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Sensitivity Analysis of Cotton Trade Liberalization: A Global Simulation Model Approach

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Abstract/ Summary

Despite global efforts to reduce international trade barriers in order to enhance trade liberalization and establish a more fair competition environment with generally accepted standards, agricultural trade is still regarded as a distorted area, where subsidies are particularly abused by some countries with an aim to create unfair advantage for their goods in the world market. The cotton sector is one of the typical examples for the abuse of subsidies in international trade by titling the playing arena against developing countries. This thesis seeks to study the impact of cotton trade liberalization (i.e. removal of all tariffs and subsidies) and analyze the sensitivity of the Armington elasticities; in particular how escalating these elasticities may affect the results. This analysis is undertaken by developing a partial equilibrium model similar to the Global Simulation model ('GSIM') designed by Francois and Hall (2003). The results show that the world prices increase evenly with the level of trade liberalization. The complete removal of tariffs and subsidies would increase the world cotton price by 7.13 per-cents. If the world price is lifted, non-subsidizing countries increase their production while the subsidizing countries decrease the same. The research once again confirms that huge losses that non-subsidizing countries suffer due to subsidies will become attained gains for these countries when such subsidies were eliminated. In addition, escalating the maximum value of elasticities of substitution will lead to smaller impacts on world prices (6.82 per-cent change in world price), but larger impacts on quantity (23.05 per-cent change in quantity).

Furthermore, the sensitivity analysis performed in this thesis showed no evidence that the Armington elasticities have a significant impact on the results.

Abbreviations

ATSPM - Agriculture Trade Policy Simulation Model

CGE - Computable General Equilibrium

EU - European Union

FAO - Food and Agricultural Organization of the United Nations

FAOSTAT - Food and Agricultural Organization of the United Nations' database

FAPRI - Food and Agricultural Policy Research Institute

GDP - Gross Domestic Product

GSIM - Global Simulation Model

GTAP - Global Trade Analysis Project

ICAC - The International Cotton Advisory Committee

IMF - International Monetary Fund

MacMap - Market Access Map

MT - Million Tons

ODI - Overseas Development Institute

OECD - Organization for Economic Co-operation and Development

ROW - Rest of the World

UNCTAD - United Nations Conference on Trade and Development

UNSD - United Nations Statistics Division

USDA - United States Department of Agriculture

USD - United States Dollars

WITS - World Integrated Trade Solution database

WTO - World Trade Organization

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1 Introduction

1.1 Problem background

Subsidies have been a sensitive issue in international trade for decades. Subsidies along with anti-dumping measures have even become the most commonly used trade barriers during the last thirty years since tariff and non-tariff barriers have been reduced to conform to the World Trade Organization ('WTO') regulations. In this global economy era, when international trade barriers tend to be removed in order to enhance the trade liberalization and establish a fairer competition environment with generally accepted standards, agricultural trade is still regarded as a distorted area, where subsidies are particularly abused by some countries with an aim to create unfair advantage for their goods in the world market. The cotton sector is one of the typical examples for the abuse of subsidies in international trade by titling the playing arena against developing countries. Considering the cotton market structure, it is easy to find that developing countries, including both some of the poorest i.e. West and Central African countries and the largest such as Brazil, China, India etc., are those which possess a competitive advantage in raw cotton production. However, this competitive advantage is outweighed by subsidies of rich developed countries such as the United States and the European Union ('the EU'), which spends billions of dollars in subsidies each year to uphold their inefficient and high-cost production (Primack, 2005). And in fact, such subsidies have a crucial impact on social and economic development of developing countries, particularly of African countries, where cotton production and trade contribute to approximately 40 per-cent of many countries' total merchandise exports and about 5 per-cent of their total Gross Domestic Product ('GDP'), sustaining the source of income for millions of poor households (Baffes, 2004).

The subsidies paid by the United States to their farmers are so influential to the world markets because of the export of its huge share of domestic production. The export prices that are set by the United States have a great impact on farmers in developing countries, who compete directly against American exporters in both domestic and international markets. Since subsidies are often linked to production, directly or indirectly, thus, they will certainly affect the world market by virtue of their sheer scale. Therefore, any decline in cotton exports of the United States as a consequence of eliminating governmental subsidies would lift the world price up, motivating a supply reaction from other exporting countries. As a result, this effect might also lead to partial or complete counterbalance against any price changes. Correspondingly, higher price could also restrain the growth of cotton consumption (Watkins, 2002).

As such, the impact of the United States and the EU's subsidies on the world cotton market has been subject to various claims from suffering developing countries during the last decade. In 2003, Brazil submitted their claim to WTO contending that subsidies of the United States on its cotton production caused losses to Brazil's cotton exports and claiming right to oblige 2.5 billion United States Dollars ('USD') in retaliatory sanctions against the United States. Later in 2003, the proposal to liberalize domestic supply, market access, and export subsidies in agricultural negotiations was submitted to WTO by West African cotton producing countries, demonstrating the position of the African group countries (Schnepf, 2009).

1.2 Problem

Many studies have been implemented to inspect and evaluate the impacts of cotton subsidies of some developed countries on the global cotton market. Since these studies employed different modeling strategies, different sets of countries, and different reference years, hence the results produced were also different. However, one of the vital behavioral parameters that is frequently used by policymakers in such analyses is the so called Armington elasticities, which measures the degree of substitution between domestic and imported goods (Armington, 1969), is often specified by many trade economists as too small, even though the standard transparent approaches to econometric estimation of these elasticities have been proposed for the last 30 years (McDaniel & Balistreri, 2003).

1.3 Aim and delimitations

Based on the problem background presented above, this thesis seeks to: (a) study the impact of agricultural trade liberalization; and (b) analyze the sensitivity of the agricultural trade liberalization scenarios to changes in the Armington elasticities, i.e. how escalating these elasticities affect the results. This analysis is undertaken by developing a partial equilibrium model designed by Francois and Hall (2003). The baseline encompasses the existing policies whereas the three simulations incorporate (a) the removal of the EU and the United States subsidies, (b) the removal of all subsidies, and (c) the liberalization trade of cotton (removal of all tariffs and subsidies).

1.4 Outline

In the first part of this thesis the cotton market and policy setting will be reviewed in order to present the general overview and the background of the study. The thesis will then, in the following section, examine the literature that estimated the impact of cotton subsidies, and the analysis methods used in such literatures. Before reaching the conclusion based on results of simulations, the model and data setting will be analyzed in the third part of this thesis.

2 Cotton market setting and literature review

Chapter 2 provides an overview on the cotton market by identifying which countries are the main producers, how cotton is traded, how policies affect cotton trade, as well as providing a review of the literature.

2.1 Cotton market setting

Cotton and cotton textile industries have been considered as key sectors for economic development of both developed and developing countries, contributing to the sustainable, socially responsible development. Cotton has even been regarded as the raw material of wealth, industrialization, and development, which not only provides income for numerous sectors, from education, health, to transportation etc., but also serves as catalyst of industrialization, and raises the general social welfare. As such, cotton has been always a significant agricultural and industrial crop that was widely cultivated around the world. Cotton has been grown in more than 100 countries, occupying about 2.5 per-cent of the total arable land of the world. Cotton is also regarded as one of the most vital crops with respect to land use, only after food grains and soybeans.

With such characteristics, cotton is traded worldwide with more than 150 nations involved in cotton trade, making cotton one of the heavily traded agricultural commodities. Regarding the labor involved in cotton production, the total involvement reaches approximately 350 million people, of which about 100 million family units are involved directly in the production. Besides, the cotton production also provides employment to millions of people in other relevant industries i.e. agricultural inputs, machinery and equipment, cotton-seed crushing and textile manufacturing. Thus, cotton farming also significantly contributes to food security and helps to improve living standards of residents of rural areas in developing countries such as Africa, Asia and Latin America. As a main source of revenue of many of developing countries, cotton still plays a vital role in industrial development (www, International Trade Center, 2007).

2.1.1 Cotton production

The world's overall top cotton[1] producing countries are Australia, Brazil, Burkina Faso, China (mainland), Côte d'Ivoire, Egypt, India, Mexico, Nigeria, Pakistan, Syria, Turkey, the United States of America, and Uzbekistan (FAO, 2007). Among those countries, China, India, the United States, Pakistan, and Brazil hold about 79 per-cent of the total world cotton production in 2010 (Figure 1).

According to the Food and Agricultural Organization of the United Nations ('FAO') (Figure 2), China has been the country with the largest proportion of cotton production in the world since 2000 with the production peak reached to 7.6 million tons ('MT') in 2007. During the 2000 – 2007 periods, the United States was the second largest cotton producing country with approximately 3.7 MT - 5 MT was produced each year. India was the third and Pakistan was the fourth in the world cotton production ranking. Afterward, records of these countries swapped in the ranking table when India moved to the second place, replacing the United States and forced them to the third position.

[1] Note cotton in the thesis is regarded as cotton lint which is defined as lint: "*fibers from ginning seed cotton that have not been carded or combed*" (FAO).

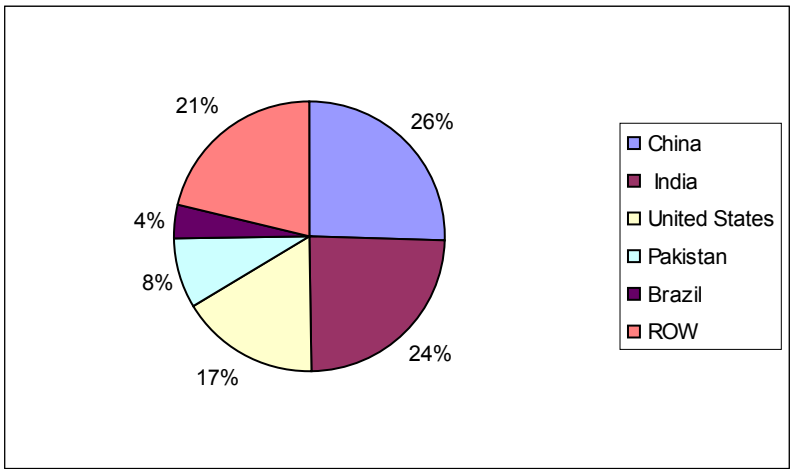

Figure 1. World Cotton Production (2010)

Source: Food and Agricultural Organization of the United Nations: Production – Crops
http://faostat.fao.org/site/567/default.aspx#ancor

Despite the fact that the cotton production of the United States has been decreased during the last decade, other American cotton production has slightly increased. Brazil and Mexico have increased their production by 50 per-cents and 100 per-cents to 0.96 MT and 0.16 MT in 2010, respectively.

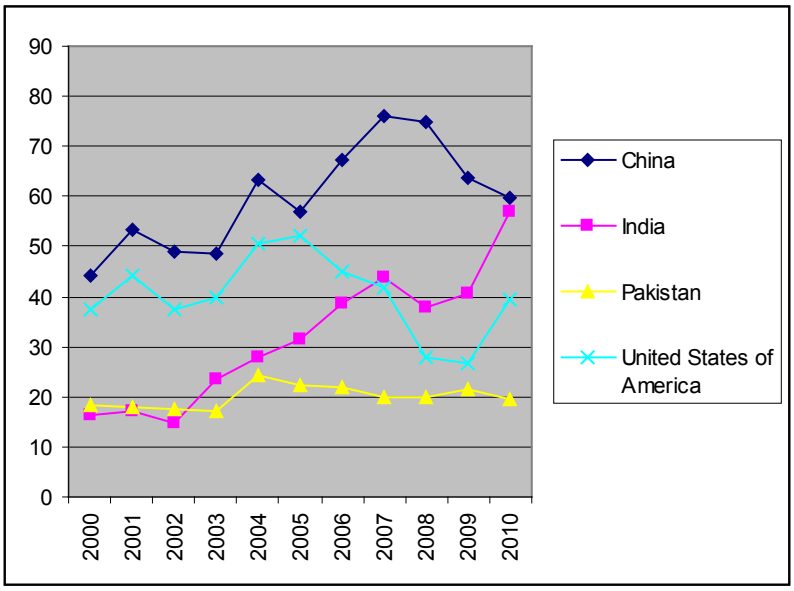

Figure 2. Leading Cotton Producers in millions tons (2000-2010)

Source: Food and Agricultural Organization of the United Nations: Production – Crops
http://faostat.fao.org/site/567/default.aspx#ancor

With regards to Europe, the European cotton production has been decreasing dramatically during the last decade. Production by Greece declined from approximately 4 MT in early 2000s to nearly 2 MT in 2009-2010. The situation for Spain was even worse when its production dropped almost 75 per-cents within 10 years. In summary, the total cotton production of the EU decreased by 50 per-cents within 10 years. It is predicted that European cotton production will no longer play a key role in the world cotton market.

Similarly, African cotton production has decreased by 30 per-cents since 2000. The largest African cotton producer in the first half of the last decade – Egypt, now stays in the second position after having dropped its production by 39 per-cents during the last 10 years. In contrast, Nigeria's production has slightly increased and has led this country to the top position of the African cotton production. Apart from Nigeria, the cotton production of almost all remaining African countries declined within last decade (Table 1).

Table 1. African cotton producers in millions tons (2000-2010)

Countries	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Benin	1.52	1.41	1.74	1.48	1.50	1.22	1.04	1.09	1.00	0.92	0.76
Burkina Faso	1.09	1.14	1.60	1.63	2.10	2.50	2.83	1.47	2.66	1.83	1.90
Côte d'Ivoire	1.77	1.23	1.61	1.72	0.79	1.39	0.60	0.63	0.50	0.53	0.81
Egypt	2.25	3.30	2.90	1.98	2.92	2.02	2.10	2.22	1.05	0.95	1.37
Mali	1.01	2.40	1.81	2.60	2.40	1.87	1.30	0.75	0.60	0.72	0.78
Nigeria	1.47	1.48	1.50	1.59	1.71	1.93	1.97	1.54	1.67	1.77	1.60
Zimbabwe	1.28	1.28	0.73	0.85	1.00	0.75	0.72	0.80	1.16	0.80	0.38

Source: Food and Agricultural Organization of the United Nations: Production – Crops
http://faostat.fao.org/site/567/default.aspx#ancor

Regarding the cost of cotton production, West African countries are the nations with the lowest cost of production, whereas, the United States, Syria, and the EU (Greece and Spain) are countries that produce cotton with the highest cost (Baffes, 2004).

2.1.2 Consumption

Regarding the consumption of cotton in the world market, the world's cotton consumption has escalated at an average annual growth rate of approximately 2 per-cents, which was almost the same as the production growth.

