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Trade Reform and Gender in Mozambique

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This paper uses an economywide model to study the impact of trade policy reform on male and female labor in Mozambique. The model disaggregates factor markets by skill and gender, and incorporates links between trade reform, product prices and wages by gender. The model also includes a detailed treatment of production technology and import protection, and is linked to a top-down microsimulation model of households. We find that trade policy has only a modest effect on gender wage differentials, and conclude that policy concerns with gender imbalances should focus on skill upgrading and sectoral mobility rather than on trade policy.
JEL codes: D58, O24, O55

The growing body of microeconomic evidence supporting the key role women play in the development process has led to repeated calls for carefully considering gender issues in economic policymaking. This debate extends into macro policy issues including structural adjustment programs and trade reforms, which would require the inclusion of gender issues in economywide models and related analyses. For example, Çağatay, Elson, and Grown (1995) and Grown, Elson, and Çağatay (2000) argue that gender should be introduced into computable general equilibrium (CGE) models, and there are some examples of adding such a gender lens, including Arndt and Tarp (2000), Fontana (2003), and Fontana and Wood (2000).

Arndt and Tarp (2000) developed a CGE model of Mozambique that distinguished female labor in the agricultural sector, focusing on cassava as a low-risk insurance crop. They found that improvements in

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cassava technology greatly favor women, especially when risk is considered. This paper extends that model to support the analysis of trade policy reform, including changes in both the structure of protection and the balance of trade. The extension involves expanding the data on the gender composition of the labor force across the economy to capture the sources of female labor income. We also specify sectoral production technology that captures differential substitution elasticities by gender, and provides a more accurate representation of trade policy in Mozambique.

This paper explores the impact of traditional causal channels in trade theory, which suggests three mechanisms by which trade reform would differentially affect female and male wages. The first are Stolper-Samuelson effects whereby changes in the prices of traded goods potentially have a magnified impact on relative wages given sectorally differentiated factor proportions and production technologies. The second is the specific-factors model which assumes that some factors are sectorally immobile and therefore their wage depends on prices of sectoral output, which can be linked to trade policy. Finally, non-traded goods are very important in Mozambique, especially in agriculture, which dampens the impact of trade policy on product and factor markets.[1]

In Mozambique, women have substantially lower educational attainment than men and tend to represent a larger share of the rural population. They are far more likely to work as unskilled agricultural labor than men, and the overwhelming majority of economically active women work in the agricultural sector, especially in non-traded sub-sectors. Consequently, the implications of trade policy reform for agricultural labor, especially unskilled agricultural labor, are particularly important for women. The CGE model employed here is designed to capture these features of the labor market.

Mozambique is typical of a number of poor countries, especially in Africa where a large share of agriculture is effectively non-traded. Many agricultural commodities are of a subsistence nature, not suitable for international markets. Also, many producers are isolated from international markets due to lack of infrastructure and high transactions costs. As a result, much production is for home consumption.

The net effect of changes in trade policy on labor markets and gender wage differentials cannot be predicted from theory alone. There are too many causal chains at work, many with opposing impacts, and only an empirical model can sort out the relative strengths of the different effects. A CGE model provides a good framework for such analysis, since it incorporates the relevant channels linking trade policy to factor returns and gender wage differentials.

The analysis focuses on female wages, not household income. Issues of intra-household income distribution and female welfare are not addressed here. There is extensive work indicating that, if female wages increase, the situation of females and children within households improves (Haddad, 1999; Haddad, Hoddinott and Alderman, 1997; Quisimbing, 2003). A focus on female wages is therefore an important dimension of any comprehensive analysis of how females are affected by economic reform.

The paper is structured as follows. After

1. Since we do not consider changes in the relative aggregate supplies of male and female labor, we do not need to consider Rybzynzsky effects in our analysis.

Table 1: Skill and gender composition of the labor force

	Working Population (thousand)		
	All	Women	Men
Unskilled	6,508.4	3,791.4	2,717.0
Skilled	578.2	160.8	417.4
Highly Skilled	86.0	20.8	66.2
Total	7,172.5	3,972.0	3,200.6
	Row shares (%)		
	All	Women	Men
Unskilled	100.0	58.3	41.7
Skilled	100.0	27.8	72.2
Highly Skilled	100.0	24.2	77.0
Total	100.0	55.4	44.6
	Column shares (%)		
Unskilled	0.1	0.1	0.1
Skilled	0.0	0.0	0.0
Highly Skilled	0.0	0.0	0.0
Total	0.1	0.1	0.1
	Rural shares (%)		
Unskilled	77.1	77.7	76.2
Skilled	28.8	25.8	30.0
Highly Skilled	4.5	0.9	5.5
Total	72.3	75.2	68.7

Source: NIS (2003) and authors' calculations.

this introduction, we describe the gender features of the labor market in some detail, and then discuss how these features are incorporated into the CGE model including a microsimulation module. Subsequently we present model simulations and results, while the last section summarizes and concludes.

Economic Structure, Gender and the Labor Market

Data from the 1997 Mozambique census and from the 2002-03 household survey indicate that women have significantly lower educational attainment than men (NIS, 1999, 2001 and 2003). According to the census, women represented about one of three persons who had completed upper primary school (EP2) and only about one in four persons who had completed any level of secondary school. While current enrolment rates paint a slightly more favorable picture, enrolments of boys still substantially exceed enrolments of girls especially at higher levels in the school system. This implies that gender inequalities in educational attainment (and hence human capital) are likely to endure for a considerable period (MINED, 2001).

