} and θ_{iK} are the factor shares for labor and capital or, more generally, for the mobile factor (L) and the fixed factor (K) (Dervis, de Melo and Robinson, 1982: 264).

Table 10 – Effects of tariff abolition on output (percentage changes from the base case)		
	Bangladesh	**Zambia**
Market, of which:	0.5	0.6
Agriculture	-0.2	0.4
Mining	-	1.8
Manufacturing	3.2	0.1
Services	0.2	0.4
Social reproduction	-0.2	-0.3
Leisure	-0.3	-0.7

Source: Model simulations

The corollary of higher market production is an output fall in social reproduction and leisure. The effect of tariff elimination is to reduce the average price of traded relative to non-traded goods and services. Hence, in both countries, market sectors expand and non-market sectors, being non-traded, contract. The decline is higher in leisure than in social reproduction, since the consumption of leisure is more responsive to price changes than that of household work. Leisure, a male-intensive activity, declines in Zambia more than in Bangladesh, because its opportunity cost increases more in the former country than in the latter, reflecting a larger rise in male wages. The increase in total output (both market and non-market) is 0.2 percent in Bangladesh and negligible in Zambia.[13]

Because of the different gender composition of the expanding and contracting sectors in the two countries, the increase in female market labor force participation in the experiment is larger in Bangladesh than in Zambia and so is the rise in female wages. Effects across educational groups also vary between the two countries.

[13] Under the assumption of full employment of all factors, changes in total output from simulations can only be slight. A small increase in output could be the result of reallocation of resources from less productive sectors to more productive ones. A wage distortion term called WFDIST is included in the model to capture possible wage differences across activities for the same labor category that might result from various market distortions. WFDIST measures the extent to which the sectoral marginal revenue product of the factor deviates from the average return across the economy. Manufacturing is more productive than the average (WFDIST >1) in Bangladesh and so is mining in Zambia, but agriculture is less productive than the average (WFDIST<1) in both countries.

Employment in the garment sector in Bangladesh rises by about 37 per cent for both women and men, but the absolute increase is higher for women than for men, because of their much larger initial share. Reflecting the educational composition of the garment sector's female labor force, the increase in market employment is largest for women with primary and secondary education (about three per cent), and less significant for the highly skilled (two per cent). Market participation of uneducated female workers rises only by one per cent, as the increase in their garment employment is partly offset by a decline in their time inputs in grain production. A shift in employment from agriculture to the manufacturing sector could have potentially significant positive effects, even when net increases in participation are slight, as this sector generally offer better working conditions than agriculture. Time spent in social reproduction by women with primary and secondary education declines on average by about 0.4 per cent, while their leisure time declines more. A similar pattern, although smaller in magnitude, can be observed for female workers with both higher education and no education. Because the abolition of tariffs causes a significant expansion of the most female-intensive sector in the Bangladesh economy, the economy-wide demand for female labor rises more than the demand for male labor, and hence the wage rate of women increases both absolutely and relative to men. The rise is largest for women with primary and secondary education. Their wage increases by about three per cent in absolute terms, and by two per cent and one per cent respectively relative to that of men with similar skills. These results are described in table 11.

Table 11 – Effects of tariff abolition on employment and wages, Bangladesh (percentage changes from base case)

	F no ed	F prim ed	F sec ed	F post ed	Total female	Total male[14]
Employment						
All market sectors, of which:	**1.4**	**3.1**	**3.4**	**2.2**	**2.1**	**0.3**
Grains	-1.7	-2.0	-1.9	-1.7	-1.8	-1.4
Commercial crops	1.7	0.0	1.5	1.7	1.6	2.0
Livestock and horticulture	0.2	-0.1	0.0	0.2	0.1	0.5
Fishing	0.6	0.3	0.3	0.6	0.5	0.8
Food processing	-2.8	-3.1	-3.0	-2.8	-2.9	-2.6
Garments	36.8	36.4	36.5	36.8	36.6	37.1
Other textiles	10.5	10.2	10.2	10.5	10.4	10.7
Other manufacturing	-13.0	-13.3	-13.2	-13.0	-13.1	-12.9
Infrastructure	0.2	-0.1	-	0.2	0.2	0.4
Trade	0.5	0.2	0.2	0.5	0.4	0.7
Transport	0.7	0.4	-	0.7	0.6	0.9
Public services	0.2	-0.1	-0.1	0.2	0.1	0.3
Financial services	-	-0.1	0.0	0.2	0.1	0.3
Domestic services	0.0	-0.4	-0.3	-0.1	-0.1	0.1
All social reproduction	**-0.2**	**-0.4**	**-0.4**	**-0.2**	**-0.3**	**-0.1**
All leisure	**-0.3**	**-0.5**	**-0.5**	**-0.4**	**-0.4**	**-0.3**
Hourly wages						
Absolute	1.8	2.9	2.5	1.7		
Relative to males*	0.9	1.8	1.4	0.5		

Source: Simulation results

*This is the difference between the absolute percentage change for females and the absolute percentage change for males. A positive value indicates that the female/male wage gap has narrowed.

Because the elimination of tariffs on traded market goods raises the average demand for market goods relative to non-market goods, female market employment rises in Zambia too, and so does the female wage rate, but by a smaller proportion than in Bangladesh. An important difference, however, is that in Zambia the gender wage gap widens, instead of narrowing as in Bangladesh. This is because mining and

[14]The percentage increase in total female market time is significantly higher than the increase in total male market time despite the fact proportional changes in specific sectors are rather similar for the two categories of workers. This is due to different weights between them: more than 8 per cent of total female market time is spent in garments and other textiles (the sectors that expands the most) while only a negligible share of total male time is used by these sectors. The extent to which male time substitutes for female time in each sector in response to changes in relative wages (about 0.3 per cent) might appear rather small. However these aggregate results mask differences across educational categories.

commercial crops, the sectors that expand the most as a result of tariff elimination in Zambia, are male intensive.

The increase in market labor force participation in Zambia is small on average (about one per cent) for all educational groups. Employment rises the most (1.1 per cent) for female workers with no education, because of expansion of commercial crops, and for women with secondary education, whose largest sectoral increase is in mining. While for this latter group the rise in market participation is entirely at the expense of their leisure, with only a negligible change in time spent on household work, for the former the decline in non-market time is by 0.5 in social reproduction and by more than one per cent in leisure. Although social reproduction and leisure decline on average, there are differences between some (rich) households, where non-market time rises, and other (poor) households, where it falls. Women of the same skill experience either a decline or a rise in their time inputs on household work and leisure, depending on the type of household they belong to.[15] It is because in Zambia women with higher education are concentrated in rich households, while women with less education mainly belong to poor ones, that the decline in female non-market time is larger for the latter than for the former.

The impact on wages too differs between these two groups of female workers, with gains being smaller for the higher educated. Women with secondary education are in fact the ones for whom wages increase the least in absolute terms (0.4 per cent) and decline the most (1.1 per cent) relative to men. This is because the sectors that expand in the experiment on average use uneducated female labor more intensively

[15]Differences among households are not discussed in detail in this paper. Household-disaggregated results for this experiment are available on request. Fontana (2001) and Fontana (2002) analyze this aspect for other simulations.

than secondary educated labor. As for other categories of female workers, employment rises by 0.4 per cent for women with primary education, while their wages increase by 0.8 percent in absolute terms but fall by 0.5 per cent relative to men. Employment of women with tertiary education increases by 0.6 per cent and their wages by 1.0 per cent. The results are reported in table 12.

Table 12 – Effects of tariff abolition on employment and wages, Zambia (percentage changes from base case)

	F no ed	F prim ed	F sec ed	F post ed	Total female	Total male
Employment						
All market sectors, of which	**1.1**	**0.4**	**1.1**	**0.6**	**0.7**	**1.1**
Groundnuts & horticulture	0.0	0.1	-	-	0.1	-0.2
Commercial crops	6.7	0.0	-	-	6.7	6.4
Food & livestock	-0.4	-0.3	-	-	-0.3	-0.6
Fishing & forestry	0.6	0.8	1.0	0.7	0.8	0.5
Maize	2.3	2.4	-	-	2.4	2.1
Infrastructure	5.7	5.8	6.0	5.7	5.9	5.5
Mining	13.8	14.0	14.2	13.9	14.1	13.7
Intensive-intensive manufacturing	0.8	0.9	1.1	0.8	0.8	0.5
Capital-intensive manufacturing	-1.8	-1.7	-1.5	-1.8	-1.6	-2.0
Market services	0.9	1.0	1.2	0.9	1.1	0.7
Trade & Transport	0.5	0.6	0.8	0.6	0.6	0.3
Public services	0.1	0.2	0.4	0.1	0.3	-0.1
All social reproduction	**-0.5**	**-0.4**	**0.0**	**-0.1**	**-0.4**	**-0.4**
All leisure	**-1.1**	**-0.9**	**-0.4**	**-0.2**	**-0.8**	**-0.8**
Hourly wages						
Absolute	1.0	0.8	0.4	1.0		
Relative to males	-0.8	-0.5	-1.1	-0.3		

