The Doha Round Declaration on Cotton: A Catalyst for Poverty Reduction in Africa?

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ABSTRACT

Cotton plays a strategic role in the development policies and poverty reduction programs of a number of African countries. Several African countries have introduced reforms in the cotton sector to improve its quality and competitiveness. The impact of these reforms has to date been virtually nullified by the fact that certain WTO Members continue to apply support measures and subsidies that distort global market prices. These are the arguments behind the Cotton Initiative raised in 2003 in the World Trade Organization (WTO) by Benin, Burkina Faso, Chad and Mali, which reflects the position of the African Group countries until the Sixth WTO Ministerial Conference in Hong Kong recently. In this conference two important policy changes were agreed in international trade of cotton. First, all forms of export subsidies for cotton will be eliminated by developed countries in 2006. Second, developed countries will give duty and quota free access for cotton exports from the least-developed countries (LDCs).

This paper uses a computable general equilibrium (CGE) model of the Zambian economy with a three fold purpose: (a) to study the impact of the Doha Round agreement on the cotton sector in Zambia, (b) to analyze the reality of the Doha agreement versus the African countries' cotton initiative during the WTO Hong Kong conference, and (c) to contribute to the analysis of further agricultural trade liberalization and its implications for poor countries. The results show the extent of the benefits of implementation of both, the Doha WTO Round and the African Countries Proposal in Zambia. We quantify the impacts of both policy initiatives on the Zambian cotton sector (production, exports, prices), and agrarian population welfare. The results show that the positive effects of the Cotton Initiative in Zambia are higher than the Doha Round polices benefits.

Introduction

In 2002, world cotton trade increased by more than 400,000 tons, attaining 6.2 million tons. A third of cotton production is traded internationally. Cotton, comprising only 0.12% of total merchandise trade, is a small part of the economic activity in industrialized countries. However cotton production and trade play an important role in some Least Developed Countries (LDCs) in West and Central Africa. Cotton production and trade are vital activities in the economic and social lives of several African countries, sustaining the livelihoods of millions of poor households and contributing in several countries as much as 40 percent to total merchandise exports and more than 5 percent to total GDP (Baffes, 2004). Thus, it is not surprising that many million Africans depend directly on cotton production and exports. In many developing countries, where the scope of substituting cotton for other crops is limited, the cotton cultivation extension has played an important role in reducing poverty. Consequently, cotton's role in the development of policies and poverty reduction programs of a number of African countries is strategic. But, the drop in world cotton prices had endangered the benefits of cotton sector (Gillson et al., 2005).

Several African countries have introduced reforms in the cotton sector and have made the necessary adjustments to improve quality and competitiveness in this agricultural production. At least six cotton producing countries in Eastern and Southern Africa initiated a reform process during the late 1980s and early 1990s. These countries are Ghana, Mozambique, Tanzania, Uganda, Zambia, and Zimbabwe (Poulton et al. 2004), which comprise 85 percent of the region's cotton production (Baffes, 2004). Reforms were introduced in 1995 in Zambia, the country chosen for this study.

The impact of these reforms on the development of the African countries has been to date practically nullified by the fact that certain World Trade Organization (WTO) members continue applying domestic support, import restrictions, and export subsidies. These policies, contrary to the basic objectives of the World Trade Organization (WTO, TN/AG/SCC/GEN/2), distort global market prices. Townsend and Guitchounts (1994) estimated that in the early 1990s more than two-thirds of cotton was produced in countries with some form of government interference.

Support to cotton producers has been greatest in the United States, followed by China and the European Union (EU). For 2001/02, combined supports to the cotton sector were US$2.3 billion, US$1.2 billion, and US$700 for the United States, China and EU (to Greece and Spain) respectively. Subsidies encourage surplus cotton production, which is then sold on the world market at subsidized prices (Gillson et al.,2005). This has depressed world cotton prices, hurting those developing countries which rely on cotton exports for a large part of their foreign exchange earnings.

The U.S. cotton policies, being the second-largest cotton producer and by far the largest exporter, are extremely important in the cotton trade arena. The history of cotton subsidies in the United States is long and constitute part of the commodity programs introduced in the early 1930s. The U.S. cotton program is extremely generous. For instance, in 1997 (the first year of the *1996 Farm Bill),* U.S. cotton growers received $878 million, of which approximately $700 million came in the form of decoupled payments, and the rest as an insurance subsidy payments and in 1998 government payments were $1.2 billion (Baffes, 2004). Even though spending for export subsidies was limited to US$201 million for the 1996–2002 period, it was exceeded by the end of

1998. In 1999 the U.S. Agricultural Appropriations Bill was passed by the Congress providing an additional US$200 million in 2000 and US$430 million through 2002 for export subsidies (Gillson, et al.,2004).

As consequence of the massive U.S. cotton subsidies and their strong impact on world markets, a number of reactionary steps were taken by other countries. Two of which have significant policy implications. On the policy front, a WTO dispute settlement was brought by Brazil in 2003, asserting losses to its cotton exports due to subsidies by the United States (WTO, 2002). During this dispute resolution, it was found that the United States paid $ 3.2 billion in annual cotton subsidies and $1.6 billion in export credits. In March, 2005 the WTO panel concluded that U.S. policies were adversely impacting world trade in cotton, which was so prejudicial for Brazil and other exporters such as West African countries, and, consequently these policies should be eliminated. Accordingly, this case, which constitutes the first formal challenge to the massive agricultural subsidies provided by rich nations to their farmers, ended with the victory to Brazil (WTO, 2004). Finally, U.S. cotton export subsidies are calculated to be US$3 (Malik, 2005).

China leads cotton production and consumption in the world. China began to offer protective policies to cotton growers in 1953. Currently, major barriers for cotton trade include state trading, tariffs, value-added tax (VAT), tightened import licensing procedures, and export subsidies. Cotton producers also receive price support measures, subsidies to cover the transaction cost, and public stockholding. However, since China's accession into the WTO, China's farmers have been progressively more exposed to the market forces while U.S. and European farmers continue to be protected.