The 1997 census and the 2002-03 household survey also picked up continued strong demographic effects of the civil war (which ended in 1992) and work-related migration. Due to these effects, women represented 55% of the working age

population (defined as the population greater than 15) in rural areas in 1997. Due to lower school enrollments particularly in the age category 15-19 years old, women represent an even higher share of the labor force. According to the household data from 2002-03, women represented 58% of the rural labor force.

We employed the 2002-03 household survey, census data, national accounts data, labor force data, and education data to break the labor force in Mozambique into skill categories. The skill categories correspond to functionally illiterate and enumerate (unskilled), literate and numerate up to first level secondary or technical school level (skilled), and completed secondary school and higher (highly skilled). Table 1 shows this division of the labor force into skill categories by gender. It illustrates an economy with an extremely thin human capital base, especially for women.[2]

Mozambique is an agricultural economy and women account for a major share of the labor force in this sector. From Table 2, 80% of the total labor force is employed in agriculture. Women represent 62% of the agricultural labor force, which corresponds to 89% of total female employment. The fortunes of women in Mozambique are, for the foreseeable future, strongly linked to the performance of the agricultural sector.

Wage differentials by skill in Mozambique are fairly substantial. Based on regression results from Maximiano and Arndt (2005), we estimate that skilled labor in rural areas earns about 20% more than unskilled labor. In urban areas, the skills gradient is steeper. Skilled and highly skilled labor earns about 50% and 100% more respectively than unskilled labor. In addition, unskilled urban

Table 2: Employment by sector and gender

Working Population (thousand)			
	All	Women	Men
Agriculture	5,707.1	3,546.2	2,160.9
Mining	28.0	4.6	23.4
Manufactures	56.6	5.5	51.1
Construction	156.5	4.8	151.7
Transport	76.8	3.1	73.7
Commerce	538.6	219.1	319.5
Service	375.0	131.0	244.0
Government	234.0	57.7	176.2
Working	7,172.5	3,972.0	3,200.6
Working Age	8,902.0	4,842.7	4,059.6
Row shares (%)			
	All	Women	Men
Agriculture	100	62.1	37.9
Mining	100	16.3	83.7
Manufactures	100	9.7	90.3
Construction	100	3.1	96.9
Transport	100	4.0	96.0
Commerce	100	40.7	59.3
Service	100	34.9	65.1
Government	100	24.7	75.3
Working	100	55.4	44.6
Working Age	100	54.4	45.6
Column shares (% of working)			
	All	Women	Men
Agriculture	79.6	89.3	67.5
Mining	0.4	0.1	0.7
Manufactures	0.8	0.1	1.6
Construction	2.2	0.1	4.7
Transport	1.1	0.1	2.3
Commerce	7.5	5.5	10.0
Service	5.2	3.3	7.6
Government	3.3	1.5	5.5
Working	100	100	100
LFP Rate	80.6	82.0	78.8

Source: NIS (2003) and authors' calculations.
Note: The labor force participation rate (LFP) is defined by age group (15-60).

2. More detail on gender issues in Mozambique can be found in UNDP (2002).

Table 3: Factor composition of sectoral value added (%)

	Female				Male						
	Rural		Urban		Rural			Urban			Capital
	Unskilled	Skilled	Unskilled	Skilled	Highly	Unskilled	Skilled	Unskilled	Skilled	Highly	
Grains	53.4	1.9	6.8	0.0	0.0	29.2	2.9	1.9	0.0	0.0	3.9
Basic Foods	53.4	2.0	6.8	0.0	0.0	28.0	2.8	1.9	0.0	0.0	5.1
Cash Crops	16.3	2.3	1.3	0.0	0.0	37.3	6.5	1.3	0.0	0.0	35.1
Livestock	35.3	2.4	4.0	0.0	0.0	38.6	5.7	1.8	0.0	0.0	12.3
Forestry	44.2	2.2	9.1	0.4	0.0	27.5	3.8	3.6	0.7	0.5	8.1
Fishing	12.0	1.1	1.8	0.0	0.0	21.6	2.6	0.8	0.0	0.0	60.1
Mining	0.2	0.3	1.3	0.5	0.4	2.4	0.5	4.8	1.5	1.0	87.0
Food Proc.	1.6	0.0	3.0	1.2	2.3	13.5	4.9	32.2	10.3	5.9	25.2
Beverage, Tobacco	0.9	0.0	1.8	0.7	1.3	8.0	2.9	19.0	6.0	3.5	56.0
Textiles	0.8	0.0	2.6	1.8	3.3	6.8	4.3	27.7	15.6	8.4	28.7
Leather	1.0	0.0	3.2	2.2	4.0	8.4	5.4	34.3	19.3	10.4	11.9
Woodworking	1.0	0.0	3.3	2.3	4.2	8.8	5.6	35.7	20.1	10.8	8.0
Metals	0.0	0.0	0.1	0.1	0.5	0.0	0.0	0.8	0.8	1.3	96.4
Other Manu.	0.2	0.0	0.8	0.5	1.0	2.0	1.3	8.3	4.7	2.5	78.6
Construction	0.6	0.0	0.1	0.3	0.4	6.8	5.3	11.1	7.9	7.5	59.9
Commerce	4.4	0.7	13.1	2.3	1.1	17.3	5.8	10.2	4.4	4.6	36.0
Repairs	3.1	1.9	10.7	6.1	4.2	13.8	10.3	14.7	12.2	13.6	9.6
Rest., Hotels	1.3	0.8	4.4	2.5	1.7	5.6	4.2	6.0	5.0	5.6	63.0
Utilities	2.3	1.4	7.8	4.5	3.1	10.1	7.5	10.8	9.0	10.0	33.6
Transport	0.0	0.0	0.3	0.8	2.9	11.7	8.5	17.4	12.2	9.6	36.7
Other Services	2.8	1.8	10.2	5.7	3.7	11.7	8.7	12.9	11.2	12.3	19.0

Note: rows sum to 100%.

wages tend to be significantly higher than their urban counterparts. Given the preponderance of females in unskilled rural labor (particularly agriculture), there is great scope for improving the status of female labor by skills upgrading.