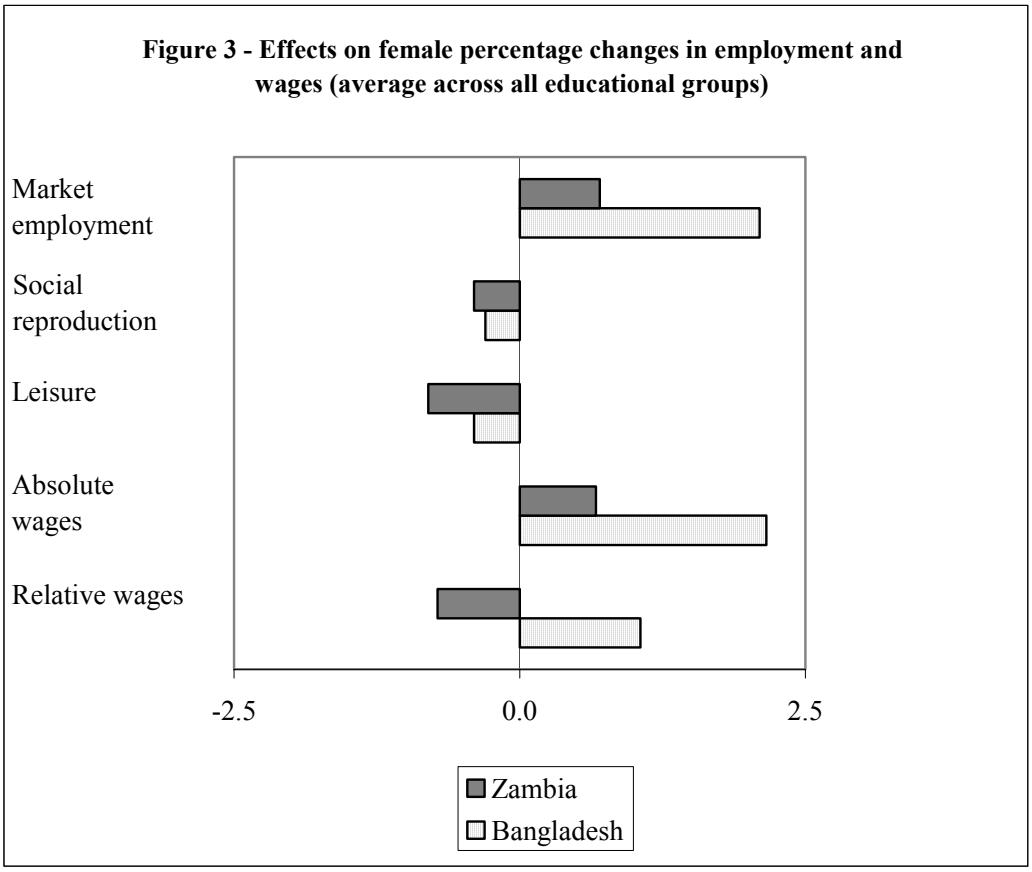
Source: Simulation results

Changes in the functional distribution of income favor female labor over male labor and labor over land and capital in Bangladesh, while in Zambia non-labor factors gain more than labor factors, and capital gains more than land.

To conclude, the gender impact of tariff abolition appears overall to be more positive in Bangladesh than in Zambia. In Bangladesh women gain in terms of higher

market employment and wages. Importantly, it is not only their absolute wages that increase, but also their wages relative to men. In Zambia, absolute income gains are smaller than in Bangladesh while the gender wage gap widens. Thus, in Bangladesh, outcomes are favorable not only because a 'practical' gender interest (an increase in the total female wage bill) is satisfied, but also because an opportunity arises for a 'strategic' gender interest to be met (through redressing the gender imbalance in economy-wide wages).

Figure 3 - Effects on female percentage changes in employment and wages (average across all educational groups)



In both Bangladesh and Zambia higher female market employment means that women spend less time on caring for families and leisure activities. This decline in non-market time is more marked in Zambia than in Bangladesh. In Bangladesh, the narrowing of the gender wage gap, and thus the increase in the opportunity cost of

female workers' time relative to that of male workers, encourages some substitution of male for female labor in social reproduction, potentially leading to a more equitable allocation of tasks within the household.[16]

III.2. Other experiments

Once the investment of constructing a model has been made, a large number of experiments of many kinds can easily be undertaken. In this section, four more simulations are described. Two are variants of the main experiment analyzed in section III.1. The first experiment increases the price elasticity of social reproduction as a proxy for greater responsiveness of the consumption or output of social reproduction to changes in its relative price (and hence more flexibility in the allocation of women's time). The second simulation increases the elasticity of substitution in production between male and female workers in both the market and the household to explore the effects of greater responsiveness of the mixture of female and male workers to changes in their relative wages. The other two simulations in this section analyze different sorts of trade changes: the third experiment simulates the introduction of an across-the-board tariff of 20 per cent and the fourth simulates an increase in the import price of food grains.

[16] This happens because the model assumes that the world works in a 'Beckerian' way. According to Becker (1965), an increase in the market value of women's time of a sufficient magnitude would bring about a re-allocation in the division of labor with women increasing their time into market-oriented activities while men reallocated some of their time into domestic or other non-paid uses of their time. In reality, the intra-household division of labor might not be very responsive to economic incentives because many aspects are governed by strong social and cultural norms. Estimates of the relative role of economic incentives and social customs in determining the allocation of household work (for example, Fafchamps and Quisumbing, 1999, on rural Pakistan) show that both are important. A way of representing this in the current model is to vary the elasticity of substitution between male and female labor in non-market activities or the price elasticity of demand for social reproduction.

III.2.1. Higher price elasticity of demand for social reproduction

In this version of the main experiment the price elasticity of demand for social reproduction is set close to – 1.0, compared to –0.3 in the main experiment in Zambia and –0.5 in Bangladesh.[17] The main effect of higher responsiveness of consumption of social reproduction services to changes in their relative price is that women's non-market time declines more in social reproduction and less in leisure, compared with the main experiment. The higher elasticity of demand for household work permits a larger outflow of female labor from social reproduction both in Bangladesh and in Zambia, but the way in which women's time released from the household is reallocated to other activities varies between the two countries, depending on the female intensity of their other sectors, both in the market and the non-market sphere. As shown in tables 13 and 14, in Zambia the main effect is to make the increase in female market participation larger, especially for women with no education and with primary education, who work mainly in agriculture. Their involvement in crop production is higher than in the main experiment and, as a result, output in this sector rises more. On average, however, gains in female wages are smaller than in the main experiment, and the gender wage gap widens more. In Bangladesh, the main effect is to allow the outflows from leisure to be smaller. The increase in market participation is smaller too, especially for semi-skilled women (with primary and secondary education), who constitute the majority of workers in the garment sector. For these workers, gains in absolute wages are about the same as in the main experiment but the gender wage gap narrows less. Because of the smaller increase in manufacturing,

[17] The relationship between different parameters and elasticity values in the Linear Expenditure System (LES) is quite rigid. Changing the price elasticity value for one commodity involves changing all other price and income elasticities for each household type, to satisfy Engel's law (sum of marginal budget shares must be equal to one). The new value of the price elasticity for social reproduction in both countries was chosen so as to keep adjustments to other parameters within a reasonable range.

market output rises slightly less than in the main experiment, social reproduction declines more and leisure falls less.

Table 13 – Effects of higher demand elasticity for social reproduction on output (percentage changes from the base case)

	Bangladesh	Zambia
Market, of which:	0.4	0.6
Agriculture	-0.3	0.5
Mining	-	1.8
Manufacturing	2.7	0.1
Services	0.2	0.4
Social reproduction	-0.3	-0.5
Leisure	-0.1	-0.6

Source: Simulation results

Since women appear to be more 'time-poor' in Zambia than in Bangladesh (recall from table 3 that leisure constitutes 22 per cent of women's time in Zambia and 34 per cent in Bangladesh), one would have hoped to see a more significant effect (i.e. a much smaller decline of) on women's leisure in Zambia, from simulating a higher elasticity of demand for their household work. This however could have not been expected given the model structure. Because in Zambia commercial crops and maize, the production of which increases as a result of tariff abolition, are more female intensive than leisure, most of the female time released from social reproduction is spent on working more in agriculture. Conversely in Bangladesh, because leisure is more female intensive than most market sectors, the time freed up from household work mainly attenuates the decline in leisure.

Table 14 – Effects of higher demand elasticity for social reproduction on female market participation and wages (percentage changes from the base case)

	F no ed	F prim ed	F sec ed	F post ed	Total female	Total male
Bangladesh						
Market employment	1.2	2.8	3.2	2.4	1.8	0.1
Social reproduction	-0.3	-0.5	-0.5	-0.5	-0.4	-0.2
Leisure	-0.1	-0.2	-0.3	-0.1	-0.1	0.0
Wages						
Absolute	1.9	2.9	2.4	1.3		
Relative to males	0.9	1.7	1.1	-0.1		
Zambia						
Market employment	1.3	0.6	1.1	0.5	0.8	1.1
Social reproduction	-0.8	-0.6	-0.1	-0.1	-0.6	-0.6
Leisure	-1.0	-0.8	-0.4	-0.2	-.0.7	-0.8
Wages						
Absolute	0.8	0.6	0.3	1.1		
Relative to males	-1.1	-0.8	-1.2	-0.3		

Source: Simulation results

III.2.2. Higher elasticity of substitution in production

In this variant of the experiment, the elasticity of substitution between male and female workers, for each skill category, is increased from -0.5 to -2.5 in all market sectors and from -0.25 to -1.25 in all non-market sectors. In Zambia there are no significant differences in sectoral output changes compared with simulation III.1. The higher substitution elasticity causes a marginally higher rise in total market participation for women with no education and women with secondary education, while the effect on market participation for women with primary and tertiary education is unchanged. Women with no education and secondary education experience also a larger decline in social reproduction time while the decline in leisure is the same as in the previous experiment. In Bangladesh, too, differences

from the main experiment, in terms of both output changes and female market force participation, are slight. Changes in market participation for women with no education and secondary education are the same as in the main simulation. Market employment increases marginally less for women with primary education (while their leisure time declines more) and more for women with higher education.