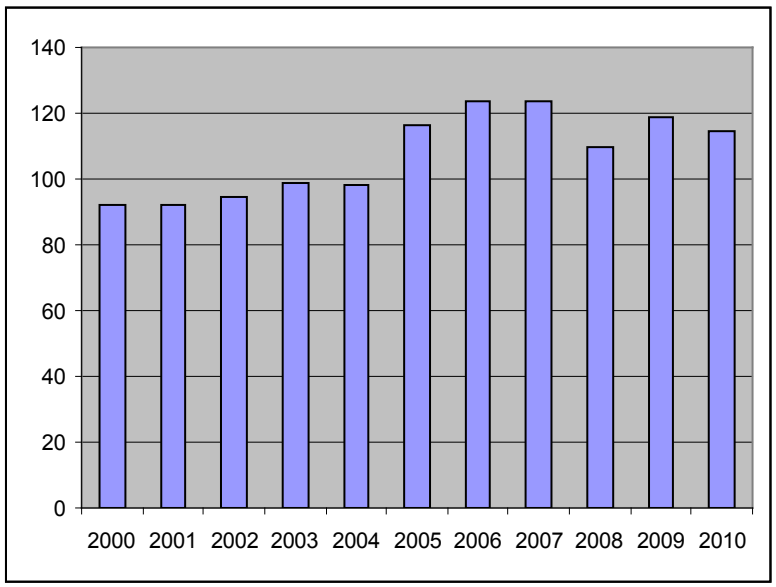

Figure 3. World cotton consumption in million 480-lb. bales (2000-2010)
Source: USDA, World agricultural supply and demand estimates reports

The demand for cotton, however, particularly increased in the period of 2005-2007 as opposed to other periods, with an average growth rate of 11 per-cents in 2005 and 13 per-cents in 2007. In fact, the world cotton production was mainly consumed by developing countries with nearly 80 per-cents since 2000 (ICAC).

According to the United States Department of Agriculture ('USDA') data, more than 60 per-cent of global cotton consumption has been accounted for by China, the United States, India, and Pakistan during the period 2000 – 2010. And the total consumption of these 4 countries has soared considerably in volume. The cotton consumption in China multiplied by 2 times, and this consumption was also increased by more than 1.5 times in India. However, among this group of world's largest cotton consumers, Pakistan has increased slightly and Turkey has remained constantly in volume. In several large cotton producing countries such as China, India, Pakistan, and Turkey; cotton production is mainly absorbed by the domestic textile sector (Watkins, 2002).

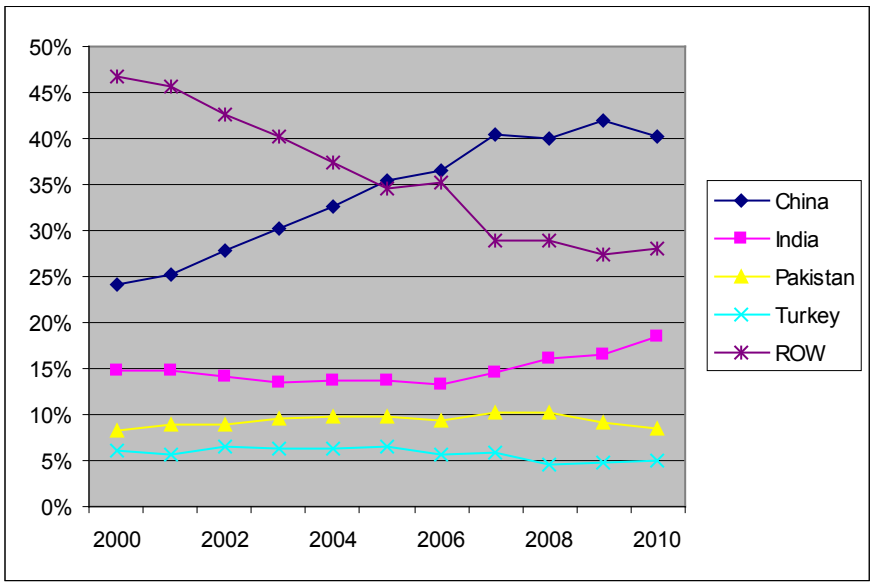

Figure 4. Share of cotton consumption by major users (2000-2010)
Source: USDA, World agricultural supply and demand estimates reports

2.1.3 Cotton trade

Although the local processing was increased, particularly in developing countries, cotton still remains a major traded agricultural raw material. Since the 1980s, more than 30 per-cent of cotton production, which accounts for nearly 6.3 million tons of fiber, is traded each year (ICAC).

In 2009, the United States, India, Brazil, and Australia alone accounted for 70 per-cent of total world cotton export. In developing countries in East Asia such as Uzbekistan, cotton export accounts for 15-45 per-cent of total export volume and is an important contribution to the GDP of these countries (Baffes, 2004). During the period from 2002-2006, the United States was considered as a foremost cotton exporter in the world with USD 3.7 billion and almost 3 million tons of cotton exported, which contributed towards nearly 40 per-cent of global exports in cotton.

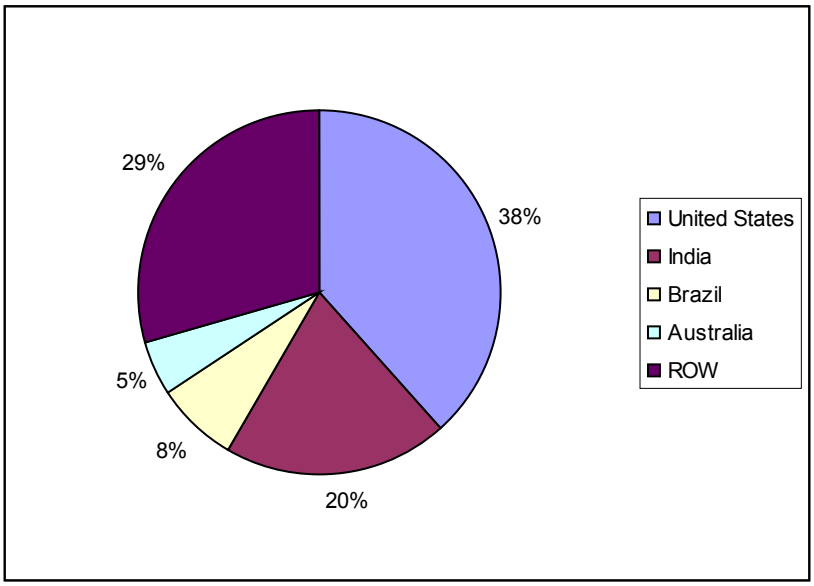

Figure 5. World cotton export (2009)
Source: FAOstat http://faostat.fao.org/site/537/default.aspx

Regarding the import of cotton, according to FAO statistics, the number of cotton importing countries has nearly doubled during the period from 1980 - 2006, from 85 to 150. And since the number of countries importing cotton is increasing year by year, the share of traditional cotton importers is simultaneously falling. The example for this could be found in the case of the European Union and East Asia countries. The combined import share of these groups of countries in the global cotton market, which was more than the two thirds during 1980s, has dropped to around 33 per-cents only in 2000s. On the contrary, the cotton imports in China boosted from 52,000 tons in 2000/01 to 2.5 million tons in 2007/08 harvest season. As a major cotton importer, China imports mainly from the United States, India, Uzbekistan, Australia, Brazil and Burkina Faso. Particularly, United States or India, each country alone has accounted for more than one third of Chinese import, and if taking Uzbekistan and Australia, the four countries constitute over 80 per-cent of Chinese import.

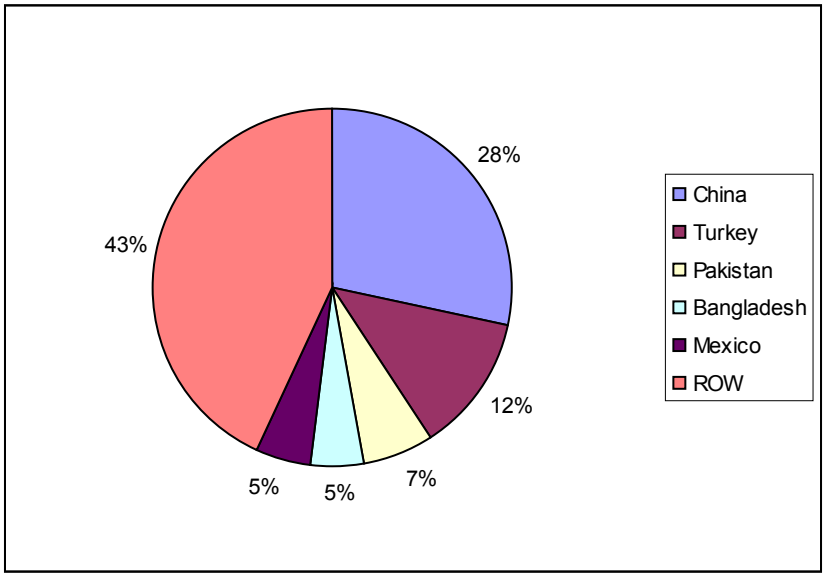

Figure 6. World cotton import (2009)
Source: FAOstat http://faostat.fao.org/site/537/default.aspx

2.1.4 Cotton price trends and policy variabilities

From the middle of 1990s onwards, the world cotton price has been showing a decreasing trend. For the 2001/2002 harvest, the cotton price was only 42 cent per pound, which was the lowest over the 1973-2008 periods. With this price, producers could hardly gain any profit. For almost developing countries, low prices created losses to both export and domestic production. India lost nearly USD 1.3 billion. With regards to Argentina and Brazil, the losses were 1 billion and USD 640 million respectively in 2001/2002 (Watkins, 2002).

Besides that, the cotton-pricing mechanisms were also influenced by government supporting programs, particularly in the United States. Subsidies in several cotton producing countries contributed to the relative fragmentation of price formation for cotton. According to a communication from the Commission of the European Communities to the Council and the European Parliament (COM(2004) 87), prices paid to domestic cotton farmers in the United States and the EU were respectively 90 per-cent and 154 per-cent higher than world prices in the 2001/2002 crop season.

As such, world cotton trade and production are seriously affected by government policy intervention, especially in the United States, China and the EU. Direct assistance to producers via price interference is considered as a serious cause for concern. According to The International Cotton Advisory Committee ('ICAC'), the combined level of direct production assistance across all subsidizing countries reached USD 2.7 billion in the season 2007/2008 as opposed to USD 5.6 billion in the 2006/2007 and USD 7.7 billion in 2005/2006.

And in accordance with Oxfam's data (2002), the United States cotton assistant program led exporting countries in Sahara to lose 302 billion USD in 2001. Among this group of countries, eight Western African countries together with Benin, Mali, Burkina Faso, Cameroon and Côte D'Ivoire were the most heavily affected. Importantly, cotton production is one of the most important industries in these countries. To notice that in 2001, Mali received USD 37.7 billion aid from the United States, but lost USD 43 billion due to unequal competition with subsidized cotton of the United States; Benin lost USD 33 million, twice the aid received from the United States (Watkins, 2002).

In order to have an insight view on cotton subsidies, the Chinese cotton subsidy policy will be particularly examined. China implemented a cotton subsidy policy firstly to guarantee employment, providing input to its world leading textile industry. The subsidy for farmers was implemented by fixing the price of cotton since the 1980s. Until 1999, this fixed price was set as reference price. Besides, state companies always bought cotton under governmental-set prices, which was higher than the world price. The Chinese Government also paid export subsidies for exporting companies to compensate for the difference between high domestic price and low international price. In 2000, payment of this form was USD 86 million, or 29 cent per kilogram.

Remarkably, the level of cotton subsidies in China reduces gradually, correlatively with the development of the cotton industry. For example, in 2000, the reference price dropped by 30 per-cent in comparison to 1997. The Chinese Government spent USD 2.7 billion for cotton subsidies in 1998, however, this number reduced to USD 1.2 billion in 2001 and to only USD 750 million in the next two following years (Gillson et al., 2004).

2.2 Literature review

A lot of studies have been carried out in order to examine the impact of cotton policies on the market, using various modeling strategies, different sets of countries, and different reference years, thus producing considerable variation of results. The ICAC, for instance, showed in their report that the complete removal of all direct subsidies within the cotton market would have increased the average cotton prices per pound by 17 and 31 cents, which means 30 per-cent and 71 per-cent higher during the 2000-2001 and 2001-2002 seasons, respectively. In case that only the United States removed their subsidies during these 2 seasons, the average cotton prices per pound would have raised by 6 and 11 cents, respectively. The study which applied the short-run partial equilibrium model conceded that the removal of subsidies would lessen the cotton production in subsidized countries and consequently raised prices in the short term. However, the reduced production in subsidized countries would be partially offset by increased cotton production in non-subsidizing countries in the medium and long terms. At the same time, the higher prices will slow down the demand for consuming cotton, hence making the long-run impact less striking. This study was based on a number of assumptions: assuming the United States' elasticity for all subsidizing countries; the measurement of the demand response to higher prices as a consequence of subsidies removal is based on the price demand elasticity of ICAC Textile demand model, and the other countries' supply response to higher prices is assumed to be 0.47 (ICAC, 2003).

The ICAC model then was expanded by Goreux (2003), who replaced the base year with 1998-2002 average subsidies to evaluate the impact of cotton subsidies on export earnings in West and Central Africa. Goreux's study, which is considered as one of the most influential studies, concluded that with the removal of subsidies, the world cotton price, depending on the demand and supply elasticities, would have increased by 3 and 13 per-cents during this 5 years period (Goreux L., 2003). The results from this study then were used by Benin, Chad, Burkina Faso and Mali in their claim to the WTO that cotton subsidies depressed the world cotton price by 15.2 per-cent and reduced West and Central African export earnings by 250 million USD for 2001/2002 market year. The model developed by Goreux was also based on numerous assumptions as follows: trade and production data for 1999/2000, subsidies data for 1999/2000; world prices for 1999/2000; a single world market; a price elasticity of supply is assumed to be +0.5 and a price elasticity of demand is assumed to be -0.1; and free entry and exist for all producers (Gillson et al, 2004). In this microeconomic approach, stock and alternative substitutes for cotton fiber are not considered.

Then, the similar analysis model to Goreux was adopted by Gilson et al. (2004), using subsidy data for 1999. Here Gilson based on the same model as in an Overseas Development Institute ('ODI') working paper. The main difference between two models is that in ODI working paper a fragmented world market is assumed, where some countries could only trade with historical partners (Guerreiro D., 2012). In this study Gilson evaluated that the withdrawal of subsidies by the countries which has largest subsidies proportion on cotton product i.e. the United States, EU, and China would have raised the world cotton price by 18 per-cents (Baffes, 2004).

Apart from the partial equilibrium approach, the general equilibrium model was also used to evaluate the impacts of removal of domestic agricultural support to cotton product. Such model was adopted by Reeves et al. (2002) based on the Global Analysis Trade Project ('GTAP') model. In this study, Reeves examined two simulations: the elimination of support to producers, and the withdrawal of support to producers and quotas. Based on a simple

Computable General Equilibrium ('CGE') model, they concluded that the elimination of production and export subsidies by the United States and the EU would increase world cotton price by 10.7 per-cent during 2001/2002 season, simultaneously causing reductions in the United States' cotton production by 20 per-cent, reduction in the United States' cotton exports by 50 per-cent and much higher numbers for the EU (Reeves et al, 2002).