In the European Union, cotton support began when Greece (1981) and Spain (1986) joined the European Union's Common Agricultural Policy (CAP). Before the accession to the European Union, during the 1960s and 1970s Greece and Spain together were producing 130,000 tons of cotton. But, once they became European members and, were eligible for CAP funds, cotton production increased by an annual average of 7.3 percent and exceeded 400,000 tons during the 1990s (Baffes, 2004). These two countries together accounted for 2.5 percent of world production and 6 percent of world exports in 2001. However, with a subsidy of US$979 million in 2001/02, they accounted for 16 percent of world cotton subsidies in 2001(Gillson et al.,2005). EU cotton export subsidies were found to be US$4 billion (Malik, 2005).

Regarding market access, the World Integrated Trade Solution Database (World Bank/UNCTAD, 2003) shows that the average cotton world tariff is 5.3 percent. However, cotton tariffs varied between a high of 90 percent (by China) to 0 percent (by 64 countries including the EU). Of the other largest cotton-producing countries, Brazil imposes a tariff of 9.2 percent, India a tariff of 5 percent, Pakistan 5 percent and Uzbekistan 30 percent. Import textiles containing African cotton are favored by the U.S. African Growth and Opportunity Act (AGOA). Nevertheless, imports of raw cotton are excluded of this agreement and U.S. Generalized System of Preferences (GSP) for developing countries.

On April 31, 2003, four West African cotton producing countries (Benin, Burkina Faso, Chad, and Mali) submitted a joint proposal to the WTO containing two vital demands. First, they wanted United States, China, and the European Union to eliminate the support given to the cotton sectors. Second, they demanded a fair compensation for

their losses until full removal of the support. These two requirements have become known as the 'Cotton initiative' (WTO, 2003). The cotton initiative received considerable attention during the Fifth WTO Ministerial Conference held in Cancun (10-14 September 2003). Numerous countries were sympathetic to the initiative, including Argentina, Australia, Bangladesh, Canada, Cameroon, Guinea, India, Senegal, and South Africa. Despite this contrite, the inability to deal effectively with this initiative was one of the reasons for the failure to reach agreement in Cancun.

The heart of this initiative contained proposals on all three "pillars" (domestic supply, market access, and export subsidies) of the agricultural negotiations and reflects the position of the African Group countries until the Sixth WTO Ministerial Conference in Hong Kong recently. Concretely, in this conference they demanded: (a) elimination of 80% cotton domestic supports by 2006, 10% in year 2007 and 10% in year 2008, b) duty and quota free access for the LCD's cotton and cotton products to developed country markets, and c) removal of cotton export subsidies by the end of 2006. In Hong Kong, their voice was heard, and in its final declaration two important amendments in international cotton trade was reached. First, from the start of the implementation period (from 2006) developed countries will provide tariffs and quota free access for poor countries' cotton exports. Second, all forms of export subsidies for cotton by developed countries are to be eliminated in 2006 (WTO,2006). It remains to be seen whether African cotton exporters can effectively compete with developed countries' cotton producers given the massive production subsidies in the rich countries. Will this success be a catalyst for poverty reduction in Africa as the developing countries claimed? This paper tries to provide the answer to this question by considering one African country,

which belongs to the LDCs and already had implemented cotton reforms and significant producer of cotton: Zambia.

Cotton production in Zambia increased from 42,000 tons in 2003/2004 to 180,000 tons in 2004/2005 and furthermore cotton is one of the most important export crops, reaching $100 million in foreign exchange earnings in 2004. Several economic reforms were adopted in Zambia during the last decade including the elimination of marketing boards in cotton and trade liberalization. A free international cotton market will benefit Zambian producers, and also workers in cotton sector, as it will lead to an increase in the cotton world price.

The purpose of this analysis is three fold: (a) to study the impact of the Doha Round agreement on the cotton sector in Zambia, (b) to analyze the reality of the Doha agreement versus the African countries' cotton initiative during the WTO Hong Kong conference, and (c) to contribute to the analysis of further agricultural trade liberalization and implications for poor countries. This analysis is undertaken by developing a computable general equilibrium (CGE) model of the Zambian economy based on the social accounting matrix (SAM) of this country. We will run simulations for baseline and alternate scenarios. The baseline encompasses the existing policies whereas the two scenarios incorporate (a) the Doha Round policies, and (b) the African countries proposals, respectively.

The paper is structured as follows. First, we introduce a short description of the Zambian economy highlighting on the huge importance of its cotton sector. Second, we present a detailed review of the existing studies of the effects of the trade liberalization on cotton world prices. Third, we discuss about the social accounting matrix employed in

our study. Fourth, we explain in detail the CGE model results of the different scenarios on Zambian cotton production, exports, prices, and welfare of agrarian population. Finally, we will present our conclusions.

The Zambian economy

The Republic of Zambia or Zambia is located in Southern Africa. Its border countries are Angola, Democratic Republic of the Congo, Malawi, Mozambique, Namibia, Tanzania, and Zimbabwe. Zambia, with a GDP (purchasing power parity) of $10.23 billion, a GDP per capita of $900, and a real GDP growth rate of 5% in 2005, is one of the poorest countries in the world with belongs to the LDCs (CIA). This poverty can be defined in terms of difficult access to income and employment opportunities (United Nations, 2005). In 2005 around 67% of the Zambian population lived bellow the poverty line (monetary value of a basket of commodities that allow a person to achieve a minimum caloric requirement). 64% of the population lives on less than $1 per day. This poverty affects especially the Zambian rural population. In 2004 extreme poverty in rural areas was 74%, in contrast with the 52% accounted by the urban areas (United Nations, 2005).

In 2005 the labor force was equal to 4.8 million. The 50% of the Zambian labor force was unemployed. The labor was principally employed in agriculture (85%), followed by services (9%), and industry (6%). The public debt was 104.2% of the GDP (CIA).

The undernutrition affects about 50% of children under age 5. The death rate is 19.93 deaths per 1,000 habitants and the infant mortality rate is 19.93 deaths per 1,000 persons. The life expectance at birth is 40.03 years.

Cotton is the most important Zambian export crops, reaching $100 million in foreign exchange earnings in 2004. In 2004 cotton lint was the leading agricultural good exported and cottonseed and cotton wastes were the seventh and eighteen, respectively (FAO Statistics). Cotton seed sales constitute a huge cash income source in Zambian rural households (Balat and Porto 2005a). Furthermore cotton production in Zambia increased from 42,000 tons in 2003/2004 to 180,000 tons in 2004/2005.