Table 15 – Effects of higher elasticity of substitution in production on output (percentage changes from the base case)

	Bangladesh	Zambia
Market, of which:	0.5	0.6
Agriculture	-0.2	0.4
Mining	-	1.8
Manufacturing	3.2	0.1
Services	0.2	0.4
Social reproduction	-0.2	-0.4
Leisure	-0.3	-0.7

Source: Simulation results

Table 16 – Effects of higher elasticity of substitution in production on female market participation and wages (percentage changes from the base case)

	F no ed	F prim ed	F sec ed	F post ed	Total female	Total male
Bangladesh						
Market employment	1.4	3.0	3.4	2.3	2.0	0.3
Social reproduction	-0.1	-0.4	-0.3	-0.2	-0.2	0.0
Leisure	-0.4	-0.6	-0.5	-0.4	-0.4	-0.3
Wages						
Absolute	1.5	2.4	2.1	1.6		
Relative to males	0.5	1.0	0.8	0.3		
Zambia						
Market employment	1.2	0.4	1.2	0.6	0.7	1.1
Social reproduction	-0.6	-0.4	-0.1	-0.1	-0.4	-0.5
Leisure	-1.1	-0.8	-0.4	-0.2	-0.7	-0.8
Wages						
Absolute	1.3	1.0	0.9	1.1		
Relative to males	-0.2	-0.1	-0.3	-0.1		

Source: Simulation results

Even though these changes are slight, it is possible to note some dissimilarity between Bangladesh and Zambia, particularly as regards patterns across educational categories. In Bangladesh, the higher elasticity of substitution affects female workers with primary and tertiary education, but hardly alters the impact on women with no education and secondary education. Conversely, in Zambia, it is these two latter categories which are most affected, while the effects on female workers with primary and tertiary education are unchanged compared with the main simulation. These differences can be explained by the different wage patterns by level of education in the two countries.

To sum up, the variants of the main experiment described in sections III.2.1 and III.2.2 show that higher price responsiveness of social reproduction and higher elasticity of substitution in production between male and female labor matter for the overall impact of tariff abolition.[18] These elasticities are determined by a variety of social and cultural factors. The effects of changing them can be positive or negative for gender equality, depending on the gender composition of the non-market sectors relative to market sectors, and on the extent and nature of the gender wage gap.

III.2.3. Uniform tariff of 20 per cent

The introduction of an across-the board tariff of 20 per cent, just above the average tariff rate in the two countries, was also simulated. Uniform taxation has the effect of making protection higher in sectors with previously low tariffs and lower in sectors with previously high tariffs. In both Zambia and Bangladesh the least protected sector is agriculture– especially commercial crops (coffee, cotton, tobacco and maize in Zambia and jute, tea and sugar in Bangladesh) while vegetable and food

[18] However the effects of changes in these parameter values are rather weak. Sensitivity analysis over a wider range of values will be undertaken as a way of testing the robustness of the results.

production, traditionally female intensive, are more protected. Commercial crops use on average more agricultural land than other crops and employ more male than female labor. In Zambia a larger share of the labor force (about 40 per cent) than in Bangladesh (about 3 per cent) in this sector is female, but consists only of uneducated women, often working on their husband's crops as unpaid family labor. Although different mechanisms operate in Bangladesh and Zambia, the main effect of uniform tariffs in both is an overall small decline in market output (with agriculture production increasing and all other activities declining), a slight increase in leisure and almost no change in social reproduction. This is shown in table 17.

Table 17 – Effects of uniform protection on output (percentage changes from the base case)

	Bangladesh	Zambia
Market, of which:	-0.2	-0.3
Agriculture	0.2	0.1
Mining	-	-1.0
Manufacturing	-1.2	-0.1
Services	-0.1	-0.2
Social reproduction	0.0	0.1
Leisure	0.0	0.2

Source: Simulation results

In agriculture, as expected, the rise is in male-intensive commercial crops and away from female-intensive crops. Production of the main export – copper in Zambia and ready-made garments in Bangladesh – falls, but more so in Bangladesh (8 per cent compared with 1 per cent in Zambia), where RMG are more dependent than mining in Zambia on imported inputs whose price increases as a result of the tariff (the tariff on other textiles used in garment production is below average in the base case). The resulting impact on the functional distribution of income in both countries is that returns to land rise while returns to all other factors fall. This is paradoxical in Zambia given the difference in land/labor ratios. A simple Heckscher-Ohlin analysis

would lead one to expect that an across the board rise in protection would reduce the returns to land in Zambia because it is the abundant factor. The reason is that land in the model is only agricultural land and hence does not include natural resources.

As described in table 18, female wages decline in absolute terms in both Bangladesh and Zambia, with the exception of uneducated female workers in Zambia who gain slightly from expansion of commercial crops. Because of likely gender asymmetries in relations of production, however, it is not clear whether these women would have control over their higher income or whether this would be managed by their male relatives. Because in Bangladesh the economy-wide demand for female labor declines more than the demand for male labor, the gender wage gap widens. Conversely, in Zambia, because the economy-wide demand for male labor declines more than the demand for male labor, the gender wage gap narrows, except for women with primary education who are the most negatively affected by the decline in female-intensive agriculture.

Table 18 – Effects of uniform protection on female market participation and wages (percentage changes from the base case)

	F no ed	F prim ed	F sec ed	F post ed
Bangladesh				
Market employment	-0.3	-0.6	-0.5	-0.2
Social reproduction	0.0	0.1	0.1	0.0
Leisure	0.1	0.1	0.1	0.0
Wages				
Absolute	-0.2	-0.4	-0.6	-0.8
Relative to males	-0.4	-0.6	-0.6	-0.4
Zambia				
Market employment	0.0	-0.1	-0.5	-0.3
Social reproduction	-0.1	0.1	0.0	0.0
Leisure	0.1	0.2	0.2	0.1
Wages				
Absolute	0.1	-0.4	-0.3	-0.7
Relative to males	0.5	-0.1	0.7	0.2

Source: Simulation results

III.2.4. Higher import price of food grains

Both Bangladesh and Zambia are net importers of grains. Reform of agricultural policies in OECD countries could cause a rise in the world price of food. An increase by (an arbitrary) 50 per cent of the world price of rice and wheat in Bangladesh and of maize in Zambia was thus simulated to assess the likely gender effects of these reforms. Only 24 per cent of the labor force in grain production in Bangladesh is female, with the majority of it being uneducated. In Zambia maize production employs a larger proportion of women (54 per cent of the total labor force in this sector) and these women mostly have primary education. The rise in the import price of grain causes an increase in its domestic production in both countries, although in Zambia by a larger extent than in Bangladesh (Table 6 shows that Zambia is more import dependent in grain than Bangladesh). Output declines marginally in all other

sectors. As shown in table 19, in Zambia social reproduction and leisure fall by the same proportion (0.2 per cent) while in Bangladesh leisure declines by 0.1 per cent and social reproduction is unchanged. These differences in the behavior of the non-market sectors reflect different wage effects in the two countries, namely small (both absolute and relative) increases in female wages in Zambia and declines in female wages in Bangladesh.

Table 19 – Effects of higher import price of grains on output (percentage changes from the base case)

	Bangladesh	Zambia
Market, of which:	0.0	0.0
Agriculture	0.3	0.7
Mining	-	-0.1
Manufacturing	-0.5	-0.4
Services	-0.1	-0.1
Social reproduction	0.0	-0.2
Leisure	-0.1	-0.2

Source: Simulation results

Because the sectors that expand use land relatively more intensively than the sectors that contract, in both countries the resulting functional income distribution favors land over other factors of production. Female workers gain in terms of employment and wages in Zambia, while in Bangladesh the gender impact in the market economy appears negative. The results are reported in table 20. The gender wage gap narrows for all women in Zambia. Female wages rise also in absolute terms, for women with no education and with primary education. Their market participation increases by about 0.5 per cent and their time inputs into household work and leisure decline slightly, by a similar proportion. Conversely, in Bangladesh female wages decline for all, both absolutely and relative to men.[19] Uneducated women's market

[19] A similar simulation with a simplified data set for an earlier period (Fontana and Wood, 2000:1180-1181) lead to conclude that in Bangladesh the impact of higher food import prices on women's absolute and relative wages was positive. This was because of the very aggregate level of the SAM,

participation increases (by 0.2 per cent) at the expense of their leisure while their participation in social reproduction remains the same. Employment changes for women with higher education – who do not work in agriculture - are slight in both countries but their wages decline, due to lower demand for non-market services, which is more marked in rich households (where the majority of highly educated female workers live).

Table 20 – Effects of higher import price of grains on female market participation and wages (percentage changes from the base case)

	F no ed	F prim ed	F sec ed	F post ed
Bangladesh				
Market employment	0.2	0.2	0.2	0.2
Social reproduction	0.0	0.0	0.0	0.0
Leisure	-0.1	-0.1	-0.1	-0.1
Wages				
Absolute	-0.2	-0.3	-0.5	-0.7
Relative to males	-0.6	-0.5	-0.5	-0.3
Zambia				
Market employment	0.7	0.5	-0.1	0.0
Social reproduction	-0.4	-0.6	0.1	0.0
Leisure	-0.5	-0.7	0.0	0.0
Wages				
Absolute	0.3	0.6	-0.7	-0.8
Relative to males	0.6	0.3	0.2	0.1

Source: Simulation results

In both simulation III.2.3 and simulation III.2.4 the main change, although in each experiment for different reasons, is an increase in agricultural output and decline in other production, both market and non-market. Within agriculture, it is one particular crop that expands at the expense of other crops – commercial crops, as a result of uniform tariffs, and grains, as a result of possible agricultural reforms in OECD countries. In both cases, and in both countries, this expansion is offset by a fall

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which had only one agricultural sector and did not distinguish between female-intensive and male-intensive crops.

in female-intensive agricultural production of vegetables and other basic food staples that are less exposed to international trade. The effects on women's well being are ambiguous and vary between uneducated female workers, who are directly affected by these changes, and women with higher education, who do not work in agriculture. Women's wages tend to decline in absolute terms in both countries but increase in relative terms in Zambia. This however is due to downward equalization of wages rather than upward equalization, with male wages declining even more than female wages. Increases in uneducated women's participation in agriculture are at the expense of their leisure. Moreover, because of likely inequalities in intra-household allocation of power and resources, it is not clear whether these women, mostly working as unpaid family labor on fields managed by male relatives, would have control over higher income earned.