Tables 3 and 4 describe the structure of factor remuneration, including labor by gender, skill and sector. From Table 4, the preponderance of agriculture in factor returns mirrors the above observations on the distribution of employment. Most female income is from unskilled agricultural labor, and most agricultural income goes to females. After agriculture, the next most important sectors for unskilled rural female income are services and commerce, which represent 10% of their aggregate wage bill. Commerce and services are important to skilled females and to females for all skill categories in urban areas. In terms of technology, Table 3 shows that the agriculture, forestry and livestock sectors are extremely intensive in their use of unskilled female labor.

The impact of trade policy depends strongly on the initial sectoral structure of the economy, production technologies, and the pattern of protection. Table 5 presents the sectoral structure of trade and rates of tariff protection. The story with respect to protection is complex. Due to official exemptions and smuggling, average tariff rates, defined as total tariff revenue divided by the value of imports, differ substantially from posted tariff rates. Since the marginal import is assumed to be tariff laden, published

Table 4: Sectoral composition of factor earnings (%)

	Female					Male					
	Rural		Urban			Rural		Urban			Capital
	Unskilled	Skilled	Unskilled	Skilled	Highly	Unskilled	Skilled	Unskilled	Skilled	Highly	
Grains	20.9	9.2	5.3	0.0	0.0	9.5	2.5	0.9	0.0	0.0	0.7
Basic Foods	50.5	22.2	12.8	0.0	0.0	21.9	5.9	2.1	0.0	0.0	2.1
Cash Crops	1.4	2.4	0.2	0.0	0.0	2.7	1.3	0.1	0.0	0.0	1.3
Livestock	4.4	3.6	1.0	0.0	0.0	4.0	1.6	0.3	0.0	0.0	0.7
Forestry	8.7	5.2	3.6	0.5	0.1	4.5	1.7	0.8	0.2	0.2	0.7
Fishing	1.6	1.7	0.5	0.0	0.0	2.3	0.8	0.1	0.0	0.0	3.4
Mining	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	1.0
Food Proc.	0.6	0.0	2.2	2.7	6.8	4.1	4.0	14.3	7.4	4.5	4.0
Beverage, Tobacco	0.1	0.0	0.3	0.4	0.9	0.6	0.6	2.0	1.0	0.6	2.1
Textiles	0.0	0.0	0.3	0.6	1.5	0.3	0.6	1.9	1.8	1.0	0.7
Leather	0.0	0.0	0.1	0.1	0.3	0.1	0.1	0.4	0.4	0.2	0.1
Woodworking	0.0	0.0	0.3	0.7	1.7	0.4	0.6	2.1	1.9	1.1	0.2
Metals	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	1.4
Other Manu.	0.0	0.0	0.2	0.4	0.8	0.2	0.3	1.1	1.0	0.5	3.6
Construction	0.7	0.0	0.2	2.3	4.1	6.9	14.4	16.1	18.8	18.7	31.5
Commerce	5.3	10.6	31.2	17.1	10.3	17.2	15.5	14.6	10.3	11.1	18.7
Repairs	0.2	1.6	1.5	2.6	2.3	0.8	1.6	1.2	1.6	1.9	0.3
Rest., Hotels	0.1	0.8	0.7	1.2	1.1	0.4	0.7	0.6	0.8	0.9	2.2
Utilities	0.3	2.5	2.3	4.1	3.7	1.3	2.5	1.9	2.6	3.0	2.2
Transport	0.0	0.0	0.3	2.5	12.0	5.0	9.8	10.8	12.3	10.2	8.2
Other Services	5.1	40.0	37.0	64.7	54.2	17.8	35.6	28.4	39.8	45.9	15.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

tariff rates drive prices within the system and the resource allocation implications of trade reform will depend primarily on the published rates. More detail on the treatment of these differential published and average rates is provided in the following section as well as in Arndt and Tarp (2005).

Regarding trade shares for the sectors important to women, commerce is completely non-traded and agriculture and services typically have modest trade shares in both exports and imports. Crop agriculture consists of grains, basic food crops, and cash crops. The country is a net importer of grains, while basic food crops are essentially non-traded. Cash crops are traded, with a small net export but low trade shares. In contrast to many developing countries with large commercial agricultural sectors and significant exports, agriculture in Mozambique is largely for subsistence, with very low trade shares.

Based on the trade shares and standard trade theory, one would *a priori* expect that trade reform which favors the highly traded sectors should be less favorable to women than to men. Actual outcomes and magnitudes will depend strongly on various elasticities, including factor substitution elasticities in production and trade substitution elasticities in export supply and import demand—the degree of tradability matters as well as trade shares. Ultimately, the impact of trade policy on female labor is an empirical question.