The Food and Agricultural Policy Research Institute ('FAPRI') (2002) also scrutinized the impacts of policy reforms in the cotton market by adopting a multimarket non-spatial partial equilibrium model. The model is widespread due to its geographic and commodity coverage. In this model, the complete liberalization (i.e. withdrawal of trade barriers and domestic support of all commodity sectors) is presumed. FAPRI concluded that with the complete liberalization by all countries, world cotton prices would have been higher by 11.44 per-cents on average. If only trade barriers were eliminated, such price would have raised by 2.93 per-cents. This model is considered as the most complete analysis in terms of which countries are the gainers and losers following liberalization in comparison with other models. In accordance with FAPRI's analysis, Africa is the region with the greatest gains in trade, of which its exports would increase by 12.6 per-cents on average. In contrast, the export of the United States will drop by 3.5 per-cents. However, the most dramatic impact belongs to the European Union, where its cotton production would decline by more than 70 per-cents (FAPRI, 2002).

The FAPRI econometric simulation model then was adopted by Sumner (2003), who evaluated that the world price would increase by around 12.6 per-cents if six major subsidies promoting cotton production and export of the United States are removed. The study carried out by Sumner was based largely on FAPRI's assumptions and data. In this study, the probable impact of upland cotton subsidy removal during 2003-2007 periods was also examined by Sumner, which would result in the increase of world cotton prices by 10.8 per-cents (Sumner, 2003).

Also based on the partial equilibrium approach, the International Monetary Fund ('IMF') economist Tokarick (2003) estimated that multilateral trade liberalization in all agricultural markets would have increased the world price of cotton by 2.8 per-cents. In this 2.8 percentage increase in cotton price, 0.8 per-cent is expected to be caused by the withdrawal of market price support and 2 per-cents is expected to result from the elimination of subsidies. According to Tokarick, the global reforms would also lead to 95 million USD in total change in welfare per year (Aksoy et. al., 2004). In this model, agricultural supports are classified as 4 types: tariffs, export subsidies, input subsidies, and production subsidies. The model was adopted to simulate the withdrawal of each type of support. Three simulations were tested with partial or total removal of world agricultural support. Unlike the former studies, the data for cotton support measures were derived from WTO, and the elasticities' values are also different as opposed to other models. Here, 4 elasticity values were adopted, including the domestic price elasticity of supply; the domestic price elasticity of demand; the rest of the world's export supply elasticity; and the rest of the world's import demand elasticity. The supply elasticities were presumed to be 1.5 and the demand elasticities were presumed to be -0.75 (Tokarik, 2003).

Poonyth et al. (2004), applying the Agriculture Trade Policy Simulation Model ('ATSPM') developed by the UNCTAD, found that the withdrawal of cotton subsidies would raise the international cotton price by between 3.1 to 4.8 per-cents, depending on the demand and supply elasticities' value, with larger changes caused by more inelastic demand. This model

examines 2 alternative simulations with their own elasticity calculations and no distinction between coupled and decoupled subsidies, of which the first simulation is based on ICAC data on subsidies, and the second simulation is based on WTO data on subsidies (Poonyth et al, 2004). The ATPSM model was also adopted in the Gadankis et. al. (2004) study, however applying only to EU subsidies. Here Gadanakis found that the world cotton price would increase by 3.5 per-cent if full removal of tariffs is applied according to Swiss Formula, i.e. the coefficient of tariff reduction is different for developed and developing countries, which are 25 and 50, respectively (Gadanakis et al., 2007).

Beside the partial and general equilibrium approaches mentioned above, the equilibrium displacement model was also often used by economists in agricultural policy assessments. This model was adopted by Sumner (2006), Plastina (2007), Alston et. al. (2007), and Jales (2010), of which the study of Sumner (2006) was used by Brazil as background for their submission to WTO. The study provided by Sumner (2006) aimed to quantify the impact of the United States subsidies on cotton prices. This model examined two regions only: The United States of America and the Rest of the World. In this model, stocks and substitute are not considered, however, the distinction between coupled and decoupled support was examined (Sumner, 2006). Sumner's model was also a background for other studies to base on with few adjustments. In almost all following studies, the elasticities are derived from Sumner (2003), and simulations on partial withdrawal of world subsidies are adopted. Plastina (2007), who also based on Sumner's model (2006), divided the world subsidies into 6 regions (the United States, the EU, China, Latin America, Turkey, and the rest of the world) and introduced different elasticities (Plastina, 2007). The study of Alston et al. (2007) was also built on the Sumner (2006) model to evaluate the impacts of the United States subsidies on the C-4. The main difference between these models is that in Alston et. al. (2007) three regions are tested (the United States, Western and Central Africa, and the rest of the world) with slightly different elasticities (Alston et al, 2007). The framework used by Jales (2010) in his study was also similar to that of Sumner (2006), however, Jales mainly based on country decomposition but not examining only 2 regions as in Sumner (2006) (Guerreiro, 2012).

Based on the models reviewed above, it can be expected that the results derived from such models differ highly across studies. This divergence could be attributable to the specific structure of each model and to the assumed elasticities. Besides, there are also other reasons causing such divergence that could be identified here. One of such factors is the difference in the level and structure of support. For instance, in some models, China's support to its cotton sector was assumed, and thus the elimination of such support was modeled, however, some models do not incorporate this at all. The second reason for the high divergence in results between models is the differences in the assumed simulations. In some models, the liberalization in all agricultural market is presumed, but in some other models, only liberalization in the cotton sector is presumed. Another reason lays in the difference in selection of base years, thus resulting in the different level of subsidies examined. Nevertheless, despite of all the differences mentioned above, taking a simple average over all models' results demonstrates that the removal of subsidies would increase the world cotton price by approximately 10 per-cents as opposed to the actual market price (Baffes, 2004).

In the next chapter the used model characteristics will be reviewed, and afterwards the detailed data and simulations will be presented.

3 Method

3.1 The model[2]

The Armington modelling assumption has been adopted in various empirical agricultural trade modelling exercises. However, only a few studies have employed this approach in calibrated partial equilibrium trade models over the last two decades (Sarker & Surry, 2006). The model applied in this study is the Global Simulation model ('GSIM') for the analysis of global, regional or unilateral trade policy changes (Francois and Hall, 2003). Francois and Hall created the model based on a partial equilibrium framework. Unlike general equilibrium models, in partial equilibrium models many factors are reduced. Hence, the GSIM model is relatively simple, flexible, transparent, and involves "*minimum data and computational requirements*". As cotton lint is defined as "*fibers from ginning seed cotton that have not been carded or combed*" (FAO) with no processing, GSIM is an appropriate framework for analyzing such goods.

A fundamental assumption of the model is imperfect substitution, i.e. imported goods are imperfect substitution for other goods. As such, aggregated demand is consistent with Armington (1969) defined in two stages. Hence, between different origins of goods, "*a critical element of the model approach is own and cross-price elasticities*" (Francois and Hall, 2003). Here the point to which changes in relevant prices lead to a change of the source of imports is defined by an elasticity of substitution. However, the elasticities of substitutions are assumed equal and constant across products from different sources, of which both the elasticity of export supply and elasticity of aggregate demand are maintained constant.

Francois and Hall (2003) used import demand as a function of industry prices and total spending on the category:

(1) $\mathbf{M_{(i,v),r} = f(\ P_{(i,v),r}\ , P_{(i,v),s\neq r}\ , y_{(i,v)}\ )}$

where $M_{(i,v),\mathbf{r}}$ is the import demand of country **v** with category *i* of goods from exporting country **r**; $P_{(i,v),\mathbf{r}}$, $P_{(i,v),s\neq r}$ are internal prices of *i* from **r** and **s** (other varieties) within country **v** respectively; $y_{(i,v)}$ is total spending on imports of *i* in country **v**. The model assumed weak separability, i.e. goods in one group are complements. Export supply to the world market from country **r** is defined as a function of world price ($\mathbf{P_{i,r}^*}$), and production subsidies ($\mathbf{G_{i,r}}$):

(2) $\mathbf{X_{i,r} = f(P_{i,r}^*, G_{i,r})}$

The world price (that exporting country **r** receives) and internal price (in country **v**) is linked in an equation:

(3) $\mathbf{P_{(i,v),r} = (\ t_{(i,v),r} - s_{(i,v),r}\ )P_{i,r}^* = (\ T_{(i,v),r} - S_{(i,v),r}\ )P_{i,r}^*}$

where T = 1 + t is the power of the tariff t; S = 1 + s is the power of subsidy s; $P_{(i,v),\mathbf{r}}$ is internal price for goods from country **r** imported into country **v**.

[2]The model presented in this section mainly relies on Francois and Hall (2003). A GSIM model EXCEL file template was downloaded to perform the various simulations and data were plugged in to get simulation results- The GSIM 25x25 model excel file can be downloaded from http://www.i4ide.org/content/wpaper/dp20090803.zip

Hicksian demand equations are based on minimizing expenditure with a fixed level of utility while Marshallian demand is based on maximizing utility with a fixed expenditure budget. Applying the Slutsky decomposition of partial demand, indicating the two equations are different in substitution effect and income effect, and using "*advantage of the zero homogeneity property of Hicksian demand*", own and cross-price elasticities are derived by differentiating the import demand function (1) as follows (Francois and Hall, 2003):

(4) Cross-price elasticity: $\mathbf{N_{(i,v),(r,s)} = \theta_{(i,v),s}\,(E_m + E_s)}$

(5) Own-price elasticity: $\mathbf{N_{(i,v),(r,r)} = \theta_{(i,v),r}E_m} - \sum_{s\neq r}\theta_{(i,v),s}E_s = \mathbf{\theta_{(i,v),r}\,E_m - (1 - \theta_{(i,v),r})E_s}$

where $\theta_{(i,v),s}$ and $\theta_{(i,v),r}$ are expenditure share of good *i* (at internal price) in country **v** from exporting country **s**, **r** respectively[3]; E_s is the elasticity of substitution; E_m is the elasticity of aggregate import demand in country **v**.[4]

Differentiating equation (1), (4) and (5) the proportional change[5] will be as follows:

(6) $\hat{\mathbf{X}}_{i,r} = \mathbf{E_{X(i,r)}}\,(\hat{\mathbf{P}}_{i,r}^{\,*} + \hat{\mathbf{G}}_{i,r})$

(7) $\hat{\mathbf{P}}_{(i,v),r} = \hat{\mathbf{P}}_{i,r}^{\,*} + \hat{\mathbf{T}}_{(i,v),r} + \hat{\mathbf{S}}_{(i,v),r}$

(8) $\hat{\mathbf{M}}_{(i,v),r} = \mathbf{N}_{(i,v),(r,r)}\,\hat{\mathbf{P}}_{(i,v),r} + \sum_{s\neq r}\mathbf{N}_{(i,v),(r,s)}\,\hat{\mathbf{P}}_{(i,v),s}$

where E_x is elasticity of export supply[6]; At global equilibrium, the condition for each export variety is the total change in import demands equal to total change in export supplies. Substituting equation (6), (2), and (3) into (8) we have:

(9) $\hat{\mathbf{M}}_{i,r} = \hat{\mathbf{X}}_{i,r} \Rightarrow \mathbf{E_{X(i,r)}}\,\hat{\mathbf{P}}_{i,r}^{\,*} = \sum_{v}\mathbf{N}_{(i,v),(r,r)}\,\hat{\mathbf{P}}_{(i,v),r} + \sum_{v}\sum_{s\neq r}\mathbf{N}_{(i,v),(r,s)}\,\hat{\mathbf{P}}_{(i,v),s}$

$$= \sum_{v}\mathbf{N}_{(i,v),(r,r)}\,[\hat{\mathbf{P}}_{r}^{\,*} + \hat{\mathbf{T}}_{(i,v),r} + \hat{\mathbf{S}}_{(i,v),r}] + \sum_{v}\sum_{s\neq r}\mathbf{N}_{(i,v),(r,s)}\,[\hat{\mathbf{P}}_{s}^{\,*} + \hat{\mathbf{T}}_{(i,v),s} + \hat{\mathbf{S}}_{(i,v),s}]$$

where $\hat{\mathbf{P}}_{i,r}^{\,*}$ is internal price for goods from country **r**. Solving equation (9), the crucial equation of the model, will give the results of relative price changes, new demand, and new supply.

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[3] $\theta_{(i,v),r} = M_{(i,v),r}T_{(i,v),r} / \sum_{s} M_{(i,v),s}T_{(i,v),s}$

[4] $E_m = \dfrac{\%\ change\ in\ aggregate\ imports}{\%\ chang\ in\ composite\ price\ P_{(i,v)}} = \dfrac{\partial M_{(i,v)}}{\partial P_{(i,v)}} \cdot \dfrac{P_{(i,v)}}{M_{(i,v)}}$

[5] $\hat{X} = \dfrac{dx}{x}$

[6] $E_x = \dfrac{\%\ \text{change in export supply}}{\%\ \text{chang in world price } P_{(i,r)}^{\,*}} = \dfrac{\partial X_{(i,r)}}{\partial P_{(i,r)}^{\,*}} \cdot \dfrac{P_{(i,r)}^{\,*}}{X_{(i,r)}}$

The benchmark composite good's price is set to equal 1; hence total consumer expenditure is equivalent to the total quantity of the composite good. As such the change in price will be:

$$\hat{\mathbf{P}} = \frac{\mathbf{dP}}{\mathbf{P}} = \sum_{i=1}^{r} \boldsymbol{\theta}_{(i,v),r} \cdot \hat{\mathbf{P}}_{(i,v),r}$$

$$= \sum_{i=1}^{r} \boldsymbol{\theta}_{(i,v),r} \cdot [(1 + \hat{\mathbf{P}}_{i,r}^{*}) \cdot ((\mathbf{T}_{(i,v),r})_1 / (\mathbf{T}_{(i,v),r})_0) \cdot (((\mathbf{S}_{(i,v),r})_0 / (\mathbf{S}_{(i,v),r})_1) - 1] \quad (10)$$

In addition, according to Francois and Hall (2003), having the change in price and traded quantity, welfare and revenue effects are also calculated by the model.

On the other hand, there are practical limitations of the model that have to be kept in mind: losses and gains might be overestimated. As such, the disadvantages of a partial equilibrium model can be advantages in this model because "*it focuses on limited set of factor*" and "*the approach followed allows for relatively rapid and transparent analysis*" (Francois & Hall, 2003). The GSIM model is built on the assumption of a representative agent; hence the receptivity to price changes is set to be consistent across different income groups and geographic places. However, in case the region examined has high divergent producer and consumer groups (i.e. these groups have very different income elasticity of demand, supply as well as the level of response to price changes), the consumption and production responses to trade reforms could also be considerably different across countries. Similarly, the anticipated welfare responses could also overrate the actual responses to reforms since welfare responses are based on the assumption of the complete transmission of prices; however, in fact the changes in border parity prices are only partly transmitted to consumer and producer levels. Moreover, since the GSIM model is a partial equilibrium model, it does not consider inter-sectoral connections between the cotton sector and other sectors of the economy. As such, the actual equilibrium responses might be less severe than those evaluated by applying the GSIM model (Mutambatsere, 2006).

3.2 Data Sources

The data inputs required for this model include (1) bilateral matrix of trade flows in value terms, which are expressed as Cost-Insurance-Freight values;[7] (2) value of domestic shipments, which is represented as "own-trade"; (3) bilateral matrix of import tariffs; (4) bilateral matrix of output taxes or subsidies; and (5) elasticities of supply, composite demand, and substitution. Data were obtained from the Food and Agriculture database, FAOSTAT, World Integrated Trade Solution ('WITS') database, the Trade Analysis Information System, and the Market Access Map ('MacMap') database of the International Trade Centre and the Centre d'Études Prospectives et d'Informations Internationales.