Several cotton sector reforms were adopted in Zambia during the last decade in order to improve the quality of the product and to be more competitive in the international markets. Before 1994 the cotton sector was extremely intervened. The government policies were basically input subsidies and price guaranties. Since 1977 until 1994 the only connection between the local and the international market was the Lint Company of Zambia (Lintco). This company behaved as a monopoly in credit loans and input sales to the cotton farmers and as monopsony in the seed cotton markets (Balat and Porto 2005b). One of the most important reforms adopted during the mid-1990s was the elimination of the marketing boards (Balat and Porto 2005a). Lintco was liberalized in 1994. This fact promoted the market entry; rising a regional private monopolies phase in the Zambian cotton market. In 1999 the competition increased considerably (Brambilla and Porto 2005). At the moment out grower-schemes (agreements by which cotton firms provide inputs on loans that may be repaid by the farmers at the yield time) carry out most of the cotton production in Zambia.

The Effects of the Trade Liberalization on Cotton World Prices

Due to the increasing importance of the cotton in the international negotiations arena, especially since the WTO Brazil/USA case, an the plight of African cotton

producers, number of studies have tried to measure the effects of cotton trade liberalization on world production, consumption, trade, prices, and cotton farmers' welfare in the developing countries in particular. Studies of this kind are continuing to be conducted. These studies differ in the countries considered, products, period, baseline and alternative scenarios, data, elasticities, and modeling approach, which makes it so difficult to compare. We will summarize the most relevant studies dealing with the possible effects of trade liberalization on the cotton sector, with focus on world cotton prices changes (see Table1). We will use these prices changes to analyze the impacts of trade liberalization on Zambian cotton sector.

Valderrama (2000) studied the effects of U.S. subsidies removal on the international cotton prices. He employed the International Cotton Advisory Committee (ICAC) Price Model, which is a forecasting tool consisting of a single equation regression relating prices, U.S. export market share and stock-to-use ratios. He concluded that as the result of U.S. subsidy elimination the average international cotton price would rise by 6 cents related to 1999/00 prices.

FAPRI (2002a) used a multimarket nonspatial partial equilibrium model to study the impact of the multilateral removal of agricultural border measures and farm programs on developing countries. Country submodels with grains, other crops, oilseeds, livestock, and dairy products for 34 countries constituted the modelling system, which is solved for world prices. The baseline scenario incorporated the URAA, the CAP and China and Taiwan's WTO accession. Two alternative scenarios were run: the first scenario is liberalization of both domestic and trade policies and the second is only trade policy liberalization. The period of study includes 2002/2003 to 2011/2012. This study found

that under complete liberalization world cotton prices would increase on average by 11.44% and under elimination of trade barriers only by 2.93%.

FAPRI (2002b) used the same methodology as the paper described above (FAFRI, 2002a). The *FAPRI 2002 World Agricultural Outlook* for 2002-2011 formed the baseline. The alternative scenarios were, once again, the complete cotton market liberalization, and, the trade liberalization (elimination of border measures). The estimated increases in prices were 15% above the baseline for the complete liberalization scenario, and 4% for the only trade liberalization.

Tokarik (2003) using a partial equilibrium model, provided quantitative estimates of the impact of removing agricultural domestic policies comprising of, export subsidies, production subsidies, and input subsidies. The PSE/CSE database (OECD, 2001) provided this study with data on agricultural support for all commodities except cotton. The support data of cotton were constructed from budget data maintained by the U.S. Department of Agriculture. The PSE/CSE database provides information on production, subsidy rates, and input subsidies. The PSE/CSE measurement captures the difference between consumer and world prices. Data for trade flows were taken from the Food and agricultural Organization (FAO). The benchmark for all the data was 2000. The values of domestic demand and supply elasticities for various commodities and countries were taken by Gardiner et al. (1989). The import demand used in the majority of the cases is -0.75, while the export supply elasticity has a range between 1.5 to 10. The model was used to perform four simulations: removal of market-price support, production subsidies, input subsidies, and all forms of support. The resulting cotton price increase is 2.8%, which can be decomposed as 2.0% increases

for production subsidy removal, and a 0.8% rise for price support elimination.

Sumner (2003) estimated the effects of the removal of the five U.S. policies (marketing loan, direct and production flexibility contract payments, market loss assistance and counter-cyclical payments, crop insurance, and export credit guarantee subsidies) for U.S. upland cotton production and export subsidies over the marketing years 1999-2002. He adapted the FAPRI (2002a) econometric simulation model for his study. This model replicates historical prices and quantities using a multi-commodity, multi-country simulation framework. All the relevant data were taken from the U.S. Department of Agriculture (USDA), while the elasticities were taken from FAPRI. The cotton supply and demand elasticities utilized were 0.3 for the supply, –0.25 for the demand, while the U.S. export demand elasticity ranged between -2.5 and –4.0. The baseline results were from the FAPRI model including the six cotton domestic policies. The seven alternative scenarios were: six for the removal of each of the U.S. relevant subsidies separately, and one for the elimination of all of the policies. The results of this study show that the world cotton price would have raised by 12.6 % without the U.S. policies. The model also compared baseline projections based on the Farm Security and Rural Investment Act (FSRI Act) of 2002 and the Agricultural Risk Protection Act of 2000 in order to predict the possible impact of the upland cotton subsidies elimination in the period 2003-2007. This study predicted an increase on world market cotton prices of 10.8%.

Pan et al. (2004) analyzed the possible effects of U.S. cotton liberalization in world cotton prices. These authors used a partial equilibrium structural econometric model containing the 24 principal cotton importers and exporters. The baseline scenario

contained the 2004 U.S. farm programs. The alternative scenario consisted of the elimination of The U.S. loan rate, target price, and direct, countercyclical, and step two payments. This study predicted an increase in the world cotton price of 2.14% for 0.86% for 2004/05 and 2013/14 respectively.