Table 5: Sectoral structure of imports and exports and tariff protection rates

	Sectoral Composition		Sectoral Trade Ratios		Tariff Rates (%)	
Commodity	Exports	Imports	Exports	Imports	Marginal	Average
Grains	0.2	2.3	0.3	21.3	2.5	1.8
Basic food crops	0.3	0.2	0.4	2.0	10.0	5.7
Cash crops	4.4	0.3	6.8	5.3	9.9	5.3
Bovine cattle, sheep, goats, horses	0.0	0.1	0.0	3.6	1.7	1.7
Animal products nec	0.0	0.5	0.2	15.3	13.5	8.7
Forestry	1.5	0.0	3.3	0.7	3.2	2.2
Fishing	12.1	0.0	42.5	0.1	29.1	14.3
Minerals nec	0.3	0.2	1.5	7.8	6.8	4.5
Bovine meat products	0.0	0.1	0.0	3.5	30.0	14.5
Meat products nec	0.2	1.1	0.5	15.8	12.8	6.6
Vegetable oils and fats	1.0	1.5	9.4	45.1	19.2	9.9
Processed rice	0.0	5.6	0.1	96.1	7.5	3.7
Sugar	0.5	0.6	5.8	56.3	7.5	4.2
Food products nec	0.6	2.1	0.6	16.2	22.7	11.4
Beverages and tobacco products	0.1	1.5	0.1	24.0	16.0	8.0
Textiles	2.9	1.9	48.2	55.1	27.2	17.4
Wearing apparel	0.7	0.6	6.7	24.4	28.8	14.1
Leather products	0.1	0.6	2.2	52.2	28.8	14.7
Wood products	0.4	1.2	3.0	34.9	19.9	9.7
Paper products, publishing	0.0	1.0	1.3	80.2	7.8	5.7
Petroleum, coal products	0.0	9.2	0.0	100.0	5.0	4.5
Chemical, rubber, plastic products	0.3	10.8	3.5	84.1	12.8	8.9
Mineral products nec	0.1	2.2	0.3	37.5	8.2	5.3
Ferrous metals	53.3	0.2	99.8	85.4	7.4	7.4
Metal products	0.4	4.9	7.6	78.3	7.0	5.1
Motor vehicles and parts	0.3	7.2	100.0	100.0	11.1	5.2
Electronic equipment	0.2	12.8	43.5	99.6	0.0	0.0
Other Equipment	0.1	4.2	100.0	100.0	8.6	4.6
Manufactures nec	0.5	2.4	100.0	100.0	2.7	2.7
Electricity	6.4	3.4	22.8	38.8	18.5	11.3
Transport nec	8.4	0.0	5.6	0.0	0.0	0.0
Financial services nec	0.5	0.2	1.3	2.0	0.0	0.0
Insurance	0.0	0.1	0.0	37.3	0.0	0.0
Business services nec	4.2	21.0	7.9	63.2	0.0	0.0
Total/Average	100.0	100.0	5.9	25.1	10.0	6.0

Notes: The export trade ratio is the share of exports in total production. The import trade ratio is the share of imports in total domestic demand. Commodities that are neither exported nor imported are excluded, and nec is not elsewhere classified.

Modeling Approach

The basic purpose of trade liberalization is to alter relative prices, including factor prices, in order to expand production in sectors with comparative advantage, attracting factors of production (labor and capital) from other sectors. Similarly, reducing the trade deficit involves changing the volume of exports and imports. In both cases, the resulting changes in the structure of production and employ-

ment must be analyzed from an economywide perspective. In modeling this process, we link trade reform to the operation of factor markets with a particular focus on gender impacts.

We start from a standard, trade-focused CGE model, which contains three basic elements: (a) behavioral specification of all economic actors; (b) simulation of the operation of markets; and (c) macro closure.[3]

Behavioral Specification

The model has 21 "activities" (or sectors of production), 44 "commodities" (domestically produced or imported), 11 factors of production (with labor differentiated by skill, sector, and gender), and two representative households (one rural and one urban). There are five agricultural sectors, which provide some detail on the sources of rural income. The model assumes profit maximization by producers under a sectoral translog technology. This treatment allows specification of separate substitution elasticities between male and female labor in production, independently of substitution elasticities with respect to capital.

Households are assumed to demand commodities according to fixed expenditure shares, which is consistent with maximizing a Cobb-Douglas utility function. Investment and government expenditures are allocated across commodities with fixed real coefficients rather than fixed expenditure shares.

The model incorporates the division of labor types by sex, as shown in Table 3, which constitute separate inputs into the sectoral translog cost functions. The translog allows specification of different substitution elasticities between any pairs of factors, which is useful when considering gender. Elasticities of substitution between male and female labor of the same skill class are set at the fairly high level of three, which assumes that they are similar in production. This is an important assumption, whose implications are explored in sensitivity analysis. Male-female substitution elasticities can be a result of technology or arise from institutional and/or cultural factors that limit the ability of men and women to work together.

Elasticities across labor classes employ the values used by Arndt (2003) regardless of sex. Skilled and unskilled rural labor categories are mobile in that they can move to the non-agricultural sectors, but such mobility is limited in that their shares in non-agricultural sectors are much smaller than those of urban labor categories. This approach formally captures the concentration of rural female labor in the agricultural sector, with limited mobility to non-agricultural sectors, and focuses attention on the implications of trade policy reform for female labor. Arndt and Tarp (2000) employed a similar approach to examine the interactions between agricultural technology, risk, and gender.[4]

Foreign trade is specified using the Armington assumption.[5] There are constant elasticity

3. Arndt, Jensen, Robinson and Tarp (2000), Löfgren, Harris and Robinson (2001) and Tarp, Arndt, Jensen, Robinson and Heltberg (2002) provide detailed explanations and applications of the basic CGE model that was revised for the purposes of this analysis.
4. Our model does not consider intra-household distribution issues—an important area of research where much can be accomplished. Fontana and Wood (2000) present a stylized model for Bangladesh that explicitly considers household work (and leisure) along with the division between male and female labor. For the case of Mozambique, a major constraining factor is a dearth of information on how resources are allocated within the household (Bell, 2003).
5. See Armington (1969), who specified imperfect substitution for imports. We follow most trade-focused CGE models in extending the notion to the treatment of exports.

of transformation (CET) functions for sectoral exports and constant elasticity of substitution (CES) functions for commodity imports. The commodity/sector export transformation elasticities used in this paper were estimated econometrically by Arndt, Robinson and Tarp (2002). For the crops and livestock sectors, the export transformation elasticities are 1.5. For the non-agricultural sectors, they are equal to 0.8. Armington import elasticities from the Global Trade Analysis Project (GTAP, 2005) were employed.