IV. COMPARISON OF METHODS

Many different methods can be used to analyze the gender effects of economic reforms: qualitative methods, econometric methods and modeling methods. Each of these methods includes in turn a variety of approaches. For example, some econometric studies use time-series analysis while others are based on panel data analysis. Single-country static general equilibrium models, such as those used in this paper, are only one of many types of models. Modeling can be at the household level, country level or global level, could focus on specific sectors (partial equilibrium) or on the whole economy (general equilibrium) and be either dynamic or static.

Each approach has strengths and weaknesses. No single method or discipline can provide all the answers and often a combination of tools is the best solution. This

combination can take various forms. In some cases it might be preferable to use different methods simultaneously but separately, while in others (for example when qualitative information from anthropological and sociological studies is used to specify some model behavior) a full integration of approaches can be more effective.[20] Validating model results with studies from other methods can also significantly strengthen their influence on policy (Devarajan and Robinson, 2002).

This section compares the model results described in the previous sections with other work in the gender and trade literature. It is divided in three main parts. The first part highlights results that are the same as with other methods. The second part discusses ways in which the modeling approach contributed to a better understanding of the impact (its 'strengths'). The third part examines aspects that the Bangladesh and Zambia models did not cover (their 'limitations'). Some of these limitations are specific to the models used in this paper, while others are characteristic of CGE modeling in general. The third part also suggests how SAMs/CGE models could be improved, so as to reduce their shortcomings relative to what we would like to know about the gender impact of trade.

IV.1. Results in common with other methods

The simulation findings that trade liberalization raises female employment and wages in a abundant-abundant country like Bangladesh but is not as beneficial for women in a natural resource-abundant country like Zambia are consistent with other evidence. Several studies –mainly case studies of specific sectors or firms, and some cross-country econometric analyses (reviewed in Joekes and Weston, 1994 and Joekes

[20] For an interesting discussion on integrating qualitative and quantitative methods in development research see Kanbur (2002) and Kanbur (2001).

1999a) – show that the growth of export-oriented manufacturing, especially in South and South-east Asia, has created many jobs for women, at wages which, though lower than those of men, are higher than they could have earned in the alternative forms of work open to them. Very little research exists on the impact of trade on women in mineral-rich countries like Zambia. The limited research on Sub-Saharan Africa focuses on agriculture. It shows that the impact of expanding exports in this sector is generally less favorable to women and varies according to the prevailing systems of property rights and to other socio-cultural factors governing the gender division of labor (Gladwin, 1992, Joekes, 1999b).

The SAMs and CGE models in this paper expose reasons for the differences in impact. They clearly show where women are located in the economy, and highlight the mechanisms through which changes in the domestic prices of imports and exports affect a country's output structure and hence its factor demand (and wages). Thus in Bangladesh, where the main export is female intensive (and low skill intensive), women benefit from trade liberalization. Conversely in Zambia, where the main export is a mineral resource that is highly capital and male intensive in production, women are disadvantaged by greater exposure to trade. Moreover, when agricultural output rises because of trade shocks such as uniform protection or higher import prices for grains, women are adversely affected, in both Bangladesh and Zambia, despite being heavily involved in this sector. This outcome, as a glance at the two SAMs reveals, is due to a marked gender division of labor in both countries (although more so in Bangladesh than in Zambia) that assigns women to crops mainly used for household consumption and limits their involvement in commercial crops.

An important point made in feminist economics research (most notably by Elson, 1991) is that increases in female market employment might be at the expense of the time women devote to caring for their families, or, more likely, of their leisure. It often results in heavier work burdens and a decline in well being. Macro-economic analysis that omits explicit consideration of household work and assumes that women's unpaid labor is infinitely elastic points a seriously incomplete picture of the impact of changes in policies on the welfare of women and of their dependents. By incorporating social reproduction and leisure sectors, the model used in this paper addresses these concerns and operationalizes them numerically.

The responsiveness of gendered aspects of the division of labor to changes in economic incentives – for example, how much the amount of time women spend on household activities falls in response to improvements in their market wage or employment opportunities– varies depending on a wide range of social and cultural norms. This point is often made in the sociological and anthropological literature. In an analysis of foreign direct investment in Indonesia, Braunstein (2000) discusses how family structures and institutional contexts influence female labor supply. She suggests that women heads of households with few job alternatives available to them may be prepared to work for much lower wages than women in patriarchal households. Changes in institutional arrangements or economic circumstances might also affect women's reservation wages, such as when '... subcontracting in the form of industrial homework is introduced, so even in situations where male heads prefer their wives to stay at home, wives' reservation wages for homework might be very low while those for waged employment outside the home are still high.' (Braunstein, 2000:1164). Although not all of these interesting dimensions and nuances can be represented explicitly in the CGE framework, some can be implicitly captured by the

value of key parameters in the model: for instance, the elasticity of substitution between male and female labor in market and non-market production, and the price elasticity of demand for social reproduction. Depending on the values assigned to these key parameters, the magnitudes of the effects of the experiments in this paper have been shown to vary, which is important to consider when designing policies.

IV. 2. Results not attainable by other methods

The gendered CGE models of Bangladesh and Zambia provide an integrated framework for the analysis of the effects of trade on women which allows consideration of more constraints and interactions than it is possible using other methods.

Most existing research on the gender impact of trade liberalization looks at specific firms or sectors in isolation, or only at one aspect of welfare (employment or consumption), and hence does not provide sufficient analysis of linkages among different dimensions. Partial equilibrium analysis assumes that repercussions from one market to another will be slight and neglects the indirect effects that change in one sector may have on prices, output and employment in other sectors (both market and non-market). Such approaches cannot produce an accurate measurement of net outcomes – it would not be possible to know whether, for example, the number of female jobs that are destroyed in sectors producing import-substitutes would be greater than the number of female jobs created in female-intensive exporting sectors. Or whether the positive effect on well being from higher wages and market employment would be more than offset by the negative impact on it from reduced leisure.

Moreover, the use of a partial sectoral method to assess the impact of a trade shock in a non-female-intensive sector, would be highly likely to lead to conclude that the shock did not have any gender implications, even though the indirect effects on women were substantial. Most studies of the manufacturing sector in Bangladesh and elsewhere explore effects at the household level (for example Zohir and Paul-Majumdar, 1996), but do not consider linkages with the rest of the market economy. Some of the Africa agricultural studies (for instance Kennedy, 1988 on Kenya, Kumar, 1994 on Zambia and Katz, 1995 on Guatemala) do however go beyond a single-sector approach, since they examine the effects of commercialization of certain crops on the food production sector, on other non-farm activities, and on consumption as well as income – important steps towards a general equilibrium analysis.

One of the most important advantages of CGE modeling over other existing methods is its ability to include a wide range of macroeconomic, sectoral and social impacts and to provide economy-wide quantification of these effects. It is important to know whether effects of a specific policy measure are big or small and what are the main causal chains. By providing a simulation laboratory for controlled experiments, CGE models improve our understanding of the many ramifications induced by a shock and highlight the strength of various forces at work. This can help to expose particular mechanisms that had not been apparent before.

By contrast with the sectoral studies, more conventional CGE models permit analysis of both direct and indirect effects of trade policies. However, by excluding the household and leisure sectors, they disregard important broader welfare implications and are likely to yield inaccurate results about the impact of such reforms on standard market variables. Within the CGE modeling methods class, gendered

models get closer than non-gendered models to results obtained by other methods. Fontana and Wood (2000) provide an example of this in their analysis of an archetype Bangladesh model, by comparing results of the same experiment run with and without the non-market sectors. Exclusion of social reproduction and leisure from the model not only omits important information about women's activities and well being, but also makes the supply of labor to the market economy less flexible. This results in changes in wage rates and employment of men and women that are quantitatively different, although qualitatively similar, from those simulated with the gendered model.

IV. 3. Model limitations and suggestions for further research

The Bangladesh and Zambia CGE models shed no light on whether gains in female employment from greater trade openness would be sustained over time. Recent studies based on time-series analysis (e.g. Kusago and Tzannatos, 1998, Joekes, 1999) point to a decline in women's share in the manufacturing labor force of several middle-income countries (such as Mexico, Malaysia and South Korea)– a phenomenon often referred to as 'de-feminization' of employment. Female workers do not seem able to maintain their position within the industrial workforce as the composition of exports moves towards more technologically sophisticated goods. Changes over time in gender patterns of production have been observed also in some African agriculture– these too, often, to women's disadvantage. Evidence (Blackden and Selim, 1993, and Saito, 1994) seems to suggest that, as the prospects for market sales of a crop rises, more men tend to move into its production, e.g. groundnuts in Zambia. On a more positive note, case studies of Bangladesh (Kabeer, 2000, Zohir and Paul-Majumdar, 1996) suggest that increasing female employment has the

potential to change families' attitudes towards considering daughters as assets instead of liabilities. This could lead to more girls being sent to school and hence to a better educated female labor force in the future. These long-term changes are likely to affect strategic gender interests in important ways and are better captured by other methods, such as time-series econometrics and qualitative case studies.