3.2.1 The countries

The study examines 25 countries which include main cotton producers, exporters and importers. The rest of the countries participating in trade of cotton are treated as the Rest of the World ('ROW'). The members of the European Union are set as one country. Selected

[7] Cost-Insurance-Freight-trade values include the transaction value of the goods, the value of services performed to deliver goods to the border of the exporting country and the value of the services performed to deliver the goods from the border of the exporting country to the border of the importing country. Import values are mostly reported as Cost-Insurance-Freight" (UNSD. 2004) (FAOSTAT).

countries are almost in the top 25 exporters and importers of cotton in the world (FAO): Australia, Bangladesh, Benin, Brazil, Burkina Faso, Chad, China (mainland), Côte d'Ivoire, Egypt, the EU, India, Iran (Islamic Republic), Republic of Korea, Mali, Mexico, Nigeria, Pakistan, Russia, Syria, Turkey, the United States, Uzbekistan, Vietnam, Zimbabwe, and ROW.

3.2.2 Bilateral trade

Comprehensive bilateral trade data were available from FAOSTAT for 21 of the 25 selected countries for the year 2007. Figures for Vietnam and Zimbabwe were obtained from the available figures in WITS. This difference does not create a problem for the analysis since there is no difference between these two sources of data. The data for domestic shipments on the diagonal of the matrix GSIM 25x25 were stated as Free-On-Broad[8] values, which constitute total domestic production minus exports. The production and export data were obtained from FAOSTAT. The domestic shipments of Australia, Burkina Faso, Chad, Côte d'Ivoire, Republic of Korea, Mali, and Russia are assumed to be equaled to zero.

3.2.3 Bilateral tariffs

Import tariffs were collected from MacMap and represent the total ad valorem tariff equivalent[9]. The import tariff of ROW is assumed to be equaled to zero. Import tariffs are applied in 14 out of 25 countries, with the highest level of protection belonging to Uzbekistan. Table 2 only presents the general applied tariff by each country, but not the specific bilateral tariffs between countries since such bilateral tariffs are different among countries, depending on each bilateral agreement.

Table 2. Cotton import tariff in 2007 (percentage)

BEN	5	**MLI**	5
BRA	8.67	**MEX**	3.33
BFA	5	**NGA**	5
TCD	10	**SYR**	1
CHN	6.79	**USA**	7.15
CIV	5	**UZB**	20
IRN	4	**ZWE**	2.5

Source: MacMap

3.2.4 Bilateral subsidies

The subsidies obtained are the direct assistance which is provided through production programs in 2006/2007. Details of production subsidies are presented in Table 3 with the total assistance reaching approximately USD 2.4 billion.

[8] Free-On-Board-trade values include the transaction value of the goods and the value of services performed to deliver goods to the border of the exporting country. Export values are mostly reported as Free-On-Broad (UNSD. 2004) (FAOSTAT).

[9] "An ad valorem equivalent is a tariff presented as a percentage of the value of goods cleared through customs. It is the equivalent of a corresponding specific tariff measure based on unit quantities such as weight, number or volume" (MacMap).

Table 3. Level of direct assistance provided by governments to the cotton sector through production programs*

Country	Production (1000 tons)	Assistance to production (USD millions)	Producer price (USD/tons)	Producer subsidy (USD/tons)	Ad valorem subsidy rate
USA	4,182	888	1102	212.3	0.19
Brazil	1062	337	1418.7	317.3	0.22
China (Mainland)	8,071	684	1690.9	84.7	0.05
EU	326	358	448.6	1098.2	2.45
Mexico	137	8	1427.5	58.4	0.04
Turkey	625	429	759.0	686.4	0.90

* Income and price support programs only. Credit and other assistance are not included.
Source: ICAC, FAO, OECD, and author's own calculations

The last column of Table 3 presented above indicates the subsidy parameters in *ad valorem* equivalents that were employed by the GSIM model. These parameters were calculated by dividing the total value of subsidies by the country's domestic production in order to generate the certain amount per ton subsidy. This amount then was divided again by producer's price to result in partial subsidy rate per unit of the product. The ad valorem equivalent of producer subsidy rates is displayed in Table 3. The ICAC report (2008) is the source for the subsidies and production yield; the subsidy of the EU is obtained by the sum of Greece and Spain; the producer price is adopted from FAO (China, the EU, and the USA), from ICAC (Brazil and Mexico), and from OECD (Turkey).

3.2.5 Elasticities

Appendix 3 shows the cotton import demand and export supply elasticities for all countries and regions. Aggregate import demand elasticities reflect the import demand response to price changes. The database of the Agricultural Trade Policy Simulation Model ('ATPSM') (Gadanakis et al., 2007) is the source for the values of aggregate import demand elasticities (E_m) for all countries. Omitted variables of Côte d'Ivoire and ROW are set at -0.6. Value -0.6 meaning that a ten per-cent increase in the price of cotton would reduce the import of cotton by 6 per-cents. Among the 25 countries, import demands of China, India, Mexico, and Pakistan are more elastic than the demand of other countries.

Elasticities of export supply reflect the export supply response to price changes. For this elasticity (E_x), the value from ATPSM (Gadanakis et al., 2007) was adopted for the all exporters of cotton; for Côte d'Ivoire and ROW, the value of 0.8 was adopted. Value 0.8 meaning that a ten per-cent increase in the price of cotton would increase the export of cotton by 8 per-cents. Export supply is more elastic in Bangladesh, Brazil, China, India, Mexico, Pakistan, and Turkey.

Elasticities of substitution (Armington elasticity) reflect the degree of substitution between domestic and imported goods. Regarding the elasticity of substitution (E_s), the value of 5 (Donnelly et al., 2004) was adopted for all countries of the model.

3.3 Simulations

The following simulations were performed to analyze how altering policies affects prices, production and economic welfare. These effects were evaluated by comparing the actual prices and quantities of cotton products during marketing year 2006/2007 with substituting simulations resulted from the alternative policies. For instance, the removal or reduction of the EU and the United States subsidies will provoke producers from other countries to increase their production since lower exports, as an effect of such reductions, are expected. Furthermore, such reductions of subsidies will also lead to the higher world market price. The influences of the world market on prices and amounts of cotton produced are the mixture of direct and indirect reactions of suppliers and importers from various countries. The total reaction of suppliers and importers to the policy change will reveal the net effects of the policy alteration on the world supply and demand balance, which, in turn will determine prices in domestic markets.

The simulations that will be examined in this thesis include the following scenarios:

Simulation 1: Complete removal of the EU and the United States' subsidies (regional assistance reforms). This simulation assesses the potential impacts of subsidy elimination in the cotton sector of the two large assistance providing countries.

Simulation 2: Complete removal of all subsidies. This simulation assesses the potential impacts of subsidy elimination in the cotton sector to compare effects of regional to global cotton assistance reforms.

Simulation 3: Full global trade liberalization (including the elimination of cotton tariffs and subsidies). This simulation assesses the potential impacts of both subsidies and tariff elimination.

4 Results

4.1 Simulation results: Price and Trade effects

This section presents and discusses the simulation results from the GSIM model pertaining to price and trade effects. A first inspection of the results reveals that all three simulations have positive impacts on market prices. On the other hand, the results on trade must be analyzed for each simulation scenario. The discussion on the price and trade effects is conducted at an aggregate level. Thus, the aggregate market price effects are captured by an overall "world" price variation, which is a weighted average of the changes in the market (export) prices of each of the 25 countries,[10] the weights of which being the respective export shares expressed at the new "world" prices. In the same way, overall change in trade associated with each simulation scenario is obtained by summing all changes in all the values of cotton exports by the 25 countries.

It appears that the world prices increase evenly with the level of trade liberalization. In this section, details of world price and trade changes will be examined first followed by an evaluation of simulated welfare effects.

Table 4. Impact of policy reforms on total trade and world price

	World price	Total trade USD'000
Baseline		10573968.5
Simulation 1		10347930.2
% Change	**3.08%**	**-2.14%**
Simulation 2		10627471.4
% Change	**4.86%**	**0.51%**
Simulation 3		11328057.7
% Change	**7.13%**	**7.13%**

Source: Author's own calculation based on extracted results from GSIM

From the table above, it can be seen that the world price variation is positive in comparison to the size of trade distortion and farm subsidies. When subsidies are removed, the average world price increases. This is because due to the removal of subsidies, producers of subsidizing countries, on one hand, will have to increase the selling price in order to set off against the subsidy value they have lost. And since these subsidizing countries are the large cotton exporters in the world market, thus the increase in their selling price will lift the world price up. On the other hand, producers of subsidizing countries, as a consequence, will also reduce the production since they have lost the low price incentive owing to subsidies. With respect to non-subsidizing countries, the increase in the average world price, in turn, will stimulate them to boost the production in order to promote the competitiveness with the previously subsidizing countries. As such, the subsidies removal will provoke the increase in the average world price and export from non-subsidizing countries.

[10] It is important to stress the fact that in an Armington trade model there is not one unique world price since the commodities are differentiated according to the sources of production origins.

4.1.1 Simulation 1: Removal of the EU and the United States' subsidies

In simulation 1, when the subsidies of the EU and the United States were removed, the producer prices of these countries were also consequently reduced. However, the level of reduction of producer prices in these two countries were remarkably different, i.e. whereas the production price of the EU sharply decreased by 66.55 per-cent, this price of the United States only reduced by 12.18 per-cent. This is because the EU's initial production subsidy was 2.45 times higher than the border price of its produced cotton, while such initial production subsidy of the United States was much lower, only 0.19 times higher than its border price (Table 3). The decrease in the production prices in these two countries then led to the decline in cotton production. Particularly, the cotton production in the EU and the United States decreased by 53.24 and 9.74 per-cent, respectively.

Table 5. Elimination of the EU and the United States subsidies, prices and output effects

Country	Change in Output	Producer Price for Home Good	Market Price for Home Good
AUS	1.51%	1.89%	1.89%
BGD	1.32%	1.65%	1.65%
BEN	1.24%	1.55%	1.55%
BRA	1.22%	1.52%	1.52%
BFA	1.27%	1.59%	1.59%
TCD	2.64%	3.30%	3.30%
CHN	0.84%	1.05%	1.05%
CIV	2.13%	2.66%	2.66%
EGY	2.05%	2.56%	2.56%
EUN	-53.24%	-66.55%	15.32%
IND	0.82%	1.03%	1.03%
IRN	0.60%	0.75%	0.75%
KOR	2.27%	2.84%	2.84%
MLI	1.76%	2.20%	2.20%
MEX	1.86%	2.33%	2.33%
NGA	0.62%	0.77%	0.77%
PAK	0.87%	1.09%	1.09%
RUS	2.82%	3.53%	3.53%
SYR	0.68%	0.85%	0.85%
TUR	2.65%	3.31%	3.31%
USA	-9.74%	-12.18%	4.74%
UZB	1.33%	1.66%	1.66%
VNM	2.74%	3.43%	3.43%
ZWE	2.06%	2.58%	2.58%
ROW	1.98%	2.47%	2.47%

Source: Extracted from GSIM, Appendix 4, Table 3

Besides, the decline in cotton production in these countries is also expected to lift the market price of their produced cotton. The results extracted from the model also showed that the market price for cotton originating from the EU and the United States increased by 15.32 and

4.74 per-cent, respectively. The increase in the market price of cotton originating from the EU and the United States then will lead to the following simultaneous consequences: (1) both the domestic and international demands for this product will decline; and (2) the export of this product by these two countries will be reduced.

When the domestic demand for cotton produced by the EU and the United States is reduced due to the increase in their market price, consumers will tend to find the alternative source of cotton which has the lower market price in order to meet their demand. In particular, the EU lost 46.36 per-cent of domestic consumption for its cotton product (Table 1 of Appendix 1) whereas increased the cotton import amount from 13 to 26 per-cent from other 23 countries (including also cotton imported from the United States), of which the imports from Iran, Nigeria, and Syria increased the most. The United States only lost 2.91 per-cent of domestic consumption for its produced cotton, but also increased the imports of cotton from 4 to 16 per-cents from other 6 countries.

At the same time, the EU's cotton export reduced by average 53.49 per-cents in all markets. Similarly, the United States' cotton export also reduced 7.55 per-cents in all markets, except for the export to the EU market. It is to note that the reductions in export value of both the EU and the United States are smaller than that of export volume. Taking the United States' exports to China as an example, its export value (at world prices) declined by 13.73 per-cent whereas its export volume declined by 17.6 per-cent. Similarly, taking the EU's exports to Pakistan as an example, its export value (at world price) declined by 66 per-cent, however, its export volume declined by 70.6 per-cents.

On the other hand, due to the Armington trade specification, the increase in the market prices of the EU and the United States-produced cotton will influence, via substitution effects, the demand for cotton in cotton consuming countries. Specifically, the increase in the EU and the United States' cotton market prices will lead to the increase in the import of cotton originating from other countries within the model, except for those from the EU and the United States. As a result, the market price of the modeled countries will be lifted, varying from 0.75 per-cents to 3.53 per-cents. However, such level of increase is still less than those of the EU and the United States, which are 15.32 and 4.74 per-cent, respectively. Since among the 25 countries modeled, Iran, Nigeria, and Syria have the least market price increase level (Table 6), thus they tend to export their cotton products to all other markets, except for their own domestic markets. Whereas Chad belongs to one of the countries which has the highest increase in the market price (i.e. 3.3 per-cents) as opposed to other countries in the model, its export to other countries subsequently decreased, except for the export to the EU market (where the market price increases by 15.32 per-cents). Similar to Chad, with the sharp increase in the market price by 3.31 per-cents, Turkey reduced its export to almost all markets, except for the EU, Egypt, Vietnam and its own domestic market. With respect to Egypt, having the market price increase by 2.56 per-cent, which is lower than that of Turkey, Egypt's cotton export to Turkey increased by 6.2 per-cent, higher than the vice versa, which is only 3.2 per-cent.

Besides, due to the fact that the market price of all the modeled countries increase, thus instead of exporting, 13 out of 25 countries (including the United States) increase their domestic intra-trade of cotton. For instance, China has increased its cotton domestic flow by USD 221.1 million, which is approximately 152 times more than its increase in cotton export value (i.e. USD 1.4 million). These figures show that China keeps the majority of its produced cotton for the domestic consumption (i.e. increasing the volume by 0.84 per-cents) instead of

importing cotton from other countries (i.e. reducing the import value of cotton by 6.33 per-cents, equivalent to USD 219.9 million). Similarly, the previous large cotton importing countries such as Mexico, Pakistan, Turkey and ROW now retained the majority of their produced cotton for the domestic use instead of exporting to and importing from other countries.