The Stolper-Samuelson theorem applies strictly to an economy with only tradable goods, and the theorem is weakened in the presence of non-traded goods. The properties of the theorem in Armington models have been worked out analytically by Thierfelder and Robinson (2003), who show that the magnification effect is considerably smaller or eliminated in such models. Therefore, we would not expect to find as dramatic gender wage effects in empirical models as would be predicted by the simple theoretical model, given that women are heavily represented in non-traded sectors.

Operation of Markets

A CGE model simulates the operation of product and factor markets, solving for market-clearing prices and wages. It is a closed general equilibrium system, incorporating all elements of the circular flow of income and expenditure, and the corresponding real flows. Characteristic features of this type of model include:

a) Households must respect their budget constraint;
b) The domestic price of commodity imports equals the CIF price multiplied by the exchange rate and the prevailing tariff rate plus any marketing margins or additional domestic sales taxes;
c) The value of imports cannot exceed the availability of foreign exchange;
d) Supply of commodities must equal demand for commodities (with inventory accumulation counted as demand);
e) Firms collectively cannot use more of any factor than the total availability in the economy;
f) Investment must be financed via foreign or domestic (private plus government) savings; and,
g) Government consumption must be financed through tax revenue, foreign grants (aid), or borrowing on domestic or foreign markets.

In this model, aggregate supply of all labor types is exogenous and wages adjust to clear labor markets. The model also accounts for marketing margins as described in Arndt, Jensen, Robinson, and Tarp (2000) and Jensen and Tarp (2002). Prices and wages are solved endogenously to equilibrate supplies of and demands for commodities and factors. The model determines relative prices, and the numeraire is given by the consumer price index.

Special Features: Macro, Trade Protection and Income Distribution

All economywide models incorporate macro balances. How equilibrium is achieved between savings and investment, the government deficit, and the trade deficit constitutes the "macro closure" of the model. In our model, aggregate investment is assumed to be determined by aggregate savings (private plus government plus foreign), so the model is "savings driven". Private savings are endogenous, depending on fixed savings rates by households and enterprises. Government expenditure is set as a fixed share of aggregate absorption in the economy, and the government deficit (and

hence government saving) is endogenous. Foreign savings and aid are fixed exogenously and the real exchange rate adjusts to achieve external balance through changes in aggregate exports and imports, operating through changes in the relative prices of traded and non-traded commodities. The effect of this macro closure is to share any change in aggregate absorption between government, investment, and household consumption. Aggregate investment, however, is sensitive to changes in sources of savings; especially the trade balance and government savings.

As indicated earlier, the structure of tariff protection in Mozambique is complicated by smuggling and the existence of many exemptions, leading to a significant amount of trade entering the country free of tariffs. We capture this phenomenon in the model by differentiating between average and marginal tariff rates (see Arndt and Tarp, 2005). In this environment, tariff reform is complex and depends on what happens to exemptions as well as rates. In the model, the value of the tariff exemption is treated as a rent, some of which accrues to consumers of exempt imports and some of which is treated as a pure rent captured by re-sellers (people who import duty free and sell on the domestic market). The effect is that, at the margin, purchasers of imports value them at the marginal tariff rate, which implies that average tariff rates (tariff revenue by commodity divided by the value of imports) greatly understate the impact of protection on incentives.

The analysis of the impact of policy changes on the distribution of income and poverty cannot be done adequately with an aggregated economywide model such as ours that incorporates only a few "representative" households. There is an active literature on how to take the results from an economywide model and "map" the changes into changes in income at the household level.[6] The approach we take is a "top down" microsimulation model. We take the results of our various scenarios, compute the percent changes in factor returns and commodity prices, and use this information to compute the changes in real household incomes in a large household survey, given survey information on the sources of household income and demand.[7] While no account is taken of potential changes in household behavior or of potential feedbacks to product and factor markets, this approach does provide detailed distributional information by household.[8] We report results from this top-down procedure for one of our scenarios.

Simulations and Results

Table 6 describes five simulations undertaken with the model. The first three are designed to explore the impact of different tariff policy scenarios. The first labeled the flat tariffs scenario is the most realistic. It replaces the existing tariff regime with a uniform flat tariff designed to raise the same revenue. Moreover, evasion declines by 90% as described in Arndt and Tarp (2005). The second scenario eliminates all tariffs (and associated tariff evasion), replacing the lost revenue with an income tax. This scenario gives insight into the implications of full trade liberalization

6. Bourguignon and Pereira (2003) summarize the state of the art in such analysis.
7. Löfgren, Robinson, and El Said (2003) discuss this approach and compare it to specification of representative households, while Jensen and Tarp (2005) analyze the importance of modeling micro-household behavior and related income and expenditure distributions endogenously in Vietnam.
8. As indicated earlier, we are not able to track the distribution of resources within households.