Poonyth et al. (2004) studied the impact of cotton subsidies on the international prices, production, and welfare by using the Agricultural Trade Policy Simulation Model (ATPSM) developed by UNTAC and FAO. This model, based on the multi-region, partial equilibrium, static models, contains 36 agricultural products and 161 countries or country groups. Using the base period 1996/00, the model was utilized to run four different simulations by varying the demand and supply elasticities. The results obtained suggest changes in the international cotton prices ranged between 3.1% and 4.8%, with larger changes arising from more inelastic demand.

Goreux (2004) estimated using a standard partial equilibrium model the changes in the international cotton prices resulting from the elimination of the cotton subsidies in United States, China, Greece, and Spain. The basic reasoning of his study is as follows, cotton farmers receive the world price (P_w) in non-subsidizing countries, while they receive this price plus a subsidy (s) in the subsidized countries. Therefore, if the subsidies were eliminated, prices received by farmers in the subsidizing countries would fall. Consequently, farmers in these countries will produce less and thereby reducing the international supply (shifting the supply curve to the left). This leads to a new equilibrium with higher world price. Goreux calculated this new equilibrium assuming that the supply and demand elasticities are 0.5 and -0.1 respectively. The results showed an increment in world cotton prices of 12% on average over the period 1997-2001. He

conducted a sensitivity analysis for various elasticities [($\varepsilon_d = -0.05$ and $\varepsilon_s = 0.7$) to ($\varepsilon_d = -0.6$ and $\varepsilon_s = 0.15$)] and the results show a price ranged from 2.9 % to 13.4 %.

Shepherd (2004) studied the effects of U.S. cotton subsidies removal on cotton international price, production, and consumption. He utilized a two stage approach. First, a vector autoregression (VAR) was used to build a subsidy-inclusive model of the world cotton market. Then, the model was tested against historical data. Second, he employed this model to test more subsidies will lead to lower price. The data used covered the period 1965/2002. The cotton prices were proxied by the IMF's "Liverpool price". The total world production and consumption, and the stocks change over the period were obtained from the U.S. Department of Agriculture (USDA). U.S. cotton subsides were proxied by U.S. direct payments (in nominal terms) to the cotton producers. He developed a VAR(j) model in which the dependent variable Y (initially the vector of all data series) was a function of three deterministic terms: a constant, a dummy variable (which is zero for years between 1965/1973 and one for 1974-2002), and a time trend. A modified likelihood ratio test (Sims, 1980) was used for hypothesis testing. The results suggested that unexpected changes in subsidy policies increases the world prices marginally before decreasing these prices. The historical impact of subsidies was also examined and Sheperd reached the conclusion that subsidies do not seem to explain the price fluctuations over time. In relation to the effects of subsidy removal, Shepherd ran three scenarios using a stochastic dynamic simulations: removal of 10%, 50% and 90% subsidy, respectively. While a removal of 50% or 90% subsidy affects the cotton world prices, the paper concluded that these results were not

statistically significant, and therefore the impact of cotton subsidies removal in the international cotton prices is almost nil.

Gillson et al., (2004) used the Goreux (2004) model and adapted it by assuming first a single world cotton market and, second a perfectly fragmented one in which the producers cannot enter or exit. The 1999/00 subsidy data was used in this study. Data for production and bilateral trade were taken from the FAOSTAT Agriculture Database and COMTRADE database (2003). The initial cotton price assumed was equal to $1.16 per kilogram. The assumed elasticities were –0.1 and 0.5 for the demand and supply, respectively. Four simulations were run: a) single market with uniform elasticity (S/U), b) fragmented market with uniform elasticity (F/U), c) single world market and differentiated elasticities (S/D), and fragmented world market and differentiated elasticities (F/D). The model predicted a cotton price increase of 18%, 20%, 22%, and 28% for the simulations S/U, F/U, S/D, and S/F, respectively.

Anderson and Valenzuela (2006) estimated the impacts of a) full removal of cotton subsidies and tariffs, b) a possible U.S. partial cotton policy reforms as a consequence of the WTO U.S./Brazil dispute, and c) the Hong Kong Trade Ministerial decision in December 2005. For the first case (complete cotton liberalization) they used an adapted Version 6.05 of the Global Trade Analysis Project (GTAP). This version contains data for 2001, but Anderson and Valenzuela modified the subsidies from $1 billion (2001) to $3 billion (2000/2002). The implementation of the Uruguay Round Agreement on Textiles was also included in this database. The results estimated a 12.9% average increase in the international cotton prices. In the second scenario (U.S. only partial reform), the removal of the step two programs with a one-third cut on the domestic

subsidies predicted a rise in cotton world prices of 4.4%. The third scenario (Doha Development Agenda) included a one-third reduction in rich countries cotton subsidies with quota and duty free for the LDCs countries to the developed countries and complete export subsidy elimination. The results estimated an increase of 3.2% in the world cotton prices.

Given the divergence in these studies' framework and conclusions it is not an easy task to choose one in order to analyze the impacts of cotton trade liberalization on the Zambian cotton sector. We use a different export price change in each of the alternative scenarios, i.e. the Doha Round policies, and the African countries' proposals. In the first case we utilize the Anderson and Valenzuela estimation (i.e. 3.2%) because this study modeled the last WTO cotton agreements. For the African countries proposals case we use the 12 % increment predicted by Anderson and Valenzuela for being closer to the actual world cotton price situation.

The Zambian Social Accounting Matrix

A social Accounting Matrix (SAM) is a square matrix which provides information on all the transactions taken in a specified economy during a certain period of time. Each SAM cell represents the income or receipt from its column account to its row account or, alternatively, each cell shows the expenditure or outlay to the account of its column. Therefore, each SAM's account total receipts (row total) equal total outlays (column total).

This analysis is undertaken by developing a computable general equilibrium (CGE) model of the Zambian economy based on the 2001 Zambian SAM (Thurlow,

Evans, and Robinson, 2001). Zambian macro SAM is consistent with the World Bank's 2001 Revised Minimum Standards Model (RMSM) of Zambia. At the micro level, the macro SAM is disaggregated using national and foreign trade accounts, the input-output structure contained in the 1995 Zambia SAM, produced by IFPRI (Hausner, 1999), and the 1998 Living Conditions Monitoring Survey (LCMS). The values are in billions of 2001 Zambian Kwacha (ZK).