Table 6. Elimination of the EU and the United States subsidies, trade effects

Country	Change in Intra trade USD'000)		Change in Export Value USD'000		Change in Import value USD'000	
AUS	-	-	15396	3.43%	-	-
BGD	145	1.57%	152	20.70%	6024	0.64%
BEN	67	0.61%	4130	2.98%	-	-
BRA	15954	1.41%	25842	6.75%	-7196	-5.86%
BFA	-	-	7908	2.88%	-	-
TCD	-	-	3668	6.03%	-	-
CHN	221078	1.88%	1454	9.79%	-219959	-6.33%
CIV	-	-	2955	4.85%	0.0041	0.41%
EGY	10749	9.63%	3488	1.80%	-9726	-13.94%
EUN	-98817	-38.15%	-148407	-53.49%	103593	20.34%
IND	28448	0.72%	76739	4.55%	-20019	-9.29%
IRN	329	0.30%	1431	7.43%	-	-
KOR	-	-	224	5.18%	2873	0.94%
MLI	-	-	7293	4.00%	20	0.63%
MEX	6838	6.68%	207	0.32%	-15723	-3.40%
NGA	449	0.31%	1918	7.34%	-8	-2.91%
PAK	35571	1.65%	8193	13.24%	-37768	-5.82%
RUS	-	-	912	6.45%	2002	0.82%
SYR	1050	0.33%	4243	13.26%	-	-
TUR	51513	5.88%	5336	8.26%	-26041	-2.04%
USA	21997	1.70%	-336127	-7.55%	815	10.00%
UZB	1312	0.65%	38277	3.45%	-	-
VNM	966	6.28%	0.0333	0.13%	1089	0.42%
ZWE	27	0.92%	5081	4.80%	7	1.36%
ROW	34625	4.12%	43649	4.85%	-6022	-0.30%
Total	-	-	-226038	-2.14%	-226038	-2.14%

Source: Extracted from GSIM, Appendix 4, Table 2

Despite the fact that almost all the countries within the model boosted their cotton export volume, such increase in cotton export were not enough to set off against the sharp decline in export volume of the EU and the United States. As a result, the aggregated world export volume decreased by 2.14 per-cents. At the same time, although the import volume of cotton increased in 7 countries, with the majority increase in the EU, such increase in cotton import also cannot set off against the decline in cotton import volume of other 7 countries, including the majority decrease in China. As a consequence, the aggregate world import volume decreased by 2.14 per-cents.

In summary, the results of simulation 1 imply that when removing the subsidies from the EU and the United States, although it will lead to the increase in the world market price of cotton by 3.08 per-cents, the cotton trade will eventually decline by 2.14 per-cents.

4.1.2 Simulation 2: Removal of all subsidies

With respect to simulation 2, when the subsidies of six countries comprising of Brazil, China, the EU, Mexico, Turkey, and the United States were removed, then similar to simulation 1, the producer prices in these countries (except for Mexico) will decrease.

Table 7. Elimination of all subsidies, prices and output effects

Country	Change in Output	Producer Price for Home Good	Market Price for Home Good
AUS	2.70%	3.37%	3.37%
BGD	2.16%	2.69%	2.69%
BEN	2.40%	3.01%	3.01%
BRA	-9.33%	-11.67%	8.09%
BFA	2.43%	3.04%	3.04%
TCD	3.89%	4.86%	4.86%
CHN	-1.51%	-1.89%	3.03%
CIV	3.42%	4.28%	4.28%
EGY	3.20%	4.00%	4.00%
EUN	-52.64%	-65.81%	17.90%
IND	1.56%	1.95%	1.95%
IRN	0.96%	1.20%	1.20%
KOR	3.30%	4.12%	4.12%
MLI	3.00%	3.75%	3.75%
MEX	0.05%	0.06%	4.15%
NGA	0.99%	1.24%	1.24%
PAK	1.46%	1.82%	1.82%
RUS	3.85%	4.81%	4.81%
SYR	1.12%	1.40%	1.40%
TUR	-31.63%	-39.54%	15.13%
USA	-8.48%	-10.60%	6.62%
UZB	2.36%	2.96%	2.96%
VNM	3.85%	4.81%	4.81%
ZWE	3.31%	4.14%	4.14%
ROW	3.36%	4.19%	4.19%

Source: Extracted from GSIM, Appendix 4, Table 6

As a consequence, the cotton production in these five countries will also decrease. Mexico is the country which was least influenced among this group of countries due to the fact that Mexico's initial production subsidy was only 0.05 times higher than the border price of its produced cotton, which is lowest among this group of 6 countries (Table 3). As such, Mexico's producer price did not reduce, but rather increased by 0.06 per-cents. However, this

increase in Mexico's producer price is still lower than that in simulation 1 (i.e. 2.33 per-cents), thus the increase in Mexico's cotton output is also lower than that in simulation 1 (i.e. only 0.05 per-cents in simulation 2 as opposed to 1.86 per-cents in simulation 1).

Similar to simulation 1, when the production declines, the market price for cotton originating from this group of countries goes up as expected. In particular, the increase in the market price within this group of six countries varies from 3.03 per-cents in China to 17.9 per-cents in the EU. This level of increase in market price is higher than that extracted from simulation 1. With the higher market price, the domestic demand for the cotton produced by these countries decreases (except for Mexico). As can be seen from Table 3 (Appendix 1), among this group of 6 countries, the EU still remains the country which suffers the deepest decrease (i.e. by 48.5 per-cents). This figure reveals that the domestic cotton consumption of the EU declined more than that in simulation 1. The results extracted from simulation 2 also show that not only the domestic demand for cotton in these countries declined, but the demand for the cotton imported from such countries also decreases. Brazil, Mexico, and the United States reduced their export to almost all other markets. Taking Brazil as an example, Brazil only increased its export to the EU and Turkey, the countries which has the higher level increase in market price. China, however, only lost its export to some markets, but still manages to increase its export to the countries where the increase in market price of their home produced cotton is higher than that of China. For instance, Egypt experienced the increase in market price by 4 per-cents, which is higher than that of China (i.e. only 3.03 per-cents). Among this group of 6 countries, the EU and Turkey are the countries which suffered the most significant loss when both of these countries lost a huge amount of export volume to all other countries within the model.

Comparing the results contemplated in Table 7 and Table 8, it can be seen that for a majority of countries, the positive changes in the export prices might be sufficient to set off against the export volume reduced. This also explains why the actual change in the export value is lower than expected. For instance, although the volume of Brazil's intra-trade reduced by 6.3 per-cents, but with the increase of the market price by 8.09 per-cents, the value of Brazil's intra-trade, eventually, increased by 1.28 per-cents. If taking into account the value of export, the EU experienced the lower loss ratio than that of volume since the change in the EU's intra-trade value was 32.97 per-cents as opposed to that of 48.49 per-cents in volume. This difference in this simulation is similar with that of simulation 1.

With regards to the remaining countries, all the market prices of cotton originating from the non-subsidizing countries show the positive change as expected. However, the level of such changes is still lower than that of previously subsidized countries such as Brazil, the EU, Turkey, and the United States. Regarding China and Mexico, although these two countries previously provided subsidies to their cotton product, however at the low level, thus the market prices of these two countries did not show the significant changes. Whereas, Iran, Nigeria and Syria still remain the group of countries that has the lowest increase in the market price among the modeled countries, thus still possesses the export advantage. The evidence for this lays in the high increase in export value of these three countries. Bangladesh, although experienced the strongest increase in export value (i.e. by 26.75 per-cent) in comparison with other countries in the model, however, this 26.75 per-cent change in export value only accounted for USD 197 thousands. In contrast, China still remains the typical example for retaining the produced cotton for the domestic consumption, reducing cotton import, and exporting only a small portion of the produced cotton. However, since the market price of China in this simulation increased by 3.03 per-cents, therefore its cotton output reduced,

instead of increasing as in simulation 1. In comparison with the results of simulation 1, China retained the smaller value of its produced cotton for intra-trade, exported less its produced cotton , and reduced less its cotton import.

Table 8. Elimination of all subsidies, trade effects

Country	Change in Intra trade USD'000)		Change in Export Value USD'000		Change in Import value USD'000	
AUS	-	-	27693	6.17%	-	-
BGD	292	3.17%	197	26.75%	9989	1.05%
BEN	127	1.15%	8071	5.83%	-	-
BRA	14518	1.28%	-44797	-11.70%	17956	14.62%
BFA	-	-	15214	5.54%	-	-
TCD	-	-	5437	8.93%	-	-
CHN	171054	1.46%	1451	9.77%	-187800	-5.40%
CIV	-	-	4784	7.85%	0.0116	1.16%
EGY	12259	10.98%	10133	5.23%	-10694	-15.33%
EUN	-101728	-39.27%	-135230	-48.74%	109567	21.51%
IND	42552	1.07%	157276	9.33%	-27778	-12.89%
IRN	526	0.47%	2318	12.03%	-	-
KOR	-	-	327	7.55%	5768	1.89%
MLI	-	-	12485	6.85%	14	0.43%
MEX	6442	6.30%	548	0.86%	-19943	-4.32%
NGA	726	0.50%	3102	11.88%	-19	-6.89%
PAK	61749	2.86%	11490	18.57%	-66672	-10.28%
RUS	-	-	1250	8.85%	3329	1.36%
SYR	1727	0.55%	7076	22.11%	-	-
TUR	-176389	-20.12%	-23942	-37.04%	223127	17.46%
USA	31875	2.46%	-171027	-3.84%	-748	-9.18%
UZB	2284	1.13%	68404	6.17%	-	-
VNM	1363	8.86%	1	3.44%	1871	0.72%
ZWE	47	1.59%	8207	7.75%	7	1.35%
ROW	50867	6.05%	83036	9.22%	-4472	-0.22%
Total	-	-	53503	0.51%	53503	0.51%

Source: Extracted from GSIM, Appendix 4, Table 5

The results extracted from simulation 2 show that Turkey and Brazil also suffered the reduction in export, same as the EU and the United States. At the same time the remaining countries all increased the cotton export with the higher level of changes and value than that of simulation 1. Regarding the cotton import, the countries that showed the increase in cotton import in simulation 1 also showed the same increase in cotton import in simulation 2 with the higher level (except for the United States). From the country with positive cotton import figure in simulation 1, The United States became a country with negative cotton import figure in simulation 2. This is because the United States increased the intra-trade, but at the same time, reduced its export of cotton. Brazil and Turkey, however, transformed from the countries increasing cotton export and reducing cotton import into the countries which reduce the cotton export and increase the import. The reason for this controversial change is that the market price for cotton of these two countries is no longer competitive as opposed to other

countries. To sum up, the aggregate cotton export of 25 countries modeled increased by 0.51 per-cents due to the fact that the increase in cotton export of 21 countries set off the decrease in cotton export of the remaining 4 countries. Similarly, the aggregate cotton import of 25 countries modeled increased by 0.51 per-cent since the increase in cotton import of 17 countries set off the decrease in cotton import of the remaining 8 countries.

In summary, the results of simulation 2 imply that the removal of all the subsidies from six countries will lead to an increase in the world market price of cotton by 4.86 per-cents and the expansion of the cotton trade by 0.51 per-cents.

4.1.3 Simulation 3: Free trade - Removal of all tariffs and subsidies

With respect to simulation 3, when the tariffs of all 14 countries are withdrawn, the market prices of all 25 countries in the model will increase. Similar to the results of simulations 1 and 2, the producer prices of the subsidizing countries such as Brazil, China, the EU, Turkey, and the United States will all decrease, however at a lower level. Therefore, the level of reduction of cotton output in these countries will be lower than that of simulations 1 and 2. However, the market price of these subsidizing countries will increase more than that of simulations 1 and 2. As such, the demand for cotton originating from these subsidizing countries in both domestic and international markets will be reduced. This, in turn, will lead to the increase in the demand for cotton originating from other countries. In particular, the figures of Table 9 show that the market prices of the remaining countries within the model all increased. The countries which have the lowest increase in market prices are Iran, Syria, and Pakistan. Thus, these three countries generate the lower increase in cotton output than other countries.

Due to the higher level increase in market price as opposed to that of simulation 2, leading to the reduced competitiveness in comparison with other countries, Brazil, China, the EU, Turkey, and the United States all reduced their volume of intra-trade (Table 5 of Appendix 1). In addition, the majority of the countries within the model experienced a decline in cotton export, of which the EU, Turkey and the United States are the countries that suffered the most significant loss from cotton export. With regards to the EU, apart from the United States and China markets (i.e. 2 countries that removed tariffs), the EU reduced its cotton export to all other markets. Similarly, Turkey also reduced its cotton export to all markets, except for the United States. However, for Brazil, its decline in cotton export to Bangladesh, China, Egypt, the EU, Korea, Pakistan, Vietnam and ROW is less than that of simulation 2. This is because the majority of the countries mentioned are the countries which cut out the tariffs. Moreover, Brazil also managed to increase its cotton export to the EU and Turkey owing to the lower increase in market price in comparison with these two countries.

Similar to the two previous simulations, since the market price is lifted to the higher level than that in simulations 1 and 2, there is a difference between the changes in value and quantity of exports. In other words, if comparing the results of Tables 5 and 6 attached to Appendix 1, it can be seen that the change in value of exports is less than that of quantity. Apart from the above-mentioned subsidized countries, Pakistan and Zimbabwe also reduced their intra-trade of cotton as opposed to that of simulation 2. For instance, Pakistan lifted their value of intra-trade by USD 61.75 million in simulation 2, but this figure in simulation 3 is only USD 16.8 million. In contrast to this group of countries, all the remaining countries of the model experienced an increase in intra-trade. Taking India as an example, India lifted its intra-trade increase from 1.07 per-cents in simulation 2 to 1.47 per-cent in simulation 3.

In general, the cotton export value of almost 25 countries increased, and is higher than such increase in simulation 2. And only the EU and Turkey reduced the value of cotton export with the lower level of reduction in comparison with the figures of simulation 2. Regarding China, unlike in 2 previous simulations, China's level of cotton export increase in simulation 3 is high, by 25.8 per-cents as opposed to 9.77 per-cents in simulation 2 and 9.79 per-cent in simulation 1. The reason for this is China's intra-trade of cotton is reduced.

Table 9. Elimination of all subsidies and tariffs, prices and output effects

Country	Change in Output	Producer Price for Home Good	Market Price for Home Good
AUS	4.84%	6.04%	6.04%
BGD	3.40%	4.25%	4.25%
BEN	5.08%	6.35%	6.35%
BRA	-9.09%	-11.36%	8.47%
BFA	5.05%	6.31%	6.31%
TCD	5.49%	6.86%	6.86%
CHN	-2.69%	-3.37%	1.48%
CIV	5.46%	6.82%	6.82%
EGY	4.92%	6.15%	6.15%
EUN	-52.18%	-65.22%	19.92%
IND	3.10%	3.88%	3.88%
IRN	1.59%	1.99%	1.99%
KOR	4.58%	5.72%	5.72%
MLI	5.13%	6.41%	6.41%
MEX	1.77%	2.22%	6.40%
NGA	1.79%	2.24%	2.24%
PAK	0.74%	0.92%	0.92%
RUS	5.10%	6.37%	6.37%
SYR	1.56%	1.95%	1.95%
TUR	-30.85%	-38.57%	16.99%
USA	-6.71%	-8.39%	9.27%
UZB	4.14%	5.18%	5.18%
VNM	5.14%	6.43%	6.43%
ZWE	4.85%	6.07%	6.07%
ROW	4.96%	6.20%	6.20%

Source: Extracted from GSIM, Appendix 4, Table 9

On the other hand, due to the reduction in intra-trade and increase in cotton export, the value of China's cotton import turned to positive figure, increasing by 10.77 per-cents as opposed to the decline by 5.4 per-cents in simulation 2.