Table 6: Simulations

Label	Description
Base value	Base data in billions of 2001 meticais
Flat tariffs	All tariff rates are reset to a single level that maintains revenue neutrality. Evasion decreases by 90%
Tariff elim.	Complete tariff elimination with revenue replacement from scaled direct taxes
Protection	Tariff rates increased by 50% with an increase in evasion of 15%
Trade balance	Cut foreign aid by 25% and force adjustment to trade balance
Tariff low	The tariff elimination scenario with elasticities of substitution in production set to 0.33

under traditional assumptions for revenue replacement; however, the revenue replacement mechanism employed is not in reality feasible. The third scenario increases protection by 50%, with an associated 15% increase in evasion.

The fourth scenario is a macro shock: the elimination of 25% of foreign aid, resulting in a forced cut in the trade balance. Thus, this scenario helps to illuminate the implications of expansion of the tradable sector for factor prices by gender.

We also ran a number of experiments designed to test the sensitivity of the results to differences in the elasticities of substitution in production, both between male and female labor of different skill categories, and also between different skill categories. The macro results of the different experiments changed very little, and generally the wage changes by gender were the same. However, when tariffs were eliminated and elasticities of substitution across all factors were set to very low levels (0.33), the wage results differed significantly. We report these results in the fifth and final experiment, and results are shown in Tables 7, 8, 9 and 10.

The Three Tariff Scenarios

The flat tariff scenario yields a modest depreciation of the real exchange rate (3.1%) and small changes in aggregate trade flows

Table 7: Macroeconomic results

		Percentage change from base				
	Base value	Flat tariffs	Tariff elim.	Protection	Trade balance	Tariff low
Real exchange rate	100.0	3.1	6.8	-2.7	11.9	7.0
Total absorption	9974.2	0.0	0.0	-0.1	-4.3	0.0
Exports	761.3	2.3	5.3	-2.1	12.1	4.3
Imports	3104.5	0.6	1.3	-0.5	-9.1	1.1
Household consumption	6100.9	-1.0	-2.5	0.4	-3.7	-2.4
Non-government investment	1546.6	1.3	3.5	0.8	4.5	3.1
Government investment	1104.2	4.0	9.2	-3.7	-24.4	8.7
GDP	7703.9	0.1	0.0	-0.1	-0.7	0.0

Note: All Metical figures are in billions. Also, the levels of some macroeconomic aggregates differ slightly from published values due to more explicit accounting for the rents associated with duty-free importation.

Table 8: Changes in sectoral real value added

Sector	Base value	Percentage change from base				
		Flat tariffs	Tariff elim.	Protection	Trade balance	Tariff low
Grains	356.2	1.6	-0.1	-0.2	5.9	1.2
Basic food crops	857.4	-0.7	-1.7	0.3	-0.7	-0.8
Cash crops	79.4	-0.8	-0.3	-0.2	15.0	-1.7
Livestock	112.8	-1.8	-3.2	1.0	0.5	-2.8
Forestry	179.0	-0.2	-1.0	0.0	0.5	-0.6
Fishery	118.0	2.4	6.1	-2.3	13.4	1.7
Mining	23.5	0.2	0.2	-0.3	0.4	-0.4
Food processing	336.5	-2.5	-4.2	1.2	0.0	-3.9
Beverage & tobacco	79.8	-1.9	-4.4	1.1	-2.3	-4.8
Textiles	52.6	-12.6	-12.7	4.8	16.6	-12.7
Leather	9.1	-25.6	-28.7	13.1	12.0	-27.8
Wood products	44.5	-9.3	-10.0	4.7	6.3	-9.3
Metals	29.9	0.0	0.0	0.0	0.0	0.0
Other manufacturing	96.9	-0.1	0.5	1.0	6.8	-0.9
Construction	1104.4	2.3	5.4	-1.0	-6.5	4.9
Commerce	1090.5	-0.5	-0.9	0.1	-0.1	-0.9
Other services	2411.2	0.2	-0.3	-0.1	0.4	-0.2

Table 9: Changes in real wages (CPI deflated)

		Percentage change from base				
		Flat tariffs	Tariff elim.	Protection	Trade balance	Tariff low
Unskilled rural labor	Female	0.0	-0.2	-0.3	-2.5	-2.1
	Male	0.1	0.3	-0.3	-3.1	-0.9
Skilled rural labor	Female	0.0	-0.1	-0.3	-2.8	-1.4
	Male	0.1	0.6	-0.3	-4.1	1.1
Unskilled urban labor	Female	-0.1	0.2	-0.2	-4.3	-2.2
	Male	-0.3	0.5	-0.2	-4.9	-1.3
Skilled urban labor	Female	-0.2	0.2	-0.2	-4.6	-1.2
	Male	-0.2	0.6	-0.2	-5.1	0.4
Highly skilled urban labor	Female	-0.5	-0.1	-0.1	-4.4	-3.4
	Male	0.0	0.9	-0.3	-5.2	1.4
Capital		0.8	2.5	-0.9	-3.4	5.7

(Table 7). The zero tariff scenario yields a larger devaluation (6.8%) and larger effects on aggregate exports and imports. The two experiments have similar qualitative impacts on the structure of production (Table 8) with the exception of grains. In the flat tariff scenario, rural wages rise slightly relative to urban wages (Table 9). In the zero tariff scenario urban wages rise more than rural wages and the relative wage of male and female