Table 2 shows the aggregate Zambian macro SAM which distinguishes between different accounts: activities, commodities, factors, households, enterprises, government, savings, and rest of the world. Each of the entries in the macro SAM are disaggregated in the micro SAM.

The macro SAM activities accounts represent the firms that produce Zambian commodities and services. Its flows are valued at producer's price. In the micro SAM, these activities are divided into fourteen agricultural sectors (maize smallholder, maize large-scale, drought tolerant staples, groundnuts, sugar, cotton, tobacco, coffee, wheat, horticulture, other crops, livestock, fishing, and forestry) and fourteen non-agricultural sectors (mining, food beverages and processed tobacco, textiles and garment, wood and furniture, fertilizer and industrial chemicals, other manufacturing, electricity and water, equipment and machinery, construction, trade and transport services, tourism, other private and community services, financial services, and public services).

In the macro SAM (Table 2) the activities row indicate that activities receive ZK 23,670 and ZK 2,500 billions from commodities and households, respectively. In other words, commodities pay 23,670 to activities (marketed output) while households pay ZK 2,500 billions (marketed output). In the micro SAM, these values are disaggregated by

activities, commodities, and households. The total activity income is ZK 26,170 billions (Table 2).

The commodities accounts correspond to activity outputs and imports. Its flows are valued at market prices, including transaction cost and taxes. The micro SAM disaggregates the commodities into fourteen agricultural sectors following the same classification as the activities.

The commodity receipts (SAM commodities column) come from the activities (intermediate demand), commodities (transaction costs i.e., domestic, imports, and exports marketing margins), households (households final consumption), government (government consumption), investment (investment), and rest of the world (exports, valued at f.o.b. prices). That is, activities pay ZK 14,118 billions to commodities. Commodities provide ZK 5,879 to commodities in the form of transaction cost. Household expend ZK 8,241 billions in commodities while government pays 1,704, investment ZK 2,627 and the rest of the world ZK 3,760 billions. Therefore, the total demand is 36,346 billions (Table 2).

The macro SAM (Table 2) total factor income (ZK 11,844 billions) is composed by the value-added (receipt from the activities) and the factor income from the rest of the world (receipt from the ROW). The activities pay factors ZK 11,844 billions while the ROW does not pay in Zambian case. These receipts/payments are disaggregated by factors in the micro SAM. In the micro SAM the factors are disaggregated into eight categories: uneducated labor, primary schooling labor, secondary schooling labor, post-secondary schooling labor, agricultural capital, mining resource capital, other, and land.

The households in the macro SAM (Table 2 households' row) receive payments from the production factors, from other households, enterprises, government, and the ROW. Concretely, the factors pay ZK 5,978 billions to households as factor income to households, the households pay ZK 169 billions as inter-households transfers, the enterprises provide ZK 5,365 billions as surplus to households, and the government and rest of the world ZK 453 and ZK 7 billions respectively as transfers. The total households income is 11,972 (Table 2). In the micro SAM the households are divided in rural and urban. The rural households are clasifed in remote small scale, remote medium scale, remote non-farm, non-remote small scale, non-remote medium scale, non-remote large-scale, and non-remote non-farm households. The urban households are divided into low-skilled employee, private employee, public employee, and high-skilled employee households.

The enterprises (Table 2 enterprises' row) receipts come from the production factors and the government. The production factors payment to enterprises (VA capital) is equal to ZK 5,866 billions. The government provides ZK 106 billions to the enterprises as government transfers. In the micro SAM the enterprises are divided in enterprises-mining and enterprises non-mining. The total enterprises income is equal to ZK 5,972 billions (see Table 2).

The government receives its income (Table 2 government's row) from the activities, commodities, households, and enterprises. The activities pay ZK 208 billions to the government, while the commodities, households, and enterprises gives ZK 877, ZK 947, and ZK 296 billions, respectively. In the micro SAM the government account is divided in government, three taxes (direct, producer, and sales), and tariffs accounts.

The savings account total recipients (Table 2 savings' row) come from the commodities (households' savings), the production factors (enterprise savings), government (government savings), and the rest of the world (foreign savings). The households, enterprises, and foreign savings are ZK 115, ZK 311, and 2,629 billions, respectively while the government has a deficit for ZK 428 billions.

The rest of the world receives payments (Table 2 ROW row) from Zambian commodities, and government. The Zambian commodities give ZK 5,902 billions as imports (Table 4.23 for disaggregated values). The government pays to the rest of the world ZK 493 billions as transfers.

Based on this SAM we will develop a CGE model and use the General Algebraic Modeling System (GAMS) to run baseline and alternate scenarios simulations. The baseline, as we have said, encompasses the existing policies whereas the two scenarios incorporate (a) the Doha Round policies, and (b) the African countries proposals, respectively.

The model

The impacts of both the Doha Round agreement and the possible consequences of the African countries' cotton initiative are modeled using the Lofgren et al. (2002) static model, which follows Dervis, Melo and Robinson (1992) approach. This model, developed at the International Food Policy Research Institute (IFPRI) is also the reference used in Fontana (2002 and 2003).

The model mathematically represents the economic agents' behavior in a Walrasian economy where markets are cleared in all the sectors. The equations utilized

in this model are divided into four blocks: prices, production and trade, institutions, and systems constraints. The price block is formed by nine equations: import price, export price, domestic price of domestic non-traded goods, absorption, marketed output value, activity price, aggregate intermediate input price, activity revenue and cost, consumer price index, and producer price index for non-traded market output.

The production and trade block are formed by seventeen functions: activity production function, value-added intermediate-input ratio, demand for aggregate value-added, aggregate intermediate input demand, value- added and factor demand, factor demand, disaggregated intermediate input demand, commodity and production allocation, output aggregation, first-order condition for output aggregation function, output transformation, export-domestic supply ratio, output transformation, composite supply, import-domestic demand ratio, composite supply for non-imported outputs and non-produced imports, and transaction services demand.

Eleven equations form the institutional block: factor income, institutional factor income, domestic non-government institutions income, intra-institutional transfers, household consumption, and household consumption in marketed output, home consumption, investment demand, government consumption demand, government revenue, and government expenditure.