Time-series analysis indicates dynamic processes of the gender patterns of work. This brings attention to 'surprises'- or deviations from expected trends some of which could not be anticipated by a model. For a better understanding of the nature of, and reasons for, these 'surprises', qualitative approaches are particularly valuable. Even though qualitative methods might have the disadvantage that their findings cannot be generalized (if random samples are not used), they add depth and nuances to the analysis that could not be captured by any of the quantitative methods. Kabeer (2000), for example, provides a fascinating analysis of the unexpected large rise in female employment in Bangladesh in the 1980s. Through analysis of in-depth interviews of female factory workers and of their family members, her study points to the diversity of social, cultural and economic factors that shape women's behavior and that of their employers.

The model used in this analysis is a single period static model and assumes labor endowments and production technology to be fixed.[21] In principle however CGE models can be made dynamic. For instance, the potential positive long-term effect of trade expansion on female education in Bangladesh could be captured in the model by considering a sequence of equilibria whereby in each period the skill level of the

[21] Changes in production methods or labor endowments could of course be simulated as part of an experiment.

female labor force is updated, and the extent of this change is a function of increases in female-intensive production or a similar such hypothesis. Insights from qualitative research and time-series could significantly contribute to a better design of the model.

The Bangladesh and Zambia models were not able to establish conclusively whether rises in female employment and earnings translate into welfare gains for women. This is because the CGE approach used in this paper does not take into account the nature of production relations and the unequal distribution of power and resources between different people.

An intricate web of institutions and norms mediates individuals' access to resources and its translation into impact, which in-depth qualitative research is better able to explain. Several anthropological and sociological studies (Beneria and Roldan, 1987), for example, suggest that, in general, women are more likely to exercise control over the proceeds of their labor when it is carried out in forms of production which are independent of male household members and in social relationships outside the familial sphere. Kabeer (2000) provides an interesting example of this in her study of the effects of the clothing industry on two different groups of Bangladeshi women, one working in factories in Dhaka and one involved in home-based work in East London. While in Bangladesh the regularity of the wages from the factory jobs, and the location of the work outside the control of male relatives, has increased women's influence on household decisions, and permitted them to escape from situations of oppression, in London the organization of work around home-based piecework has meant that the empowering effects have been weak. The CGE model, in its current formulation, would record in both cases an increase in female income, without detecting any difference in outcomes arising from differences in women's ability to

control resources. This would be a limitation also in the analysis of the agricultural sector, where the organization of production often differs by crop. A contractual wage labor force whose terms and conditions of employment are akin to those of industrial workers often prevails in non-traditional agriculture (such as cut flowers and beans in Zambia), thus providing women with greater control over their earnings. Conversely, production of more traditional crops is organized in farms owned by male relations where women work as unpaid family labor (Joekes, 1999b).

A more fully developed model of the household based on bargaining behavior could redress some of these limitations. Game-theoretic approaches – which introduce the idea of preference heterogeneity, bargaining power divergences and individual resource control – are increasingly used to model household decision-making (for example Smith, 1999 and Warner and Campbell, 2000). Collective household models have the advantage that they allow consideration of unequal intra-household resource allocation. However they take the rest of the economy as given and thus neglect feedback effects.

Ideally, if data on consumption and assets were available for each household member, some intra-household allocation aspects could be explored within a CGE framework. This could be done by simply assigning different weights to individual utility functions of women and men. These weights could be chosen so as to reflect differences in asset ownership between spouses (which studies have shown is an important determinant of bargaining power). It might be desirable to take intra-household analysis a step further, by nesting a fully developed household model within a CGE model. This would allow consideration of more interactions between

macro and micro dimensions than other approaches, but would have the disadvantage of high computational complexity.

The values of elasticities of substitution between factors of production, income and price elasticities of household consumption, and trade elasticities – parameters that must be set independently of the data in the SAM– are based in the Bangladesh and Zambia models on 'educated guesses'. It would be desirable to estimate model parameters by using econometric approaches. The use of econometric estimates would provide a more accurate description of the behavioral responses of women to labor market changes. Econometrics could also be useful in guiding the choice of other features in the model – suggesting for example what are the most appropriate functional forms for wage equations or demand systems.

A shortcoming of CGE models more in general is to disregard the process required to move from the initial to the final equilibrium state, thus ignoring adjustment costs. For example, women who lose their jobs in import substituting industries might not be able to take advantage of newly created opportunities elsewhere in the economy in the short run, or not at all, if adequate training and assistance is not provided or severe constraints to their physical mobility remain. Some studies of displaced workers (for example Beneria, 1998) provide information by gender on the circumstances of their lay-offs, availability of re-training, length of their unemployment spells, quality of any new employment available to them, and other impacts at the family level. The value of these studies is to highlight important short-term effects neglected by the modeling approach.

Finally, CGE models cannot say anything about women's and men's perceptions and feelings. Subjective happiness is a concept that covers many more aspects of human welfare than the standard concept of utility based on revealed preferences (for a review see Frey and Stutzer, 2002). '…Oddly, while economists generally think that people are the best judges of their own welfare, they resist asking people directly how they feel' (Ravallion, 2001 cited in Kanbur, 2002). Research needs to incorporate the possibility that, in some cases, women might not enjoy their higher income if they face increased social tensions as a result of taking paid work. In other cases, women might derive important psychological benefits from paid work that more than compensate for the loss of leisure time and any social censure. Even as regards taking care of children and the elderly in the household, perceptions across individual women might vary from feeling happy to feeling overburdened. Satyajit Ray, in the 1960s Bengali movie 'Mahanagar' (The big city), beautifully illustrates the complexity facing women in these choices. Addressing these problems require information which is not found in conventional economic analysis but on which there is a growing literature in other disciplines (for example Chen, 1997 and Mohamed and Rajan, 2003).

IV.3.1 SAM extensions

The suggestions for model development made in the previous section could only be implemented with better and richer data. There are many ways in which SAMs could be further extended or complemented to permit a richer gender analysis. The ones described here fall mostly under the category of 'internal satellite accounts', i.e. disaggregations of existing SAM accounts. Some suggestions for a few additional 'external satellite accounts' are also made.

Consumption, which is usually reported by household, could be recorded instead for each type of worker or individual household member. This would give an indication of how resources are allocated within the household and hence how policies which affect production or consumption of one particular commodity, or the income of one particular group of workers, would have different implications for the consumption levels of different household members.

A distinction could be made between assets owned by female household members and assets owned by male household members, as well as between any transfer received by them (to document for example whether any child benefit from the government is paid directly to mothers), as these could be useful indicators of bargaining power (Quisumbing and de la Briere, 2000). It would also be helpful to account separately for items of public expenditure (health, education, etc.) and to trace by individual, and not by household, who benefits from government provision of public services.

It could be desirable to account for transportation and other transaction costs by gender. These are often higher for women than for men, for example in most African agricultural sectors (Malmberg Calvo, 1994), which might explain why a high proportion of agricultural production by women remains non-marketed. Some SAMs (for example Zambia (Hausner, 1999) and Mozambique (Arndt et al., 1999)) report already separate accounts for marketing costs by sector.

The social reproduction sector could be broken up into several sub-sectors such as childcare, preparing meals and DIY activities. This would allow a better

understanding of gender roles within the household and would help identify which aspects of women's reproductive labor are likely to be most affected when their time inputs to market activities increase. Time allocation studies of developed countries (for example Bonke et al, 2002) show that women usually perform the household tasks which are most energy-intensive and time inflexible, with important implications for their job performance.

Several studies (most notably Floro and Miles, 1999) document that multiple household activities are carried out simultaneously (for example looking after children while cleaning the house). This phenomenon appears to be more frequent among women, who experience greater intensity of work, but not necessarily an increase in working hours, when taking up paid employment. It would not be possible to disentangle the simultaneous undertaking of many activities such as cooking, housekeeping and childcare, but perhaps a way to record an activity in the SAM as producing joint outputs could be found.

Household caring activities have positive social effects and important implications for the well being of the future workforce. It would be helpful to know what is the impact of time re-allocation on dependents when women take up paid market work. Information could be incorporated, for example, on children's labor by gender, to monitor whether girls and boys are kept out of school to undertake household tasks that their employed mothers no longer have time to complete (see for example Katz, 1995). Some indicators could also be constructed to link the provision of care to outcomes – using for instance educational levels of the workforce or health statistics.

Perhaps the SAM format could also be used as the organizing principle for describing intra-household allocation of resources, time and power. This could be provided by constructing household level SAMs – as many as the household types in the corresponding economy-wide SAM. In each of the household-SAMs, the household would be treated as if it were a national economy, with various non traded goods produced within the household for home consumption using male, female labor and 'imported' intermediate goods, and exports and imports being the household's cash transactions with the rest of the economy. Household members would be represented in the same way as 'institutions' in the larger SAM, each with separately recorded sources of income, assets, consumption expenditures and transfers to other institutions/household members. Taylor and Adelman (1995) develop a SAM framework for village economies which are described with their own specific institutions and socio-cultural structures. Their study seeks to analyze the functioning of the village economy as well as economic interactions between different villages and between villages and the wider economy. The construction of household SAMs could take the idea of the village SAM one level further down.

V. CONCLUSIONS

The CGE model used in this paper provides useful insights into the gendered economic outcomes of trade policies that could not have emerged using other approaches. It is applied comparatively to Bangladesh and Zambia. Simulation results highlight how differences in resource endowments, labor market institutions and socio-cultural norms shape the way in which trade expansion affects gender inequalities, resulting in more favorable effects in Bangladesh than in Zambia.

The paper also suggests that some of the gender effects of trade are better analyzed with other methods. In particular, the SAM/CGE approach appears to be more effective in answering questions regarding practical gender needs than in shedding light on how strategic gender needs are affected by economic reforms. No single approach can provide all the insights and information and, hence, the main suggestion of this paper is that a combination of methods be applied.