Cote d'Ivoire, Mali and Zimbabwe also removed tariff, thus increased the cotton import with the higher level than those of simulation 2. For instance, reducing the tariff by 5 per-cents helped Mali to increase the cotton import value by 3.13 per-cents instead of only 0.43 per-cents in simulation 2. Removing tariff also helped Nigeria's cotton import value to turn to positive instead of the negative change in import value in simulation 2. For Mexico, although

reduced the tariff, this country still reduced the cotton import value. And Mexico increased the intra-trade at almost the same volume as its increase in cotton export.

The results of simulation 3 reveal that the world's aggregate cotton export will increase by 7.13 per-cents, equivalent to approximately USD 754 million. On the other hand, the increase in cotton import in other countries set off against the decrease in cotton import in Egypt, India, and Mexico. Therefore, the world's aggregate cotton import will also increase by 7.13 per-cents.

Table 10. Elimination of all subsidies and tariffs, trade effects

Country	Change in Intra trade USD'000)		Change in Export Value USD'000		Change in Import value USD'000	
AUS	-	-	50176	11.17%	-	-
BGD	558	6.04%	219	29.77%	16220	1.71%
BEN	255	2.30%	17329	12.52%	-	-
BRA	-21316	-1.88%	341	0.09%	59851	48.74%
BFA	-	-	32103	11.69%	-	-
TCD	-	-	7750	12.73%	-	-
CHN	-151410	-1.29%	3831	25.80%	374443	10.77%
CIV	-	-	7710	12.65%	0.0352	3.52%
EGY	12186	10.92%	22520	11.63%	-9635	-13.81%
EUN	-102692	-39.64%	-126127	-45.46%	114686	22.51%
IND	58198	1.47%	343346	20.38%	-31241	-14.49%
IRN	861	0.77%	3865	20.05%	-	-
KOR	-	-	457	10.56%	7789	2.55%
MLI	-	-	21605	11.86%	100	3.13%
MEX	6877	6.72%	6888	10.79%	-27562	-5.97%
NGA	1239	0.86%	5710	21.86%	28	9.99%
PAK	16827	0.78%	20025	32.36%	11268	1.74%
RUS	-	-	1667	11.79%	5099	2.09%
SYR	2374	0.76%	9856	30.81%	-	-
TUR	-161848	-18.47%	-17941	-27.75%	223326	17.48%
USA	36656	2.83%	74740	1.68%	5063	62.16%
UZB	3861	1.91%	121170	10.92%	-	-
VNM	1832	11.91%	2	6.77%	3102	1.20%
ZWE	13	0.45%	12198	11.52%	71	13.62%
ROW	65052	7.74%	134650	14.95%	1481	0.07%
Total	-	-	754089	7.13%	754089	7.13%

Source: Extracted from GSIM, Appendix 4, Table 8

In summary, the complete removal of all subsidies and tariffs in simulation 3 will lift the world cotton price by 7.13 per-cents and will boost the global trade of cotton by 7.13 per-cents. As such, it can be determined that the complete removal of subsidies and tariffs brings more trade opportunities for the majority of countries in the model.

4.2 Simulation results: Welfare effects

This section presents the welfare effects of the three simulations. Overall, all simulations produce similar results: exporting countries (with the exception of Brazil in simulation 1 gain positive welfare, while importing countries suffer negative welfare. The gains/losses in welfare are paralleled with the level of linearization. Although suffering losses in production and export, the EU and the United States still gain positive welfare. This is because the amount saved from the removal of subsidy payment has offset their losses from the reduction in production and export. The specific details of the welfare effects are presented thereafter.

4.2.1 Simulations 1 and 2: Elimination of the EU and the United States, and all cotton subsidies

The results of simulation 1 presented in Table 11 below show the impact on key welfare indicators for all countries, i.e. changes in producer surplus, consumer surplus, change in tariff revenue and government revenue (the positive results of subsidizing countries represent savings for these countries). The column 'net welfare effects' represents the expected sum of producer and consumer surplus changes and changes in government budget (tariff revenue and subsidy payment). This analysis evaluates the hypothesis that decreased trade-distortions, through removing production's assistance, will benefit producers of cotton. Overall, the results from the first simulation indicate that on net, the elimination of the EU and the United States' subsidies generate negative producer and consumer welfare. However, through savings in domestic subsidies, the two countries still can offset their loss in order to gain an overall positive welfare effect.

Due to the decline in the producer prices of cotton in the EU and the United States, resulting from the removal of cotton production subsidies in these countries, the EU and the United States producers experienced a decline in their producer surplus as expected. The change in producer surplus is a result of a function of the total EU's supply of cotton, the industry supply elasticity, and the change in producer price. Regarding the change in consumer surplus in the EU, it can be seen the increase in the overall (composite) consumer prices of cotton, which is a weighted average of changes in the price of each import cotton source, of which the weights being the respective import shares. As such, as expected, the change in consumer surplus in the EU declined. However, owing to the budget savings resulting from the withdrawal of the production subsidy in the EU, the overall welfare effect is still positive.

Net welfare is, however, negative as expected for most of the large importing countries (with the exception of Brazil). The results extracted from the GSIM model indicate that Brazil's expected losses originate from the higher price due to subsidy elimination. On the other hand, large exporting countries like Benin, India, Iran, Mali, Nigeria, Syria, Uzbekistan, and Zimbabwe, with higher prices, will have positive net welfare effects. Even though these countries experienced losses in consumer surplus, the gain in producer surplus overcompensates this. Welfare of Australia, Burkina Faso, Chad, and Côte d'Ivoire considerably increased in amount, owing to producers' surplus gain only.

Table 11. Elimination of the EU and the United States subsidies, welfare, price and trade effects

Country	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments[11]	Net welfare effect	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	per-cent
AUS	8546	0	0	0	8546	1.89%
BGD	165	-17837	0	0	-17672	1.65%
BEN	2330	-172	0	0	2158	1.55%
BRA	23275	-21686	-624	-7640	-6675	1.52%
BFA	4390	0	0	0	4390	1.59%
TCD	2035	0	0	0	2035	3.30%
CHN	123829	-236006	-15416	-10621	-138215	1.05%
CIV	1640	0	0	0	1640	2.66%
EGY	7901	-8231	0	0	-330	2.56%
EUN	-262007	-53891	0	380901	65003	15.32%
IND	58530	-48392	-130	0	10008	1.03%
IRN	977	-833	0	0	145	0.75%
KOR	124	-10124	0	0	-10000	2.84%
MLI	4048	-313	1	0	3736	2.20%
MEX	3919	-24942	4	-277	-21296	2.33%
NGA	1315	-1117	0	0	197	0.77%
PAK	24354	-42929	-1888	0	-20464	1.09%
RUS	506	-5314	0	0	-4808	3.53%
SYR	2939	-2665	0	0	274	0.85%
TUR	31743	-94349	0	-26997	-89602	3.31%
USA	-665978	-62582	100	928558	200098	4.74%
UZB	21978	-3382	0	0	18596	1.66%
VNM	536	-12569	0	0	-12032	3.43%
ZWE	2835	-90	0	0	2745	2.58%
ROW	43438	-91749	0	0	-48311	2.47%

Source: Extracted from GSIM, Appendix 4, Table 3

However, Brazil, once again, is an exception. Regarded as one of the large exporting countries, the country should get an overall gain in welfare. Nevertheless, the increase in production expanded the country's subsidy payment, simultaneously reduced tariff revenue (as import was reduced), adding to the losses from higher consumer prices. All these facts, in general, have caused a negative welfare to Brazil.

In general, welfare results in simulation 2 shows a similar trend to the ones in simulation 1. However, welfare in Egypt has turned from a negative figure into positive. The reason for this lays in the degree of increase in producer surplus, which is higher than the degree of reduction in consumer surplus. There is also a change in tariff revenue for all countries in simulation 2 as opposed to that in simulation 1 due to the change in cotton imports. Another significant

[11] The negative figure presented in this column is an actual gain of governments due to the removal of subsidies, since a reduction in subisidy paymnet led to budget savings. And this, in turn, translates in a positive effect.

point worth mentioning here is the decrease of producer prices, which is more noteworthy than that in the simulation 1.

Despite the fact that China, Mexico and Turkey do not have to allocate the budget for paying subsidies anymore when the subsidies are removed, these countries still suffer a negative welfare effect. In contrast, the EU and the United States gained positive welfare results from savings of subsidies. With higher consumer price changes than in the first simulation, ranging from 2.5 to 6.4 per-cents, almost all large importing countries suffered higher welfare losses.

In this simulation, Brazil, the EU and Turkey presented a considerable increase in consumer prices, confirming the overlap of price effects with subsidy reforms. Similar to the previous simulation, the removal of subsidies does help exporting countries to gain more in trade. The net welfare effect is positive, however, with higher volume due to the higher increase in price.

Table 12. Elimination of all subsidies, welfare, price and trade effects

Country	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	per-cent
AUS	15362	0	0	0	15362	3.37%
BGD	271	-30571	0	0	-30300	2.69%
BEN	4549	-336	0	0	4213	3.01%
BRA	-164426	-100564	1557	276998	13565	8.09%
BFA	8441	0	0	0	8441	3.04%
TCD	3014	0	0	0	3014	4.86%
CHN	-219581	-534539	-13273	560694	-206700	3.03%
CIV	2653	0	0	0	2653	4.28%
EGY	12418	-11220	0	0	1198	4.00%
EUN	-260117	-73635	0	380901	47149	17.90%
IND	111349	-89164	-149	0	22035	1.95%
IRN	1579	-1345	0	0	235	1.20%
KOR	181	-19401	0	0	-19219	4.12%
MLI	6925	-376	1	0	6549	3.75%
MEX	102	-36216	5	6531	-29577	4.15%
NGA	2126	-1807	-1	0	318	1.24%
PAK	40803	-72720	-3334	0	-35251	1.82%
RUS	693	-9259	0	0	-8566	4.81%
SYR	4887	-4429	0	0	458	1.40%
TUR	-283839	-227283	0	446910	-64212	15.13%
USA	-583555	-88385	-92	928558	256526	6.62%
UZB	39220	-6028	0	0	33193	2.96%
VNM	756	-17722	0	0	-16966	4.81%
ZWE	4577	-146	0	0	4431	4.14%
ROW	74255	-150424	0	0	-76170	4.19%

Source: Extracted from GSIM, Appendix 4, Table 6

In summary, only nine out of 25 countries shown in the Table 12 suffered losses in total welfare terms (2 countries less than the result of the first simulation). The gains from the policy reform process are considerably positive. These computations also emphasize that the current cotton policy systems generate substantial global welfare losses.

4.2.2 Simulation 3: Free trade – Removal of all tariffs and subsidies

In this simulation the effects of a complete removal of tariffs and subsidies in all countries are evaluated. Similar to the second simulation, production subsidies of Brazil, China, the EU, Mexico, Turkey, and the United States are eliminated. Simultaneously, tariffs of 15 countries are also removed. The simulation's result is similar to two previous results, however, tariff revenue decreased dramatically.

Table 13. Free trade scenario simulated welfare, price and trade effects

Country	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	per-cent
AUS	27803	0	0	0	27803	6.04%
BGD	431	-50691	0	0	-50261	4.25%
BEN	9742	-718	0	0	9024	6.35%
BRA	-160370	-96517	-10645	276998	9465	8.47%
BFA	17786	0	0	0	17786	6.31%
TCD	4293	0	0	0	4293	6.86%
CHN	-387501	-180877	-236816	560694	-244500	1.48%
CIV	4270	0	0	0	4270	6.82%
EGY	19230	-14874	0	0	4356	6.15%
EUN	-258623	-90167	0	380901	32111	19.92%
IND	224404	-172827	-193	0	51384	3.88%
IRN	2623	-2232	0	0	392	1.99%
KOR	253	-25599	0	0	-25346	5.72%
MLI	11969	-214	-161	0	11595	6.41%
MEX	3723	-52043	-74	6531	-41863	6.40%
NGA	3856	-3262	-14	0	580	2.24%
PAK	20502	-31803	-32425	0	-43726	0.92%
RUS	923	-14524	0	0	-13601	6.37%
SYR	6789	-6149	0	0	640	1.95%
TUR	-278961	-277499	0	446910	-109551	16.99%
USA	-465773	-123304	-1002	928558	338478	9.27%
UZB	69306	-10628	0	0	58677	5.18%
VNM	1016	-23810	0	0	-22794	6.43%
ZWE	6766	-202	-13	0	6551	6.07%
ROW	110648	-215945	0	0	-105297	6.20%

Source: Extracted from GSIM, Appendix 4, Table 9

The results show higher increase in welfare for almost all countries but also a higher loss for one third out of 25 countries. The highly protected markets of China and Pakistan suffer losses in consumer surplus as well as tariff revenue, resulting in an overall negative net welfare. Although without lower level of protection, Mexico ends up with quite similar welfare losses as Pakistan. Bangladesh, Korea, Russia, Turkey, Vietnam, and ROW also come up with welfare losses when trade is liberalized.

African countries end up with a positive welfare effect. Burkina Faso, Mali, Benin, Chad, and Côte d'Ivoire almost doubled their benefits when there is no tariff in comparison with the simulation 2. Welfare effects are equal to producer surplus in these countries. This is because these countries are cotton net exporting countries, thus the net welfare change is primarily generated from the change of producer surplus. And since the producer surplus of these countries are all positive, therefore the aggregate change in net welfare is also positive. Nigeria, Egypt, and Zimbabwe, although lost consumer surplus and tariff revenue (except Egypt), still manage to gain positive welfare results.

Australia has no tariff on cotton, as such, due to a positive producer surplus; it ends up with a positive welfare effect, which overcomes the loss in consumer surplus. The United States increases its loss due to a reduction of tariff revenues, but gets overall a positive welfare effect by 32 per-cents more than in simulation 2. Welfare of the EU is on the downward trend from the first to the third simulation, as consumer prices go up evenly, leading the consumer surplus to suffer increasing losses.

The simulated effects on production and welfare received are the same as anticipated. Hence, with full liberalization, production diminishes in countries that cut down subsidies (i.e. Brazil, China, the EU, Turkey, and the United States) (52.18 and 30.85 per-cent drops in cotton output in the EU and Turkey, respectively, indicating the fact that the base subsidy levels were moderately high (Table 9)).

Almost all countries (including West African countries: Benin, Burkina Faso, Chad, Côte d'Ivoire and Mali) gain in outputs when subsidizing countries remove subsidies, which are anticipated. There are only 9 out of 25 countries that suffered negative welfare effects.