The system constraint block consist of eight equilibrium conditions: factor markets, composite commodity markets, current-account balance for the rest of the world in foreign currency, government balance, direct institutional tax rates, institutional savings rates, savings-investment balance, and total absorption.

Representative agents in various sectors apply microeconomic behavior, i.e., maximize their objective functions subject to certain constraints. Producers maximize profits given the resource endowments; assuming perfect competition (i.e. fixed prices). Factor use is modeled by a constant elasticity of substitution (CES) production function. We assume an elasticity value of - 0.6. Once these factors are determined, some of them enter into a Leontief technology to produce some commodities and the remaining factors along with intermediate input enter into a CES technology to produce other commodities. The final ratio between value -added and intermediate inputs is determined by the interaction of their relative prices. The activity's output final price is determined by the aggregate intermediate input and value-added prices and the value-added taxes.

The producers marketed output allocation decision is governed by a constant elasticity of transformation (CET) function which, by distinguishing between domestic and exported and domestic goods, captures these products' quality differences. Following Fontana (2003) we assume an elasticity of substitution of –2.0, -1.5, and –0.8 for agriculture, manufacturing, and services sectors respectively. Producers, in order to maximize profits, will sell in the market (domestic or international) with higher price. The international price is considered fixed for Zambia, being a small country. Therefore, the optimal mix between exports and domestic sales will be determined by these relative prices interaction.

A CES Armigton specification captures the domestic output and imports imperfect substitutability. Here also we utilize Fontana's (2003) elasticities assuming an elasticity of substitution of –2.0, -1.5, and –0.8 for agriculture, manufacturing, and services sectors respectively. Cost minimization of domestic demand leads to an

optimal mix between imports and domestic output determined by the interaction of relative prices for imports and domestic goods. For the reason explained above we assume that Zambia faces fixed world price.

When commodities are exported, imported or sold domestically, transaction cost emerges. The quantity of commodity demanded as transaction service input is given by the sum of all these trade inputs generated by the exported, imported, and domestic sales activities.

Each household face the problem of maximizing Stone-Greary utility function, subject to its budget constraint. We assume identical preferences among the households. This problem leads to two linear expenditure systems (LES) as the representation of consumers spending in both, marketed commodities and, home commodities. And, therefore, each of these LES divided by its relevant price gives the marketed commodities demand and home commodities demand respectively.

The household consumption is financed principally with factor incomes generated during the production process, which are also the major income source for the enterprises. The factor income is defined as the sum of the activity return computed as the multiplication of the activity wages and the level of employment. In addition, both receive transfers. These transfers come from the rest of the world, government and other domestic institutions in the case of households.

Investment is financed by households and enterprises savings. The sum of the stock changes and the gross fixed capital formation (i.e. total investment) must be equal to the total savings within the economy.

The government deficit is defined as the difference between government

revenues (i.e. taxes, tariffs, factor income and rest of the world's transfers) and the expenditures (i.e. consumption and transfers to non-government institutions). This deficit is financed through the capital market.

We will run simulations for baseline and alternate scenarios. The baseline encompasses the existing policies whereas the two scenarios incorporate (a) the Doha Round policies, and (b) the African countries proposals, respectively. Both policies will be undertaken by changing the cotton world price, considered exogenous in the model for Zambia being a small country. As stated previously, a 3.2% world price change in the Doha Round policies scenario, and a 12 % in the African countries' proposal scenario will be used.

In order to balance different macro-accounts we establish different macro-closures. For the current account of the balance of payments we assume that a fixed level of foreign savings is maintained by a flexible exchange rate adjusts. A savings-driven closure is chosen to achieve the savings-investment balance. That is, we assume that the marginal propensities to save are fixed and investment quantities are flexible. The same assumptions are held in other studies such as Fontana (2002 and 2003), Thurlow and Wobst (2004), and Löfgren et.al. (2004).

Finally, for the market closures we assume that labor is unemployed and mobile and that the wage is fixed for each activity. We make this assumption because one of the major characteristics in the developing countries is the unemployment. In the case of the capital market we assume that capital is fully employed and activity-specific.

The simulation results

Cotton protection is one of the most important problems not only in the international trade arena but also in some of the poorest countries in the world, which have begun to play key roles in the WTO negotiations. The simulations performed in this paper show the extent of the benefits of implementation of the Doha WTO Round in Zambia and the reality of the Doha agreement versus the African countries' policy initiative during the last WTO Hong Kong conference.

We conducted simulations for baseline and two alternate scenarios. The baseline encompasses the existing policies whereas the two scenarios incorporate: (a) the Doha Round policies (duty and quota free access for developing countries' cotton to developed countries' markets, and export subsidy removal by the developed countries), and (b) the African countries' proposals (elimination of domestic cotton supports by 2008, free access for the LCD's cotton and cotton products to rich country markets, and removal of cotton export subsidies). These scenarios are run by considering the world price changes in the Doha Round policies and the African countries Initiative. In the Doha Round (DR) scenario we increase the international cotton price by 3.2%. In the African countries proposal (AP) scenario we raise the world price by 12%. We focus on the effects of these price increases on the Zambian cotton sector (production, exports, prices), and agrarian population welfare.

One of the most important effects of this external shock (i.e., increase in the world cotton export price) on the Zambian cotton sector is the increase of the Zambian cotton export price. In the DR scenario this price rises by a 4.23 % while it increases by 15.65% in the AP scenario (Table 3.1). As we can see from Table 3.2, this higher cotton export

price leads to an increase in the Zambian cotton exports by 11.12% and 43.20 % in the DR and AP scenarios respectively. Therefore the Zambian cotton export sector will benefit greatly from the rich countries' cotton trade liberalization, gaining more market share abroad as the cotton protection comes down in the developed countries.

In contrast, on the import side, the effect of the cotton trade liberalization decreases the Zambian cotton import prices in both scenarios (Table 3.1). In the UR scenario this decrease is 0.14%. In the AP scenario the cotton import prices decline by 0.58%. Nevertheless, the import quantity responds to these changes in prices are different in both scenarios (Table 3.2). In the DR scenario the quantity imported hardly changes, while in the AP simulation the quantity imported increases by 0.30% as a consequence of the lower prices. These different effects are a consequence of the different domestic-import price ratio variations in both scenarios.