Methodological tools other than CGE models are useful not only for exploring those dimensions of the gender impact of trade – such as subjective well being or sector-specific changes– that by their very nature require more in depth and more qualitative analyses than what the modeling can offer. Other methods can also be valuable in informing modeling choices. A constant 'dialogue' between methodologies should be encouraged in which insights from one approach are used to enrich, or challenge, findings from another approach. The extent to which different perspectives will be used and how they will be combined will depend, each time, on the particular focus of the analysis and specific country contexts.

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APPENDIX

Table A.1. Mathematical Summary Statement for the CGE Model

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
		$f \in FDIS(\subset F)$	disaggregated factors
		$f \in FAGG(\subset F)$	aggregated factors
$c \in CD(\subset C)$	commodities with domestic sales of domestic output	$i \in INS$	institutions (domestic and rest of world)
$c \in CDN(\subset C)$	commodities not in *CD*	$i \in INSD(\subset INS)$	domestic institutions
$c \in CE(\subset C)$	exported commodities	$i \in INSDNG(\subset INSD)$	domestic non-government institutions
$c \in CEN(\subset C)$	commodities not in *CE*	$h \in H(\subset INSDNG)$	households
$c \in CM(\subset C)$	imported commodities		

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' ∈ INSDNG'; i ∈ 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	$tins01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
$mps01_i$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates	tm_c	import tariff rate
pwe_c	export price (foreign currency)	tq_c	rate of sales tax
pwm_c	import price (foreign currency)	$trnsfr_{if}$	transfer from factor f to institution i
$qdst_c$	quantity of stock change	tva_a	rate of value-added tax for activity *a*

cont. Table A.1.

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 *fagg* in activity *a*
$\alpha_{fagg,a}^{va2}$	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 *f* in activity *a*
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
		$\rho_{fdis,a}^{va2}$	CES lower level value-added function exponent
δ_a^a	CES activity function share parameter	ρ_c^{ac}	domestic commodity aggregation function exponent
δ_{ac}^{ac}	share parameter for domestic commodity aggregation function	ρ_c^q	Armington function exponent
δ_c^q	Armington function share parameter	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		

cont. Table A.1.

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
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)		
PX_c	aggregate producer price for commodity	WF_f	average price of factor
$PXAC_{ac}$	producer price of commodity c for activity a	YF_f	income of factor f
QA_a	quantity (level) of activity	YG	government revenue
QD_c	quantity sold domestically of domestic output	YI_i	income of domestic non-government institution
QE_c	quantity of exports	YIF_{if}	income to domestic institution i from factor f

cont. Table A.1.

EQUATIONS

#	Equation	Domain	Description
Price Block			
1	$PM_c = pwm_c \cdot (1 + tm_c) \cdot EXR + \sum_{c' \in CT} PQ_{c'} \cdot icm_{c'c}$ $\begin{bmatrix} import\ price \\ (LCU) \end{bmatrix} = \begin{bmatrix} import\ price \\ (FCU) \end{bmatrix} \cdot \begin{bmatrix} tariff\ adjust- \\ ment \end{bmatrix} \cdot \begin{bmatrix} exchange\ rate \\ (LCU\ per \\ FCU) \end{bmatrix} + \begin{bmatrix} cost\ of\ trade \\ inputs\ per \\ import\ unit \end{bmatrix}$	$c \in CM$	Import Price
2	$PE_c = pwe_c \cdot (1 - te_c) \cdot EXR - \sum_{c' \in CT} PQ_c \cdot ice_{c'c}$ $\begin{bmatrix} export \\ price \\ (LCU) \end{bmatrix} = \begin{bmatrix} export \\ price \\ (FCU) \end{bmatrix} \cdot \begin{bmatrix} tariff \\ adjust- \\ ment \end{bmatrix} \cdot \begin{bmatrix} exchange\ rate \\ (LCU\ per \\ FCU) \end{bmatrix} - \begin{bmatrix} cost\ of\ trade \\ inputs\ per \\ export\ unit \end{bmatrix}$	$c \in CE$	Export Price
3	$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c}$ $\begin{bmatrix} domestic \\ demand \\ price \end{bmatrix} = \begin{bmatrix} domestic \\ supply \\ price \end{bmatrix} + \begin{bmatrix} cost\ of\ trade \\ inputs\ per \\ unit\ of \\ domestic\ sales \end{bmatrix}$	$c \in CD$	Demand price of domestic non-traded goods
4	$PQ_c \cdot (1 - tq_c) \cdot QQ_c = PDD_c \cdot QD_c + PM_c \cdot QM_c$ $\begin{bmatrix} absorption \\ (at\ demand \\ prices\ net\ of \\ sales\ tax) \end{bmatrix} = \begin{bmatrix} domestic\ demand\ price \\ times \\ domestic\ sales\ quantity \end{bmatrix} + \begin{bmatrix} import\ price \\ times \\ import\ quantity \end{bmatrix}$	$c \in (CD \cup CM)$	Absorption
5	$PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_c \cdot QE_c$ $\begin{bmatrix} producer\ price \\ times\ marketed \\ output\ quantity \end{bmatrix} = \begin{bmatrix} domestic\ supply\ price \\ times \\ domestic\ sales\ quantity \end{bmatrix} + \begin{bmatrix} export\ price \\ times \\ export\ quantity \end{bmatrix}$	$c \in CX$	Marketed Output Value
6	$PA_a = \sum_{c \in C} PXAC_{ac} \cdot \theta_{ac}$ $\begin{bmatrix} activity \\ price \end{bmatrix} = \begin{bmatrix} producer\ prices \\ times\ yields \end{bmatrix}$	$a \in A$	Activity Price
7	$PINTA_a = \sum_{c \in C} PQ_c \cdot ica_{ca}$ $\begin{bmatrix} aggregate \\ intermediate \\ input\ price \end{bmatrix} = \begin{bmatrix} intermediate\ input\ cost \\ per\ unit\ of\ aggregate \\ intermediate\ input \end{bmatrix}$	$a \in A$	Aggregate intermediate input price
8	$PA_a \cdot (1 - ta_a) \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a$ $\begin{bmatrix} activity\ price \\ (net\ of\ taxes) \\ times\ activity\ level \end{bmatrix} = \begin{bmatrix} value\text{-}added \\ price\ times \\ quantity \end{bmatrix} + \begin{bmatrix} aggregate \\ intermediate \\ input\ price\ times \\ quantity \end{bmatrix}$	$a \in A$	Activity revenue and costs

cont. Table A.1.

9	$\overline{CPI} = \sum_{c \in C} PQ_c \cdot cwts_c$ $\left[CPI \right] = \left[\begin{array}{c} prices\ times \\ weights \end{array} \right]$		Consumer price index
10	$DPI = \sum_{c \in C} PDS_c \cdot dwts_c$ $\left[\begin{array}{c} Producer\ price\ index \\ for\ non\text{-}traded\ outputs \end{array} \right] = \left[\begin{array}{c} prices\ times \\ weights \end{array} \right]$		Producer price index for non-traded market output

Production and commodity block

11	$QA_a = \alpha_a^a \cdot \left(\delta_a^a \cdot QVA_a^{-\rho_a^a} + (1-\delta_a^a) \cdot QINTA_a^{-\rho_a^a} \right)^{-\frac{1}{\rho_a^a}}$ $\left[\begin{array}{c} activity \\ level \end{array} \right] = CES \left[\begin{array}{c} quantity\ of\ aggregate\ value\text{-}added, \\ quantity\ aggregate\ intermediate\ input \end{array} \right]$	$a \in ACES$	CES technology: activity production function
12	$\frac{QVA_a}{QINTA_a} = \left(\frac{PINTA_a}{PVA_a} \cdot \frac{\delta_a^a}{1-\delta_a^a} \right)^{\frac{1}{1+\rho_a^a}}$ $\left[\begin{array}{c} value\text{-}added - \\ intermediate\text{-} \\ input\ quantity \\ ratio \end{array} \right] = f \left[\begin{array}{c} intermediate\text{-}input \\ - value\text{-}added \\ price\ ratio \end{array} \right]$	$a \in ACES$	CES technology: Value—Added—Intermediate—Input ratio
13	$QVA_a = iva_a \cdot QA_a$ $\left[\begin{array}{c} demand\ for \\ value\text{-}added \end{array} \right] = f \left[\begin{array}{c} activity \\ level \end{array} \right]$	$a \in ALEC$	Leontief technology: Demand for aggregate value-added
14	$QINTA_a = inta_a \cdot QA_a$ $\left[\begin{array}{c} demand\ for\ aggregate \\ intermediate\ input \end{array} \right] = f \left[\begin{array}{c} activity \\ level \end{array} \right]$	$a \in ALEC$	Leontief technology: Demand for aggregate intermediate input
15	$QVA_a = \alpha_a^{va} \cdot \left(\sum_{fagg \in F} \delta_{fagg\ a}^{va} \cdot QF_{fagg\ a}^{-\rho_a^{va}} \right)^{-\frac{1}{\rho_a^{va}}}$ $\left[\begin{array}{c} quantity\ of\ aggregate \\ value\text{-}added \end{array} \right] = CES \left[\begin{array}{c} aggregatedfactor \\ inputs \end{array} \right]$	$a \in A$	Value-added and aggregated factor demands
16	$W_{fagg} \cdot \overline{WFDIST}_{fagg,a} = PVA_a \cdot (1-tva_a) \cdot QVA_a \cdot \left(\sum_{fagg \in F'} \delta_{fagg\ a}^{va} \cdot QF_{fagg\ a}^{-\rho_a^{va}} \right)^{-1} \cdot \delta_{fagg\ a}^{va} \cdot QF_{fagg\ a}^{-\rho_a^{va}-1}$ $\left[\begin{array}{c} marginal\ cost\ of \\ aggregated\ factor\ fagg\ in\ activity\ a \end{array} \right] = \left[\begin{array}{c} marginal\ revenue\ product \\ of\ aggregated\ factor\ fagg\ in\ activity\ a \end{array} \right]$	$a \in A$ $f \in F$	Aggregated factor demand

cont. Table A.1.