Table 10: Gender wages and shares of total factor income

	Base value	Flat tariffs	Tariff elim.	Protection	Trade balance	Tariff low
			Shares of total factor income (%)			
Female labor	24.4	24.3	24.1	24.4	24.5	23.6
Male labor	45.5	45.4	45.3	45.6	45.3	44.9
Capital	30.1	30.3	30.6	30.0	30.2	31.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
			Average wages by gender			
	Base value		Percent change from base value (%)			
Female labor	100.0	-0.1	0.0	-0.2	-3.3	-2.1
Male labor	100.0	-0.1	0.5	-0.2	-4.3	-0.2
Capital	100.0	0.8	2.5	-0.9	-3.4	5.7
Total	100.0	0.2	1.0	-0.4	-3.8	1.1
			Average wages by skill and zone			
	Base value		Percent change from base value (%)			
Rural unskilled	100.0	0.05	0.08	-0.29	-2.83	-1.45
Rural skilled	100.0	0.06	0.48	-0.31	-3.92	0.69
Urban unskilled	100.0	-0.22	0.37	-0.18	-4.68	-1.63
Urban skilled	100.0	-0.22	0.50	-0.18	-5.00	0.01
Urban high skill	100.0	-0.11	0.67	-0.24	-5.03	0.44

labor within skill categories also change to benefit males.[9] While the average wage of females remains constant, the average wage of males increases (Table 10). Thus, scenario 2 (i.e. complete trade liberalization with the traditional simplistic revenue replacement mechanism) does produce results that favor males though the magnitude is relatively small.

The combination of the steeper decline in basic food crop production in the tariff elimination scenario and the decline in grains production, as opposed to expansion in the flat tariff scenario, underlies the above differences. The grains and food crop sectors represent 71% of female rural unskilled factor earnings. Also note from Table 5 that the protection rate in grains is below the average tariff rate, implying an increase in protection under the flat tariff scenario as opposed to a decrease under tariff elimination. At the same time, import penetration in grains is significant at 21% of total availability. For basic food crops, both scenarios reduce protection, but the overall direct impact of tariff change is much smaller as the trade shares are very low.

The increased protection scenario, which further favors existing protected sectors, has

9. Returns to factors (Table 10) tend to rise even though GDP is almost constant (Table 7) in the zero tariff scenario. While government tariff revenue is held constant, the value of tariff exemptions falls with the imposition of a uniform tariff. The effect is that total rents fall. Since they are included in the price system, average wages must rise to account for the lost rent income. See Robinson and Thierfelder (1999) for an explanation of the mechanism at work in a general equilibrium framework.

macroeconomic effects (Table 7) that are essentially the reverse of the liberalization scenarios. The real exchange rate appreciates and imports and exports decline. However, the scenario has no affect on relative wages or factor shares by gender (Table 9). Unskilled female wages tend to decline due to reductions in grains production, but tend to be supported by increases in the production of basic food crops (Table 8).

The sensitivity analyses undertaken led to relatively little qualitative changes in results with the exception of the tariff elimination scenario. In scenario 5, the impact of tariff elimination on relative wages by skill category is sensitive to assumptions about substitution elasticities in production. Reducing the factor substitution elasticities expands the impact on relative wages observed in scenario 2 – if quantities cannot adjust, prices will. Capital gains relative to labor, and male labor gains more strongly relative to female labor. In a world where men and women are not substitutable in production, either because of technology or institutional and/or cultural factors, trade policy is potentially more important in affecting gender wage differentials.

Aid Cut Scenario

The aid cut scenario forces an adjustment in the trade balance, which requires a major depreciation of the real exchange rate (11.9%, Table 7). The depreciation induces a 12.1% increase in exports, a 9.1% decrease in imports, and substantial changes in the structure of production and employment (Table 8). The cut in aid to government is assumed to lead to a fall in government investment and a corresponding fall in aggregate real investment. Overall absorption declines significantly (by 4.3%), as the economy must adjust to the decline in aid flows.

Agriculture gains, both because it is an exporting sector and because the fall in investment increases the relative share of consumption demand in total national income. Other exporting and import substituting sectors gain relative to non-traded sectors (compare Tables 5 and 8). Rural wages fall, but by about half as much as urban wages (Table 9). The female share of total factor income rises and the average female wage falls less than the average male wage (Table 10). The dramatic devaluation favors tradable sectors.

The wage results where female labor does well relative to male labor indicates that female labor is not confined to non-traded sectors. The reduction in government investment expenditure, particularly construction, is also less harmful to women, as employment in construction tends to be heavily male dominated.

Microsimulation Results

Our microsimulations permit analysis of the distributional impact of different policy scenarios. Figures 1 and 2 summarize the range of welfare impacts across households for the flat tariffs and trade balance scenarios respectively. The focus is on the lower 75% of the income distribution due to difficulties in allocating capital income at higher levels of income. As the results presented above suggest, the implications of the flat tariffs are small for the large majority of households. Rural households tend to gain slightly while urban households experience mild declines in welfare. Distributional implications tend to favor wealthier households though the differences tend to be quite small—in the order of one fifth of one percent.