The gross revenue per activity unit or activity price increases noticeably in both simulations (Table 3.1). In the DR scenario the quantity supply increases by 0.18% while in the AP scenario by 0.49%. Consequently, the quantity supplied increases. The gross revenue increases by 3.15% in the DR scenario and 12.16% in the AP scenario (Table 3.1). Again we can see that the cotton sector benefits from the world cotton free markets.

As a consequence of all these price changes, quantities of aggregate marketed domestic cotton (domestic marketed sales of domestic cotton plus exports) and cotton composite supply (domestic use of marketed domestic output plus imports) increase. The increase in the quantity of aggregate market output (cotton) is quite large in both scenarios. In the DR scenario this quantity increases by 8.84% while in the AP it rises by

34.70% (Table 3.2). The cotton composite supply increases by 0.1% in the DR scenario and by 0.41% in the AP simulation (Table 3.2). The cotton intermediate demand also is higher in both scenarios (Table 3.3). In every sector, demand for cotton as intermediate input increases, more so in the AP scenario because of increase in processed cotton exports.

Another important effect of cotton trade liberalization is the extremely high increase in cotton labor demand, which improves Zambian employment (Table 3.4). In the DR scenario each Zambian labor category is benefited by almost 12.52%. The larger is the market liberalization, the higher are the labor gains as the AP scenario results show. In this simulation the labor demand by the cotton sector increases by almost 53.06%. So, Zambian labor will benefit greatly by a free international cotton market.

This impact on labor demand has a positive effect on labor income, which increases in all categories (Table 3.5) in both scenarios. In fact, even capital income (other than mining) rises, as does land income because of the higher demand for these inputs as cotton production increases. Only mining capital is injured, but by a very low percentage. Concretely, the labor income increases between 0.12% (post-secondary labor) and 0.5% (uneducated labor) in the DR scenario. In this scenario the capital (different than mining) rises by 0.14% while agricultural capital does the same by 0.9%. Land income increases by 1.28%. As can be expected, these increases are higher in the AP scenario, ranging from 0.48% (post-secondary labor) to almost 2.07% (uneducated labor). In this case, capital (other than mining) income increases by 0.59% while agricultural capital does the same by 3.82%. Land income rises by 5.51%. Mining

income decreases by 1.70%. Within the labor income gains, uneducated labor benefits more, as does the agricultural capital in the case of the capital gains as the Stolper-Samuelson theorem predicts. The elimination of world trade distortions will increase the cotton relative price raising the real return of the intensive factor i.e., uneducated labor, in cotton production.

Therefore, all the production factors, with the exception of mining capital, benefits with the free trade in cotton (Table 3.6). This translates to higher incomes in all domestic non-governmental institutions. These income increments go from the lowest (0.01% and 0.07%) to the highest (0.54% and 2.31%) in the DR and AP scenarios respectively. The major income gains are concentrated in the remote rural medium-scale households in both cases, while the lowest benefits are found in the urban high-skilled employers. The mining enterprises, the only losers, decreases their income by 0.2% in the DR scenario and 0.82% in the AP scenario because factor move to profitable sectors.

Conclusions

Cotton rich countries' protection and its effects had become a key issue in the WTO negotiations especially since the US-Brazil dispute and African Cotton Initiative were brought to the fore front. In the last WTO Conference some changes in cotton trade had been reached but they fell short from African countries' demands. In this paper we have developed a CGE model of the Zambian economy based on the 2001 Zambian SAM to: (a) contribute to the analysis of the impact of the Doha Round agreement on the cotton sector in Zambia, (b) compare the Doha Round and the African countries' proposal

outcomes to the Zambian economy, and (c) render more information about further agricultural trade liberalization and its implications for the poor countries.

The results illustrate that the African countries' demands are justified. We have shown the huge benefits of cotton trade liberalization to the Zambian economy. The less is the rich countries' protection, the more are the Zambian gains (i.e., the Cotton initiative policies provide much more gains to the African cotton producers countries than the Uruguay Round policies). We have demonstrated the rich countries protection removal (translating to a higher international cotton price) leads to a Zambian cotton export price increase which augments Zambian exports. This benefits Zambian cotton exporters significantly. The activity price (defined as producer prices times yield) increases also with more cotton market competition.

Another important effect of the cotton trade liberalization is the increase in the labor demand by the cotton sector. This implies that the elimination of the rich countries protection will alleviate considerably the Zambian 50% unemployment, one of the causes of poverty. Knowing that 85% of the labor force is employed in the agrarian sector, one can realize how important it is for African countries that the Cotton Initiative is accepted. The uneducated labor benefits the most. Further, all capital except mining rises, increasing agricultural capital as can be expected.

As we have shown in the previous chapter, more the cotton trade liberalization, higher the increase in employment and, consequently, the greater the increase in household's income. All domestic non-governmental institutions except mining enterprises obtain higher incomes due less intervention in the cotton market. The major

income gains are concentrated in the rural remote medium scale households in both cases, while the lowest benefits are found in the urban high-skilled employers. In Zambia extreme poverty is concentrated in rural areas where 74% of the households live under severe poverty.

To summarize, cotton trade liberalization will improve the Zambian economy and the welfare which underscores the importance of considering the African countries proposal for the cotton liberalization. This analysis with almost all certainty can be extended to the rest of the African countries in which cotton constitutes an important crop.