17	$QF_{fagg\ a} = \alpha^{va2}_{fagg\ a} \cdot \left(\sum_{fdis \in F} \delta^{va2}_{fdis\ a} \cdot QF_{fdis\ a}^{-\rho^{va2}_{fagg\ a}} \right)^{-\frac{1}{\rho^{va}_{fagg\ a}}}$ $\begin{bmatrix} quantity\ of\ aggregate \\ factor \end{bmatrix} = CES \begin{bmatrix} disaggregated\ factor \\ inputs \end{bmatrix}$	$a \in A$	Lower level factor aggregation
18	$W_{fdis} \cdot \overline{WFDIST}_{fdisa} = W_{fagg} \cdot \overline{WFDIST}_{fagga} \cdot QF_{fagga} \cdot \left(\sum_{f \in F'} \delta^{va2}_{fdis\ a} \cdot QF_{fdis\ a}^{-\rho^{va2}_{fagga}} \right)^{-1} \cdot \delta^{va2}_{fagg\ a} \cdot QF_{fdis\ a}^{-\rho^{va2}_{fagga}-1}$ $\begin{bmatrix} marginal\ cost\ of \\ disaggregated\ factor\ fdis\ in\ activity\ a \end{bmatrix} = \begin{bmatrix} marginal\ revenue\ product \\ of\ factor\ f\ in\ activity\ a \end{bmatrix}$	$a \in A$ $f \in F$	Disaggregated factor demand
19	$QINT_{c\ a} = ica_{c\ a} \cdot QINTA_a$ $\begin{bmatrix} intermediate\ demand \\ for\ commodity\ c \\ from\ activity\ a \end{bmatrix} = f \begin{bmatrix} aggregate\ intermediate \\ input\ quantity \\ for\ activity\ a \end{bmatrix}$	$a \in A$ $c \in C$	Disaggregated intermediate input demand
20	$QXAC_{a\ c} + \sum_{h \in H} QHA_{ach} = \theta_{a\ c} \cdot QA_a$ $\begin{bmatrix} marketed\ quantity \\ of\ commodity\ c \\ from\ activity\ a \end{bmatrix} + \begin{bmatrix} household\ home \\ consumption \\ of\ commodity\ c \\ from\ activity\ a \end{bmatrix} = \begin{bmatrix} production \\ of\ commodity\ c \\ from\ activity\ a \end{bmatrix}$	$a \in A$ $c \in CX$	Commodity production and allocation
21	$QX_c = \alpha^{ac}_c \cdot \left(\sum_{a \in A} \delta^{ac}_{a\ c} \cdot QXAC_{a\ c}^{-\rho^{ac}_c} \right)^{-\frac{1}{\rho^{ac}_c - 1}}$ $\begin{bmatrix} aggregate \\ marketed \\ production\ of \\ commodity\ c \end{bmatrix} = CES \begin{bmatrix} activity\text{-}specific \\ marketed \\ production\ of \\ commodity\ c \end{bmatrix}$	$c \in CX$	Output Aggregation Function
22	$PXAC_{a\ c} = PX_c \cdot QX_c \left(\sum_{a \in A'} \delta^{ac}_{a\ c} \cdot QXAC_{a\ c}^{-\rho^{ac}_c} \right)^{-1} \cdot \delta^{ac}_{a\ c} \cdot QXAC_{a\ c}^{-\rho^{ac}_c - 1}$ $\begin{bmatrix} marginal\ cost\ of\ com\text{-} \\ modity\ c\ from\ activity\ a \end{bmatrix} = \begin{bmatrix} marginal\ revenue\ product\ of \\ commodity\ c\ from\ activity\ a \end{bmatrix}$	$a \in A$ $c \in CX$	First-Order Condition for Output Aggregation Function
23	$QX_c = \alpha^t_c \cdot \left(\delta^t_c \cdot QE_c^{\rho^t_c} + (1 - \delta^t_c) \cdot QD_c^{\rho^t_c} \right)^{\frac{1}{\rho^t_c}}$ $\begin{bmatrix} aggregate\ marketed \\ domestic\ output \end{bmatrix} = CET \begin{bmatrix} export\ quantity,\ domestic \\ sales\ of\ domestic\ output \end{bmatrix}$	$c \in (CE \cap CD$	Output Transformation (CET) Function
24	$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1 - \delta^t_c}{\delta^t_c} \right)^{\frac{1}{\rho^t_c - 1}}$ $\begin{bmatrix} export\text{-}domestic \\ supply\ ratio \end{bmatrix} = f \begin{bmatrix} export\text{-}domestic \\ price\ ratio \end{bmatrix}$	$c \in (CE \cap CD$	Export-Domestic Supply Ratio

cont. Table A.1.

25	$QX_c = QD_c + QE_c$ $\begin{bmatrix} \text{aggregate marketed domestic output} \end{bmatrix} = \begin{bmatrix} \text{domestic market sales of domestic output [for } c \in (CD \cap CEN)] \end{bmatrix} + \begin{bmatrix} \text{exports [for } c \in (CE \cap CDN)] \end{bmatrix}$	$c \in (CD \cap CEN) \cup (CE \cup CDN)$	Output Transformation for Non-Exported Commodities
26	$QQ_c = \alpha_c^q \cdot \left(\delta_c^q \cdot QM_c^{-\rho_c^q} + (1 - \delta_c^q) \cdot QD_c^{-\rho_c^q} \right)^{-\frac{1}{\rho_c^q}}$ $\begin{bmatrix} \text{composite supply} \end{bmatrix} = f \begin{bmatrix} \text{import quantity, domestic use of domestic output} \end{bmatrix}$	$c \in (CM \cap CD)$	Composite Supply (Armington) Function
27	$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \cdot \frac{\delta_c^q}{1 - \delta_c^q} \right)^{\frac{1}{1+\rho_c^q}}$ $\begin{bmatrix} \text{import-domestic demand ratio} \end{bmatrix} = f \begin{bmatrix} \text{domestic-import price ratio} \end{bmatrix}$	$c \in (CM \cap CD$	Import-Domestic Demand Ratio
28	$QQ_c = QD_c + QM_c$ $\begin{bmatrix} \text{composite supply} \end{bmatrix} = \begin{bmatrix} \text{domestic use of marketed domestic output [for } c \in (CD \cap CMN)] \end{bmatrix} + \begin{bmatrix} \text{imports [for } c \in (CM \cap CDN)] \end{bmatrix}$	$c \in (CD \cap CMN) \cup (CM \cap CDN)$	Composite Supply for Non-Imported Outputs and Non-Produced Imports
29	$QT_c = \sum_{c' \in C'} \left(icm_{c\,c'} \cdot QM_{c'} + ice_{c\,c'} \cdot QE_{c'} + icd_{c\,c'} \cdot QD_{c'} \right)$ $\begin{bmatrix} \text{demand for transactions services} \end{bmatrix} = \begin{bmatrix} \text{sum of demands for imports, exports, and domestic sales} \end{bmatrix}$	$c \in CT$	Demand for Transactions Services

Institution block

28	$YF_f = \sum_{a \in A} WF_f \cdot \overline{WFDIST}_{f\,a} \cdot QF_{f\,a}$ $\begin{bmatrix} \text{income of factor } f \end{bmatrix} = \begin{bmatrix} \text{sum of activity payments (activity-specific wages times employment levels)} \end{bmatrix}$	$f \in F$	Factor Income
29	$YIF_{i\,f} = shif_{i\,f} \cdot \left[\left(1 - tf_f \right) \cdot YF_f - trnsfr_{row\,f} \cdot EXR \right]$ $\begin{bmatrix} \text{income of institution } i \text{ from factor } f \end{bmatrix} = \begin{bmatrix} \text{share of income of factor } f \text{ to institution } i \end{bmatrix} \cdot \begin{bmatrix} \text{income of factor } f \text{ (net of tax and transfer to RoW)} \end{bmatrix}$	$i \in INSD$ $f \in F$	Institutional factor incomes
30	$YI_i = \sum_{f \in F} YIF_{i\,f} + \sum_{i' \in INSDNG'} TRII_{i\,i'} + trnsfr_{i\,gov} \cdot \overline{CPI} + trnsfr_{i\,row} \cdot EXR$ $\begin{bmatrix} \text{income of institution } i \end{bmatrix} = \begin{bmatrix} \text{factor income} \end{bmatrix} + \begin{bmatrix} \text{transfers from other domestic non-government institutions} \end{bmatrix} + \begin{bmatrix} \text{transfers from government} \end{bmatrix} + \begin{bmatrix} \text{transfers from RoW} \end{bmatrix}$	$i \in INSDNG$	Income of domestic, non-government institutions

cont. Table A.1.