4.3 Concluding remarks on simulation results

Overall, it appears that the higher the level of trade barriers removal, the more trades are created. The results of three simulations present an upward trend in world prices from 3.08 to 7.13 per-cents. In some countries such as the EU and the United States, where production used to be heavily subsidized, the producer prices will decline significantly following a removal of the production subsidies. In contrast, for non-subsidizing countries, the increase in market prices for cotton allows these countries to expand their production and trade. And in general, the removal of subsidies creates negative welfare effects as expected for most of the large importing countries. On the other hand, large exporting countries will have positive welfare effects due to the higher prices.

In simulation 1, when only the subsidies in cotton production of the EU and the United States are eliminated, the market price will increase, but the global trade will experience the decline by 0.38 per-cents (i.e. from USD 10.57 billion to USD 10.35 billion). The reason for this is the increase in cotton export is not enough to set off against the sharp decline in export volume of the EU and the United States. In contrast, eliminating tariffs and subsidies in

simulation 2 and 3 will, simultaneously, deliver the stronger effects: higher changes in prices and trade volumes. The global cotton price will rise by 4.86 per-cents while the global trade will jump by 0.51 per-cents (to USD 10.63 billion). And under a full reform, global trade expands further by 7.13 per-cent (to USD 11.33 billion), which is much higher than in the simulations 1 and 2. World price also increases by 7.13 per-cents, which is nearly 2.5 times higher than in simulation 1.

5 Sensitivity Analyses

Since the misspecification of elasticities could cause major imprecision when evaluating welfare effects; sensitivity analysis with alternative levels of elasticities are frequently performed as part of such policy analyses. In order to assess the reliability of the results acquired from the GSIM analysis, sensitivity analyses have therefore also been carried out for simulation 3 – free trade in the following way: (1) applying different values for demand elasticities (Em), (2) employing different values for supply elasticities (Ex), and (3) using different values for elasticities of substitution (Es). These simulations are performed with an aim to ensure that the results extracted from the GSIM model are not sensitive to the selection of elasticity values. Furthermore, these simulations are also performed in order to analyze the sensitivity of the Armington elasticities and assess how these elasticities will affect simulation results if such elasticities were escalated. The simulation results from selected sensitivity tests of import demand elasticities are presented in Table 14 below.

Table 14. Import Demand Elasticities Sensitivity Analysis, Change in World Prices and Trades

	World price	**World trade**
Em	7.13%	7.13%
2Em	5.47%	4.71%
4Em	3.91%	2.69%

Source: Author's own calculation based on extracted results from GSIM

After performing the sensitivity tests, it can be seen from Table 14 that when the value for demand elasticity – Em was doubled, the world price consequently only increased by 5.47 per-cents as opposed to by 7.13 per-cent of the baseline. Similarly, the increase in the value of the world trade is also smaller than that of baseline, only by 4.71 per-cents. The increases in the world price and world trade are even lower when Em was increased by 4 times. Specifically, with Em was escalated by fourfold, the world price only increased by 3.91 per-cents and the world trade only increased by 2.69 per-cents.

Looking at Table 1 of Appendix 2, it can be seen that 4 out of 18 countries that experienced the gradual decrease in the change in the cotton import value when Em was escalated are Brazil, the EU, the United States, and Zimbabwe. All these 4 countries boosted the cotton import, however, the level of increase in cotton import gradually decreased when Em was doubled or multiplied by 4 times. For instance, when Em was doubled, the EU experienced the increase in cotton import by 14.53 per-cents. And when Em was multiplied by 4 times, the EU only increased the cotton import by 4.57 per-cents, despite the fact that the market price at this moment is lower.

The remaining countries (except for China, Cote d'Ivoire, Nigeria, and Pakistan) all suffered the decline in the cotton import volume when Em was escalated. Taking Mexico as an example, since Mexico has the highest Em value (-1.3) (see Appendix 3) in comparison with the rest countries, Mexico is the most sensitive country to the price changes. This lead Mexico to become a country which most significantly reduced its import value (i.e. by 24.92 per-

cents), nearly 5 times higher than that of the baseline (i.e. by 5.97 per-cents). Whereas, in contrast, China, Cote d'Ivoire, Nigeria and Pakistan all increased the cotton import when Em was raised.

In summary, the results showed that consumers' welfare stays negative even when all tariffs and subsidies are removed. When the Em parameters (elasticities) are increased by twofold to a range from -2 to -1.2, consumers have to suffer a less strong reduction in their welfare in almost countries. Due to the fact that the price change is less solid, the consumer surpluses are less negative and the producer surpluses appear to be stronger. This is the reason why the total welfare becomes positive with stronger changes. Therefore, the cotton world price experiences a higher effect when demand is presumed to be inelastic.

Table 15. Export Supply Elasticities Sensitivity Analysis, Change in World Prices and Trades

	World price	World trade
Ex	7.13%	7.13%
2Ex	8.10%	8.06%
4Ex	7.26%	8.66%

Source: Author's own calculation based on extracted results from GSIM

Table 15 demonstrates results from sensitivity test of export supply elasticities. When the value for supply elasticity – Ex is modified, the world price and world trade also experienced the different changes as opposed to that when Em was escalated. When Ex is set to increase by twofold, the world price increased by 8.10 per-cents and the world trade increased by 8.06 per-cents. And when Ex value was multiplied by 4 times, the world price increased less (i.e. by 7.26 per-cent), but the world trade increased more (i.e. by 8.66 per-cent) than the figures when Ex was doubled.

Since the world price is raised, the majority of the countries experienced the boost in export volume (except for Brazil and Turkey when Ex=2Ex and Brazil and the United States when Ex = 4Ex – see Table 2, Appendix 2). For instance, the EU's export changed dramatically from -45.46 per-cents to 105.35 per-cents when Ex was doubled, and even to 237.67 per-cents when Ex was set to increase by fourfold. Brazil, however, experienced the descending export value when Ex was set to increase gradually. Turkey also suffered the decrease in cotton export value when Ex=2Ex, however, its export value boosted by 115.38 per-cent when Ex=4Ex.

On the contrary, the import value of the majority of countries within the model was diminished (except for Brazil, Cote d'Ivoire, the EU, and Turkey). The simultaneous increase in both cotton export and import (with the increase in export is higher than that of import) of the EU could be an example for the EU's diversification of export and import markets.

In general, the results from Ex sensitivity analysis imply that the higher increase in supply elasticities will lead to smaller producer price impacts as well as larger output impacts. The producer price experienced a less strong decrease when supply elasticities are doubled. As such, producer surplus becomes less negative. In contrast, consumer surplus faces a stronger degree of loss.

Table 16. Sensitivity Analysis of the Elasticities of Substitution, Change in World Prices and Trades

	World price	World trade
Es	7.13%	7.13%
2Es	7.16%	8.65%
4Es	7.16%	10.68%
10Es	7.04%	15.53%
20Es	6.82%	23.05%

Source: Author's own calculation based on extracted results from GSIM

To all countries in the model the value of 5 for Es was applied. When the value of Es was increased, the world price did not significantly changed, which tends to increase slightly and then decrease gradually. However, the world trade was gradually boosted when Es was escalated. When Es was set to be 100 (the perfect substitution), the world price did not increased as much as that of the baseline, however the world trade was boosted by 3 times. When Es was escalated towards the value of 100, the majority of the countries within the model expanded its cotton export, with China and Pakistan experienced the increase in export volume by 656.6 per-cent and 500 per-cent, respectively (Table 3, Appendix 2). The cotton import volume of the majority of the importing countries also highly augmented, especially the United States, which has rocketed its cotton import volume by 1269.71 per-cents when Es reached 100. The results imply that the perfect substitution promotes the world trade.

In addition, according to the simulation results, this elasticity has a more robust and positive impact on the change in welfare of almost all countries. The reason for this lays in the fact that with lower influence on the change of output and a lower change in consumer price, producers and consumers suffer fewer losses to their welfare. World trade expands more even there is a less change in output. Here, again, increasing degrees of substitution by 20 times to equal 100 (increasing substitutability between imports into perfect substitution) will not influence the anticipated direction of change, and will not bring the region to see a positive net welfare range. Tables 4, 5, 6 and 7 in Appendix 2 present further changes in trade from sensitivity tests of Armington elasticities/elasticities of substitution. Subsidizing countries (Brazil, China, the EU, Turkey, and the United States) face deeper decrease in their trade as world price increases evenly.

Results extracted from the sensitivity tests also support the overall results presented in section 4.1 above. Although the results of the sensitivity tests do not completely support the results discussed in section 4.1, but at least show the same direction of change, or a similar scale of change. In general, the results of the sensitivity tests are the same as anticipated. Turning from imperfect to perfect substitution, Armington elasticities show changes in prices at approximately 7.1 per-cent for free-trade simulation, which is not beyond the common range of effects on the world cotton price (i.e. between 3 per-cent to 15 per-cent) that was evaluated by various other studies. Although with a different model, assumptions, data set, etc. it seems creditable to use Armington elasticities in analyzing trade effects.

6 Discussion and Concluding remarks

The last chapter of this study intends to address the research questions presented in chapter one. The aim of this study is to find out the price and trade effects if subsidies are removed as well as to analyze the sensitivity of simulation results with respect to Armington elasticities. From the analyses of all three simulations, it appears that the simulation 3, where all global tariffs and subsidies are removed, brings the most positive effect to all countries in the model. Regarding the effects on world market price, the GSIM results implied that the complete removal of tariffs and subsidies lifted the world cotton price by 7.13 per-cent under the base simulation and by the range from 3.91 to 7.26 per-cent under different simulations of supply, demand elasticities and elasticities of substitution. More precisely, the world market price would increase by 3.08 per-cent under the first simulation (removal of the EU and the United States subsidies); by 4.86 per-cent under the second simulation (removal of global cotton subsidies); and by 7.13 per-cent under the third simulation (removal of all tariffs and subsidies). In fact, the results are not exceeding the commonly accepted range between 3 to 15 per-cent increases in world price, as evaluated in the related literatures. Goreux's study concluded that with the removal of subsidies, the world cotton price, depending on demand and supply elasticities, would have increased by 3 and 13 per-cents (Goreux, 2003). Gilson estimated the withdrawal of subsidies by the most cotton subsidizing countries would have raised the world cotton price by 18 per-cents (Baffes, 2004). Reeves et. al. found that eliminating production and export subsidies by the United States and the EU would lift world cotton price by 10.7 per-cents (Reeves et al., 2002). FAPRI concluded that with the complete liberalization by all countries, world cotton prices would have been increased by 11.44 per-cents on average. And Sumner also concluded that removing the United States' upland cotton subsidies would result in the increase of world cotton prices by 10.8 per-cents (Sumner, 2003).

From the results presented in this thesis, it can be seen that the world prices increase evenly with the level of trade liberalization. When the world price is lifted, subsidizing countries lose their production whereas non-subsidizing countries boost their production. The simulated effects on production and welfare received are the same as anticipated. Hence, with the full liberalization, production diminishes in countries that reduce subsidies such as Brazil, China, the EU, Turkey, and the United States, etc. At the global level, the 2.14 per-cent fall in world trade is caused by the output in non-subsidizing countries, which climbs consequently with the escalation of the world price, but is still not enough to counterbalance the huge fall in production of subsidizing countries. Regarding the output, almost all countries (including the West African countries: Benin, Burkina Faso, Chad, Côte d'Ivoire and Mali) gain when subsidizing countries remove subsidies. There are only 9 out of 25 countries that suffer negative welfare effects. Concerning the non-subsidizing countries, the withdrawal of subsidies could even lead these countries to a better position in the world cotton trade.

The sensitivity tests performed in this thesis validated that there is a change in world price and quantities as anticipated. Escalating the value of elasticities of substitution will lead to smaller impacts on world prices (average 7.1 per-cent change in world price), but larger impacts on trade (average 13 per-cent change in trade). In addition, the sensitivity analysis showed no evidence that the value of Armington elasticities would have a significant impact on the results.

To conclude, a lot of researches on the cotton issue have been carried out, however, the aim of this thesis is to contribute a further confirmation on who gains and who loses from existing

policies. With a well-known partial equilibrium model, relevant policy scenarios have been simulated and sensitivity analysis has been performed by choosing values of the Armington elasticities. The research in this thesis once again confirms that the huge losses that non-subsidizing countries once suffered due to subsidies will become attained gains for these countries when the subsidies were eliminated, and the value of Armington elasticities does not substantially affect the simulation results. The global free trade in cotton is not easy to achieve, nor will it happen immediately; however, it is important that countries are trying their best to gradually progress towards such a system.

Bibliography

Literature and publications

Alston, J.M., Sumner D., & Brunke H., 2007, Impacts of reductions in US cotton subsidies on West African cotton producers, *Boston, MA: Oxfam America.*

Armington, P. S., 1969, A theory for demand of products distinguished by place of production, *IMF Staff Papers,* 16: 159-178.

Ataman Aksoy M. et al, 2004, Global Agricultural Trade and Developing Countries, *World Bank Publications*

Baffes, J., 2004. Cotton: Market setting, trade policies, and issues. *Policy Research Working Paper Series,* 3218, The World Bank.

Baffes, J., 2005. The Cotton Problem. *World Bank Research Observer, Oxford University Press*, vol. 20(1), 109-144.

Clapan, C. et al., 2006. The olive oil and cotton lint sectors in the European Union. *European Association of Agricultural Economists, 98th Seminar*, Chania, Crete, Greece.

Donnelly, W. A. et al., 2004. Revised Armington Elasticities of Substitution for the USITC Model and the Concordance for Constructing a Consistent Set for the GTAP Model. *Working Papers 15861*, United States International Trade Commission, Office of Economics.

Fabiosa, J. et al., 2005. The Doha round of the World Trade Organization and agricultural markets liberalization: Impacts on the developing economies, *Review of Agricultural Economics*, Vol.27, No. 3, pp. 317-335.

FAPRI, 2002, The Doha Round of the World Trade Organization: Appraising further liberalization of agricultural markets, *Working Paper 02-WP 317*

Francois, J.F.& Hall, H.K. 2003 Global Simulation Analysis of Industry-Level Trade Policy. *Tinbergen Institute, CEPR, US Commerce Department*.

Goreux L. 2003. Prejudice Caused by Industrialised Countries Subsidies to Cotton Sectors in Western and Central Africa.

Gillson, I et al. 2004. Understanding the impact of Cotton Subsidies on developing countries, *MPRA Paper 15373*, University Library of Munich, Germany. (Unpublished).

Guerreiro D., 2012, On the impact of US subsidies on world cotton prices: A meta-analysis approach, *The Journal of International Trade & Economic Development: An International and Comparative Review* (DOI:10.1080/09638199.2012.667143).

International Cotton Advisory Committee, 2003. *Production and Trade Policies Affecting the Cotton Industry.* Washington, D.C.

Jales M., 2010, How would a trade deal in cotton affect exporting and importing countries, *Issue Paper no. 26, Geneva: International Center for Trade and Sustainable Development.*

Macki M. Sissoko and Patricia A. Duffy, 1993, Effects of STABEX on Cotton Imports of the European Community, Review of Agricultural Economics, Vol. 15, No. 2 May, 379-388.

McDaniel, C.A & Balistreri, E. J., 2003. A Discussion on Armington Trade Substitution Elasticities. *Computational Economics 0303002*, EconWPA.