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TABLE 1: STUDIES DEALING WITH COTTON INTERNATIONAL PRICES CHANGES AFTER TRADE LIBERALIZATION

Study	Model	Data	Sector	Barriers removed	Countries	Change in prices
Valderrama (2000)	ICAC price model	1994/95	Cotton	Subsidies	United States	6 cents related to 1999/00 (on average)
FAPRI (2002a)	Multimarket nonspatial partial equilibrium	from 2002/03 to 2011/12	Cotton	Agricultural border measures and farm programs	All	11.44%(on average) under complete liberalization 2.93% under trade distortions removal.
FAPRI (2002b)	Multimarket nonspatial partial equilibrium	2002/11	Cotton	Agricultural border measures and farm programs	All	15%(on average) under complete liberalization 4% under trade distortions removal
Tokaric (2003)	Partial equilibrium	2001	Agricultural	Agricultural tariffs, and export, production and input subsidies.	Multi-country	2.8%
Sumner (2003)	FAPRI (2002a)	2003/07	Cotton	Production and export subsidies	United States	12.6% (1999/00) 10.8% (2003/07)
Pan et al. (2004)	Partial equilibrium structural econometric	2004/05 to 2013/14	Cotton	Farm programs	United States	2.14% for 2004/05 0.86% for 2013/14
Poonyth et al. (2004)	ATPSM	1996/00	Cotton	Subsidies	All	Between 3.1% and 4.8%
Goreux (2004)	Partial equilibrium	1997/01	Cotton	Subsidies	United States, China, Greece, and Spain	12%
Gillson et al.(2004)	Goreux (2004)	1999/00	Cotton	Subsidies	United States, China, Greece, and Spain	Between 18% and 28%.
Shepherd (2004)	VAR	1965/02	Cotton	Subsidies	US	Higher prices with not significant effect.
Anderson and Valenzuela (2006)	GTAP Version 6.5 adapted	2001	Cotton	subsidies and tariffs	All	12.9%
				Step two program and one cut in domestic subsidies	United States	4.4%
				Doha Round policies	All	3.2%

TABLE 2: THE ZAMBIAN MACRO-SAM (billions of current local currency i.e., Kwacha

	Activities	**Commodities**	**Factors**	**Households**	**Enterprises**	**Government**	**Investment**	**ROW**	**Total**
Activities		Marketed production **23,670**		Home Consumption **2,500**					Activity Income **26,170**
Commodities	Intermediate demand **14,118**	Transaction Cost **5,879**		Households final consumption **8,241**		Government consumption **1,704**	Investment **2,627**	Exports (f.o.b) **3,760**	Demand **36,346**
Factors	Value-added **11,844**							Factor income from ROW **0**	Total factor income **11,844**
Households			VA labor **5,978**	Inter-households transfers **169**	Surplus to households **5,365**	Transfers to households **453**		Transfers **7**	Total household income **11,972**
Enterprises			VA capital **5,866**			Transfers to enterprises **106**		Transfers	Total enterprise income **5,972**
Government	Taxes (producer, value-added …) **208**	Taxes(sales, export) and tariffs **877**	Factor income to government, factor taxes	Transfers to government, direct household taxes **947**	Surplus to government, direct enterprises taxes **83+ 213(taxes)**			Transfers	Government income **2,327 +2,245(Taxes)**
Savings				Households savings **115**	Enterprise savings **311**	Government savings **-428**		Foreign savings **2,629**	Savings **2,627**
ROW		Imports **5,902**	Factor income to ROW		Surplus to rest of the world	Transfers to ROW **493**			Foreign exchange outflow **6,395**
Total	Production cost **26,170**	Absorption **36,346**	Total value added **11,844**	Households expenditures **11,972**	Household expenditures **5,972**	Government expenditures **2,327+2,245(Taxes)**	Investment **2,627**	Foreign exchange Inflow **6,395**	

TABLE 3: THE SIMULATIONS RESULTS

TABLE 3.1. CHANGES IN PRICES

	Base	Doha round scenario %	African countries proposals %
Price of exports	1.000000	4.23	15.65
Price of imports	3.788105	-0.14	-0.58
Supply price	1.000000	-1.04	-3.12
Demand price	3.788105	-0.23	-0.67
Activity price	1.000000	3.15	12.16

TABLE 3.2. CHANGES IN QUANTITIES

	Base	Doha round scenario %	African countries proposals %
Quantity of exports	89.622762	11.12	43.20
Quantity of imports	18.333020	-0.006	0.30
Quantity supply	24.225551	0.18	0.49
Quantity of composite goods supply	42.558570	0.10	0.41
Quantity of aggregate Marketed commodity output	113.848313	8.84	34.70

TABLE 3.3. QUANTITY OF INTERMEDIATE DEMAND

	Base	Doha round scenario %	African countries proposals %
Cotton	0.054089	8.84	34.70
Food beverages and processed tobacco	0.091712	0.16	0.68
Textiles and garments	42.412769	0.09	0.36

TABLE. 3.4. QUANTITY DEMANDED OF FACTOR FROM COTTON

	Base	Doha round scenario %	African countries proposals scenario percent difference
Uneducated labor	30.810492	12.52	52.06
Primary schooling labor	25.588305	12.52	52.06
Secondary schooling labor	3.312716	12.52	52.06
Post-secondary schooling labor	0.888319	12.52	52.06

TABLE 3.5 FACTOR INCOME VARIATIONS

Factor	Base	Doha round scenario %	African countries proposals scenario %
Uneducated labor	1519.542655	0.50	2.068291
Primary schooling labor	1771.641782	0.37	1.53
Secondary schooling labor	1057.969333	0.17	0.71
Post-secondary schooling labor	1100.734581	0.12	0.48
Agricultural capital	390.209991	0.88	3.82
Mining capital	785.018372	-0.42	-1.69
Other capital	5081.353337	0.14	0.59
Land	137.772979	1.27	5.59

TABLE 3.6 DOMESTIC NON-GOVERNMENTAL INSTITUTIONS INCOME VARIATIONS

Institution	Base	Doha round scenario %	African countries proposals %
Enterprises-mining	1272.195074	-0.20	-0.83
Enterprises-others	4617.308856	0.14	0.58
Rural remote small scale households	1261.831190	0.49	2.06
Rural remote medium scale households	99.603674	0.54	2.31
Rural remote non-farm households	139.872197	0.19	0.82
Rural non-remote small scale households	1571.902871	0.45	1.90
Rural non-remote medium scale households	168.235099	0.47	2.00
Rural non-remote large scale households	143.313186	0.22	0.92
Rural non-remote non-farm households	347.495369	0.19	0.80
Urban low-skilled self-employed households	2738.531895	0.17	0.70
Urban private employee households	1513.565721	0.15	0.61
Urban public employee households	2764.046456	0.12	0.50
Urban high-skilled employers	1113.067801	0.016	0.07