31	$$TRII_{i\,i'} = shii_{i\,i'} \cdot (1 - MPS_{i'}) \cdot (1 - TINS_{i'}) \cdot YI_{i'}$$ $$\begin{bmatrix} \text{transfer from} \\ \text{institution } i' \text{ to } i \end{bmatrix} = \begin{bmatrix} \text{share of net income} \\ \text{of institution } i' \\ \text{transfered to } i \end{bmatrix} \cdot \begin{bmatrix} \text{income of institution} \\ i', \text{ net of savings and} \\ \text{direct taxes} \end{bmatrix}$$	$i \in INSDNG$ $i' \in INSDNG'$	Intra-Institutional Transfers
32	$$EH_h = \left(1 - \sum_{i \in INSDNG} shii_{i\,h}\right) \cdot \left(1 - MPS_h\right) \cdot (1 - TINS_h) \cdot YI_h$$ $$\begin{bmatrix} \text{household income} \\ \text{disposable for} \\ \text{consumption} \end{bmatrix} = \begin{bmatrix} \text{household income, net of direct} \\ \text{taxes, savings, and transfers to} \\ \text{other non-government institutions} \end{bmatrix}$$	$h \in H$	Household Consumption Expenditure
33	$$QH_{c\,h} = \gamma_{c\,h} + \frac{\beta^m_{ch} \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma^m_{c'h} - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma^h_{ac'h} \right)}{PQ_c}$$ $$\begin{bmatrix} \text{quantity of} \\ \text{household demand} \\ \text{for commodity } c \end{bmatrix} = f \begin{bmatrix} \text{household} \\ \text{consumption} \\ \text{spending,} \\ \text{market price} \end{bmatrix}$$	$c \in C$ $h \in H$	Household Consumption Demand for Marketed commodities
34	$$QHA_{ach} = \gamma^h_{ach} + \frac{\beta^h_{ach} \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma^m_{c'h} - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma^h_{ac'h} \right)}{PXAC_{ac}}$$ $$\begin{bmatrix} \text{quantity of} \\ \text{household demand} \\ \text{for home commodity } c \\ \text{from activity } a \end{bmatrix} = f \begin{bmatrix} \text{household} \\ \text{disposable} \\ \text{income,} \\ \text{producer price} \end{bmatrix}$$	$a \in A$ $c \in C$ $h \in H$	Household Consumption Demand for Home Commodities
35	$$QINV_c = \overline{IADJ} \cdot \overline{qinv}_c$$ $$\begin{bmatrix} \text{fixed investment} \\ \text{demand for} \\ \text{commodity } c \end{bmatrix} = \begin{bmatrix} \text{adjustment factor} \\ \text{times} \\ \text{base-year fixed} \\ \text{investment} \end{bmatrix}$$	$c \in CINV$	Investment Demand
36	$$QG_c = \overline{GADJ} \cdot \overline{qg}_c$$ $$\begin{bmatrix} \text{government} \\ \text{consumption} \\ \text{demand for} \\ \text{commodity } c \end{bmatrix} = \begin{bmatrix} \text{adjustment factor} \\ \text{times} \\ \text{base-year government} \\ \text{consumption} \end{bmatrix}$$	$c \in C$	Government Consumption Demand
37	$$YG = \sum_{i \in INSDNG} TINS_i \cdot YI_i + \sum_{f \in F} tf_f \cdot YF_f + \sum_{a \in A} tva_a \cdot PVA_a \cdot QVA_a$$ $$+ \sum_{a \in A} ta_a \cdot PA_a \cdot QA_a + \sum_{c \in CM} tm_c \cdot pwm_c \cdot QM_c \cdot EXR + \sum_{c \in CE} te_c \cdot pwe_c \cdot QE_c \cdot EXR$$ $$+ \sum_{c \in C} tq_c \cdot PQ_c \cdot QQ_c + \sum_{f \in F} YF_{gov\,f} + trnsfr_{gov\,row} \cdot EXR$$ $$\begin{bmatrix} \text{government} \\ \text{revenue} \end{bmatrix} = \begin{bmatrix} \text{direct taxes} \\ \text{from} \\ \text{institutions} \end{bmatrix} + \begin{bmatrix} \text{direct taxes} \\ \text{from} \\ \text{factors} \end{bmatrix} + \begin{bmatrix} \text{value-} \\ \text{added} \\ \text{tax} \end{bmatrix}$$ $$+ \begin{bmatrix} \text{activity} \\ \text{tax} \end{bmatrix} + \begin{bmatrix} \text{import} \\ \text{tariffs} \end{bmatrix} + \begin{bmatrix} \text{export} \\ \text{taxes} \end{bmatrix}$$ $$+ \begin{bmatrix} \text{sales} \\ \text{tax} \end{bmatrix} + \begin{bmatrix} \text{factor} \\ \text{income} \end{bmatrix} + \begin{bmatrix} \text{transfers} \\ \text{from} \\ \text{RoW} \end{bmatrix}$$		Government Revenue

cont. Table A.1.

38	$$EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{i \in INSDNG} trnsfr_{i\,gov} \cdot \overline{CPI}$$ $$\begin{bmatrix} government \\ spending \end{bmatrix} = \begin{bmatrix} government \\ consumption \end{bmatrix} + \begin{bmatrix} transfers\ to\ domestic \\ non\text{-}government \\ institutions \end{bmatrix}$$		Government Expenditures
System Constraint Block			
39	$$\sum_{a \in A} QF_{f\,a} = \overline{QFS}_f$$ $$\begin{bmatrix} demand\ for \\ factor\ f \end{bmatrix} = \begin{bmatrix} supply\ of \\ factor\ f \end{bmatrix}$$	$f \in F$	Factor market
40	$$QQ_c = \sum_{a \in A} QINT_{c\,a} + \sum_{h \in H} QH_{c\,h} + QG_c + QINV_c + qdst_c + QT_c$$ $$\begin{bmatrix} composite \\ supply \end{bmatrix} = \begin{bmatrix} intermediate \\ use \end{bmatrix} + \begin{bmatrix} household \\ consumption \end{bmatrix} + \begin{bmatrix} government \\ consumption \end{bmatrix} + \begin{bmatrix} fixed \\ investment \end{bmatrix} + \begin{bmatrix} stock \\ change \end{bmatrix} + \begin{bmatrix} trade \\ input\ use \end{bmatrix}$$	$c \in C$	Composite Commodity Markets
41	$$\sum_{c \in CM} pwm_c \cdot QM_c + \sum_{f \in F} trnsfr_{row\,f} = \sum_{c \in CE} pwe_c \cdot QE_c + \sum_{i \in INSD} trnsfr_{i\,row} + \overline{FSAV}$$ $$\begin{bmatrix} import \\ spending \end{bmatrix} + \begin{bmatrix} factor \\ transfers \\ to\ RoW \end{bmatrix} = \begin{bmatrix} export \\ revenue \end{bmatrix} + \begin{bmatrix} institutional \\ transfers \\ from\ RoW \end{bmatrix} + \begin{bmatrix} foreign \\ savings \end{bmatrix}$$		Current Account Balance for RoW (in Foreign Currency)
42	$$YG = EG + GSAV$$ $$\begin{bmatrix} government \\ revenue \end{bmatrix} = \begin{bmatrix} government \\ expenditures \end{bmatrix} + \begin{bmatrix} government \\ savings \end{bmatrix}$$		Government Balance
43	$$TINS_i = \overline{tins}_i \cdot \left(1 + \overline{TINSADJ} \cdot tins01_i\right) + \overline{DTINS} \cdot tins01_i$$ $$\begin{bmatrix} direct\ tax \\ rate\ for \\ institution\ i \end{bmatrix} = \begin{bmatrix} base\ rate\ adjusted \\ for\ scaling\ for \\ selected\ institutions \end{bmatrix} + \begin{bmatrix} point\ change \\ for\ selected \\ institutions \end{bmatrix}$$	$i \in INSDNG$	Direct institutional tax rates
44	$$MPS_i = \overline{mps}_i \cdot \left(1 + \overline{MPSADJ} \cdot mps01_i\right) + DMPS \cdot mps01_i$$ $$\begin{bmatrix} savings \\ rate\ for \\ institution\ i \end{bmatrix} = \begin{bmatrix} base\ rate\ adjusted \\ for\ scaling\ for \\ selected\ institutions \end{bmatrix} + \begin{bmatrix} point\ change \\ for\ selected \\ institutions \end{bmatrix}$$	$i \in INSDNG$	Institutional savings rates
45	$$\sum_{i \in INSDNG} MPS_i \cdot \left(1 - TINS_i\right) \cdot YI_i + GSAV + EXR \cdot \overline{FSAV} = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$$ $$\begin{bmatrix} non\text{-}govern\text{-} \\ ment\ savings \end{bmatrix} + \begin{bmatrix} government \\ savings \end{bmatrix} + \begin{bmatrix} foreign \\ savings \end{bmatrix} = \begin{bmatrix} fixed \\ investment \end{bmatrix} + \begin{bmatrix} stock \\ change \end{bmatrix}$$		Savings-Investment Balance

cont. Table A.1.

46	$$TABS = \sum_{h \in H} \sum_{c \in C} PQ_c \cdot QH_{ch} + \sum_{a \in A} \sum_{c \in C} \sum_{h \in H} PXAC_{ac} \cdot QHA_{ach}$$ $$+ \sum_{c \in C} PQ_c \cdot QG_c + \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$$ $$\begin{bmatrix} total \\ absorption \end{bmatrix} = \begin{bmatrix} household \\ market \\ consumption \end{bmatrix} + \begin{bmatrix} household \\ home \\ consumption \end{bmatrix}$$ $$+ \begin{bmatrix} government \\ consumption \end{bmatrix} + \begin{bmatrix} fixed \\ investment \end{bmatrix} + \begin{bmatrix} stock \\ change \end{bmatrix}$$		Total Absorption
47	$$INVSHR \cdot TABS = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$$ $$\begin{bmatrix} investment- \\ absorption \\ ratio \end{bmatrix} \cdot \begin{bmatrix} total \\ absorption \end{bmatrix} = \begin{bmatrix} fixed \\ investment \end{bmatrix} + \begin{bmatrix} stock \\ change \end{bmatrix}$$		Ratio of Investment to Absorption
48	$$GOVSHR \cdot TABS = \sum_{c \in C} PQ_c \cdot QG_c$$ $$\begin{bmatrix} government \\ consumption- \\ absorption \\ ratio \end{bmatrix} \cdot \begin{bmatrix} total \\ absorption \end{bmatrix} = \begin{bmatrix} government \\ consumption \end{bmatrix}$$		Ratio of Government Consumption to Absorption

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