The implications of the trade balance scenario are much stronger. As expected, all household categories experience welfare losses. Urban households tend to be much

Figure 1: Distribution of first order welfare change for the flat tariffs scenario

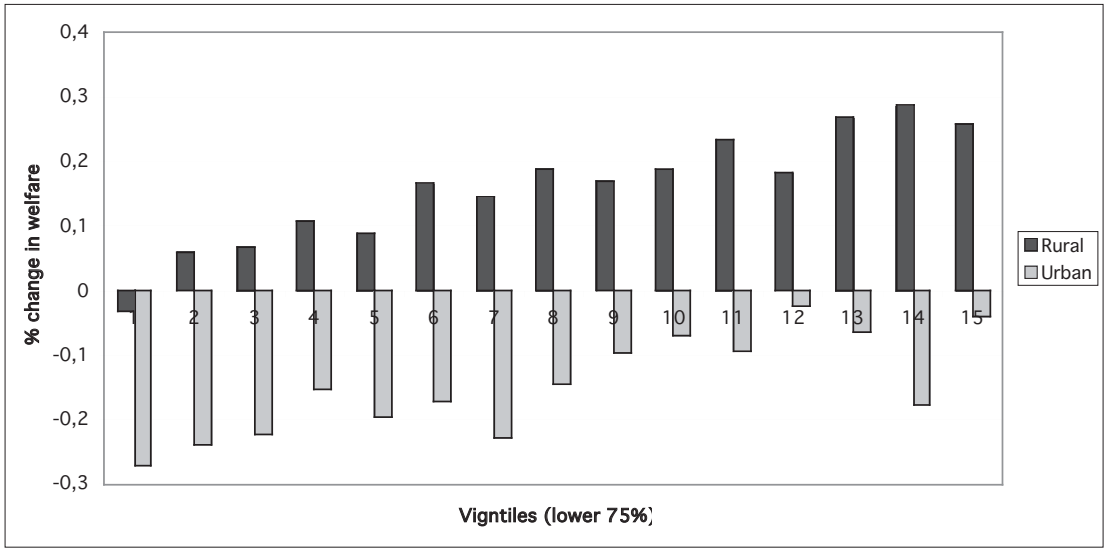
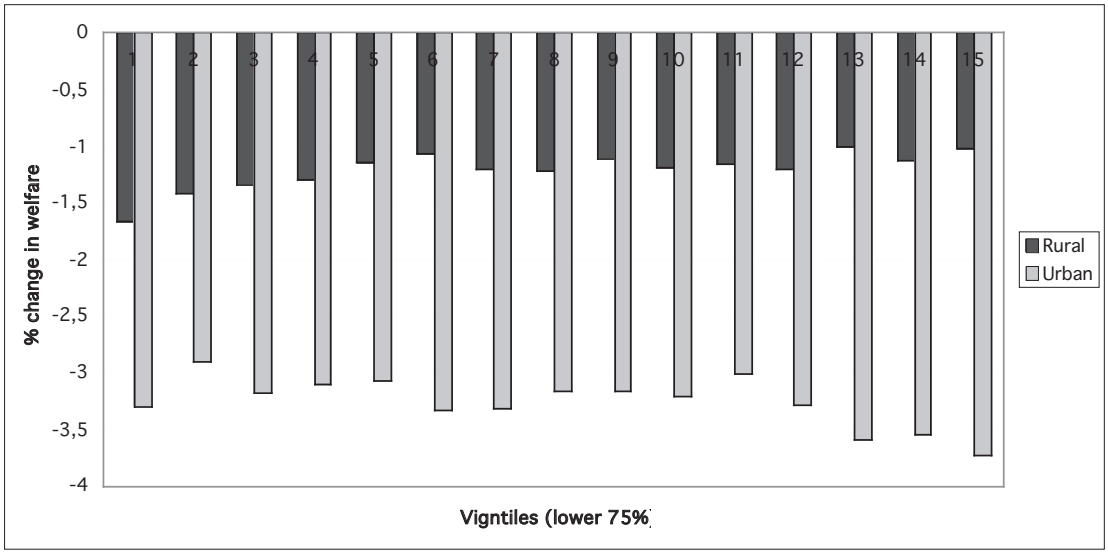


Figure 2: Distribution of first order welfare change for the aid cut scenario



more vulnerable to trade balance shocks with the average household's welfare declining by more than three percent. The high shares of home consumption by rural households provide insulation from events in the marketplace and macro-economy.

Overall, the microsimulations illustrate reasonably consistent results suggesting that the qualitative story emerging from the economywide modeling is reasonably robust across the income distribution.

Conclusions

The analysis of the impact of trade policy on male and female labor in Mozambique was motivated by a desire to identify gender differential impacts, viewing macroeconomic policy reform through a gender lens. The simulation results indicate that revenue neutral trade reform, relying on flat tariffs, has little effect on gender differences within skill categories. Tariff elimination generates larger, but still relatively mild, differentials between male and female labor of the same category. In the protection scenario, gender differentials are minimal, while female wages increase relative to male wages of the same skill category in the trade balance scenario.

If men and women are not good substitutes in production, either due to technology or institutional or cultural constraints that make it difficult for men and women to work together, then we do see a stronger effect of tariff elimination on gender wage differentials, with women losing relative to men. The effect is still small relative to observed differences in wages by skill category, and is sensitive to the assumed mechanism for replacing the lost tariff revenue.

Our results show that women in Mozambique are not fully concentrated in non-tradable sectors, nor are they exclusively in sectors which benefit from significant tariff protection. The linkages are complex, and the gender implications of trade reform depend on the exact package of reform measures, including the revenue replacement assumptions. The revenue replacement mechanism commonly assumed in the public finance literature is to replace the lost tariff revenue by a non-distorting income tax. This scenario is certainly not realistic in Mozambique. A more realistic scenario is to assume revenue-neutral uniform tariffs, which generates very little differential impact by gender under a variety of elasticity assumptions.

To conclude, we find that trade policy has only a modest effect on gender wage differentials, certainly compared to wage differentials due to differences in skill and between sectors. Women are highly concentrated in agriculture, especially non-traded food crops, and are largely unskilled. Policies to redress gender imbalances in Mozambique should focus on enhancing agricultural productivity, particularly in food crops; upgrading the skill endowment of the female labor force; and supporting increased intersectoral labor mobility. The differential gender impact of trade policy is small in comparison.

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