Mutambatsere, E., 2006. Trade Policy Reforms in the Cereals Sector of the SADC Region: Implications on Food Security. *Cornell University, Department of Applied Economics and Management, Working Papers*.

Paudel, L. et al., 2004. The Elasticity of Export Demand for U.S. Cotton. *Southern Agricultural Economics Association, Annual Meeting,* February 14-18, 2004, Tulsa, Oklahoma.

Plastina A., 2007, Effects of eliminating government measures in cotton, *Staff Papers, International Cotton Advisory Committee, Washington, DC.*

Poonyth, Daneswar, Sarris A., Sharma R., & Shui S., 2004, The Impact of Domestic and Trade Policies on the World Cotton Market, *Food and Agriculture Organization, Commodity and Trade Policy Research Working Paper, Rome.*

Primack, D., 2007. Addressing Global Cotton Subsidies: Uprooting the seeds of poverty. *After Hong Kong: Some Key Trade Issues for Developing Countries*, Commonwealth Secretariat

Rakhal, S. & Surry, Y., 2006. Product Differentiation and Trade in Agri-Food Products: Taking Stock and Looking Forward. Journal of International Agricultural Trade and Development, Vol. 2, Issue 1, pp. 39-78.

Reeves G., Vincent D., Quirke D., & Wyatt S., 2002, Trade distortions and cotton markets: Implications for global cotton producers, cotton research and development corporation, *Canberra, Center for International Economics.*

Schnepf, R. 2009. Brazil's WTO Case Against the U.S. Cotton Program. *Congressional Research Service, Report RS22187*

Sumner D., 2003, A quantitative simulation analysis of the impacts of U.S. cotton subsidies on cotton prices and quantities, *Mimeo, Department of Agricultural and Resource Economics, University of California, Davis*

Sumner D., 2006, Effects of U.S. upland cotton subsidies on upland cotton prices and quantities, *Research Working Papers, Agricultural Issue Center, University of California, Davis, CA.*

Tokarik S., 2003, Measuring the impact of distortions in agricultural trade in partial and general equilibrium, *IMF Working Paper WP/03/110.*

Watkins, K., 2002, Cultivating Poverty: The Impact of U.S. Cotton Subsidies on Africa. *Oxfam briefing paper,* Vol 30

Womach, J. 2004. Cotton Production and Support in the United States. *Library of Congress. Congressional Research Service*, RL32442

Internet

Food and Agriculture Organization of The United Nations, Statistics Division (http://faostat.fao.org/)

1. Detail Trade Matrix (19/07/2012)
http://faostat.fao.org/site/537/default.aspx
2. Detail Trade Date (19/07/2012)
http://faostat.fao.org/site/535/default.aspx#ancor
3. Glossary List (19/07/2012)
http://faostat.fao.org/site/375/default.aspx
4. Production – Crops (19/07/2012)
http://faostat.fao.org/site/567/default.aspx#ancor
5. Producer Prices (19/07/2012)
http://faostat.fao.org/site/703/default.aspx#ancor
6. Trade Indices (19/07/2012)
http://faostat.fao.org/site/611/default.aspx#ancor
7. Top Imports – Cotton Lints (19/07/2012)
http://faostat.fao.org/site/342/default.aspx
8. Top Exports – Cotton Lints (19/07/2012)
http://faostat.fao.org/site/342/default.aspx

Global Simulation Analysis of Industry-Level Trade Policy (GSIM) a 25x25 model example: http://www.i4ide.org/content/wpaper/dp20090803.zip (19/03/2012)

International Cotton Advisory Committee (http://icac.org/)

1. Production and Trade Policies Affecting the Cotton Industry – 2011 (19/07/2012)
http://icac.org/publications/publication-catalog?pub=pubdetail.php?id=P0000102
2. Production and Trade Policies Affecting the Cotton Industry – 2010 (19/07/2012)
http://icac.org/publications/publication-catalog?pub=pubdetail.php?id=P0000102
3. Production and Trade Policies Affecting the Cotton Industry – 2009 (19/07/2012)
http://icac.org/publications/publication-catalog?pub=pubdetail.php?id=P0000102
4. Production and Trade Policies Affecting the Cotton Industry – 2008 (19/07/2012)
http://www.icac.org/cotton_info/publications/statistics/stats_wtd/gm-e_08.pdf
5. Production and Trade Policies Affecting the Cotton Industry - October 2007 (19/07/2012)
http://www.icac.org/cotton_info/publications/statistics/stats_wtd/gm-e_07.pdf
6. Production and Trade Policies Affecting the Cotton Industry - Data updated in May 2007 (19/07/2012)
http://icac.org/publications/publication-catalog?pub=pubdetail.php?id=P0000102
7. Production and Trade Policies Affecting the Cotton Industry – 2006 (19/07/2012)
http://icac.org/publications/publication-catalog?pub=pubdetail.php?id=P0000102

Foreign Subsidies Database, Cotton Economics Research Institute (http://www.depts.ttu.edu/ceri/index.aspx)

1. Crop Subsidy Tables, Cotton (19/07/2012)
   http://www.depts.ttu.edu/ceri/tables1.aspx
2. Full PDF Database, Crop Subsidies in Foreign Countries: Different Paths to Common Goals (19/07/2012)
   http://www.depts.ttu.edu/ceri/CROP%20SUBSIDIES%202009%20handbook%20pdf.pdf

Market Access Map http://www.macmap.org/

1. Find tariff (19/07/2012)
   http://www.macmap.org/QuickSearch/FindTariff/FindTariff.aspx
2. Glossary (19/07/2012)
   http://www.macmap.org/SupportMaterials/Glossary.aspx
3. Tariff and trade analysis (19/07/2012)
   http://www.macmap.org/AdvancedSearch/TariffAndTradeAnalysis/Default.aspx

Organisation for Economic Cooperation and development (http://www.oecd.org)

1. Producer and Consumer Support Estimates database (19/07/2012)
   http://www.oecd.org/document/59/0,3746,en_2649_33797_39551355_1_1_1_1,00.html

World Integrated Trade Solution (http://wits.worldbank.org/wits/)

1. Tariff - Find A Tariff (19/07/2012)
   http://wits.worldbank.org/WITS/WITS/QuickQuery/FindTariff/FindTariff.aspx?Page=FindATariff
2. Tariff and Trade Analysis (19/07/2012)
   http://wits.worldbank.org/WITS/WITS/AdvanceQuery/TariffAndTradeAnalysis/AdvancedQueryDefinition.aspx?Page=TariffandTradeAnalysis
3. Trade Data (UN Comtrade) (19/07/2012)
   http://wits.worldbank.org/WITS/WITS/AdvanceQuery/RawTradeData/QueryDefinition.aspx?Page=RawTradeData

Appendix 1: Impact of policy reforms on trade

Appendix 1 - Table 1. Elimination of the EU and United States subsidies, changes in trade volume (percentage)

		Origin	
Destination		EUN	USA
	BGD	-68.43	-15.54
	BRA	-	-16.21
	CHN	-70.53	-17.64
	EGY	-56.90	-4.01
	EUN	**-46.36**	6.53
	IND	-71.76	-18.87
	KOR	-62.15	-9.26
	MLI	-36.86	-
	MEX	-	-7.80
	PAK	-70.59	-17.70
	RUS	-67.10	-
	TUR	-57.57	-4.68
	USA	-55.80	**-2.91**
	VNM	-56.69	-3.80
	ROW	-62.64	-9.74

Appendix 1 - Table 2. Elimination of the EU and United States subsidies, changes in trade value (percentage)

		Origin	
Destination		EUN	USA
	BGD	-63.60	-11.54
	BRA	-	-12.23
	CHN	-66.02	-13.73
	EGY	-50.30	0.54
	EUN	**-38.15**	11.58
	IND	-67.43	-15.02
	KOR	-56.35	-4.96
	MLI	-27.19	-
	MEX	-	-3.42
	PAK	-66.08	-13.79
	RUS	-62.06	-
	TUR	-51.07	-0.16
	USA	-49.03	**1.70**
	VNM	-50.05	0.76
	ROW	-56.91	-5.47

Source: Extracted from GSIM results, Appendix 4

Appendix 1 - Table 3. Elimination of all subsidies, changes in trade volume of subsidized countries (percentage)

		Origin					
		BRA	**CHN**	**EUN**	**MEX**	**TUR**	**USA**
Destination	**BGD**	-26.52	-1.20	-75.57	-	-61.73	-19.18
	BRA	**-6.30**	-	-	-	-41.51	1.04
	CHN	-26.84	**-1.52**	-75.89	-7.16	-62.05	-19.50
	CIV	-	-1.82	-	-	-	-
	EGY	-13.73	11.59	-62.78	-	-48.94	-6.39
	EUN	0.56	25.88	**-48.49**	20.24	-34.65	7.90
	IND	-	-6.25	-80.62	-	-66.78	-24.23
	KOR	-13.02	12.30	-62.07	6.66	-	-5.68
	MLI	-	-	-42.01	-	-	-
	MEX	-	-	-	**2.06**	-	-10.28
	PAK	-30.33	-5.01	-79.38	-10.65	-65.54	-22.99
	RUS	-	-	-73.03	-	-59.19	-
	TUR	4.59	-	-44.46	-	**-30.62**	11.93
	USA	-	14.08	-60.30	-	-46.46	**-3.91**
	VNM	-12.53	12.79	-61.58	7.15	-47.74	-5.19
	ROW	-17.70	7.62	-66.75	1.98	-52.91	-10.36

Source: Extracted from GSIM results, Appendix 4

Appendix 1 - Table 4. Elimination of all subsidies, changes in trade value of subsidized countries (percentage)

		Origin					
		BRA	**CHN**	**EUN**	**MEX**	**TUR**	**USA**
Destination	**BGD**	-20.57	1.79	-71.20	-	-55.94	-13.82
	BRA	**1.28**	-	-	-	-32.66	7.73
	CHN	-20.93	**1.46**	-71.58	-3.31	-56.31	-14.17
	CIV	-	-	-	-	-	-
	EGY	-6.75	14.97	-56.12	-	-41.21	-0.19
	EUN	8.70	29.69	**-39.27**	25.24	-24.76	15.05
	IND	-	-3.41	-77.16	-	-61.76	-19.22
	KOR	-5.98	15.70	-55.28	11.10	-	0.57
	MLI	-	-	-31.63	-	-	-
	MEX	-	-	-	**6.30**	-	-4.34
	PAK	-24.69	-2.13	-75.69	-6.94	-60.32	-17.89
	RUS	-	-	-68.20	-	-53.01	-
	TUR	13.05	-	-34.52	-	**-20.12**	19.34
	USA	-	17.53	-53.19	-	-38.35	**2.46**
	VNM	-5.46	16.20	-54.71	11.60	-39.84	1.09
	ROW	-11.04	10.88	-60.80	6.22	-45.78	-4.42

Source: Extracted from GSIM results, Appendix 4 - Table 5

Appendix 1 - Table 5. Elimination of all subsidies and tariffs, changes in trade volume of subsidized countries (percentage)

		Origin					
		BRA	**CHN**	**EUN**	**MEX**	**TUR**	**USA**
Destination	**BGD**	-19.39	15.59	-76.63	-	-61.98	-23.37
	BRA	**-9.54**	-	-	-	-5.47	30.06
	CHN	-3.21	**-2.73**	76.37	6.50	-43.10	-6.94
	CIV	-	2.01	-	-	-	-
	EGY	-7.13	27.84	-64.37	-	-49.72	-11.11
	EUN	7.57	42.54	**-49.67**	17.94	-35.02	3.59
	IND	-	9.70	-28.01	-	-67.87	-29.26
	KOR	-6.36	28.61	-63.60	4.01	-	-10.34
	MLI	-	-	-43.72	-	-	-
	MEX	-	-	-	**0.30**	-	-14.05
	PAK	-12.07	21.24	-66.58	-2.19	-52.64	-15.86
	RUS	-	-	-73.91	-	-59.27	-
	TUR	12.29	-	-44.95	-	**-30.31**	8.31
	USA	-	88.63	6.52	-	19.56	**-5.89**
	VNM	-5.08	29.89	-62.32	5.29	-47.67	-9.06
	ROW	-9.90	25.07	-67.14	0.47	-52.50	-13.89

Source: Extracted from GSIM results, Appendix 4

Appendix 1 - Table 6. Elimination of all subsidies and tariffs, changes in trade value of subsidized countries (percentage)

		Origin					
		BRA	**CHN**	**EUN**	**MEX**	**TUR**	**USA**
Destination	**BGD**	-12.56	17.29	-71.97	-	-55.52	-16.27
	BRA	**-1.88**	-	-	-	10.59	42.11
	CHN	4.99	**-1.29**	111.51	13.31	-33.43	1.68
	CIV	-	3.52	-	-	-	-
	EGY	0.74	29.73	-57.27	-	-41.18	-2.87
	EUN	16.69	44.65	**-39.64**	25.49	-23.98	13.19
	IND	-	11.32	-13.66	-	-62.41	-22.70
	KOR	1.58	30.51	-56.35	10.67	-	-2.03
	MLI	-	-	-32.50	-	-	-
	MEX	-	-	-	**6.72**	-	-6.08
	PAK	-4.62	23.03	-59.93	4.06	-44.59	-8.07
	RUS	-	-	-68.71	-	-52.35	-
	TUR	21.80	-	-33.99	-	**-18.47**	18.34
	USA	-	91.42	27.74	-	39.88	**2.83**
	VNM	2.97	31.81	-54.81	12.03	-38.78	-0.63
	ROW	-2.27	26.92	-60.60	6.89	-44.43	-5.90

Source: Extracted from GSIM results, Appendix 4 - Table 8

Appendix 2: Parameter Value Sensitivity Tests

Appendix 2 - Table 1. Import Demand Elasticities Sensitivity Analysis, Change in Export and Import values

Country	Export value change			Import value change		
	Em	2Em	4Em	Em	2Em	4Em
AUS	11.17%	8.43%	6.05%	-		
BGD	29.77%	21.71%	11.80%	1.71%	-1.09%	-3.63%
BEN	12.52%	10.33%	8.78%	-		
BRA	0.09%	-1.46%	-2.92%	48.74%	42.21%	36.18%
BFA	11.69%	9.40%	7.66%	-		
TCD	12.73%	9.04%	5.29%	-		
CHN	25.80%	17.56%	7.73%	10.77%	13.16%	17.74%
CIV	12.65%	9.34%	6.15%	3.52%	5.64%	10.68%
EGY	11.63%	9.18%	7.15%	-13.81%	-17.06%	-20.27%
EUN	-45.46%	-46.40%	-46.98%	22.51%	14.53%	4.57%
IND	20.38%	18.59%	17.58%	-14.49%	-14.66%	-13.73%
IRN	20.05%	14.68%	9.21%	-		
KOR	10.56%	6.97%	3.37%	2.55%	-2.03%	-7.21%
MLI	11.86%	8.83%	6.06%	3.13%	0.38%	-1.84%
MEX	10.79%	12.36%	15.51%	-5.97%	-14.75%	-24.92%
NGA	21.86%	17.51%	13.55%	9.99%	9.83%	10.17%
PAK	32.36%	23.76%	13.21%	1.74%	4.46%	9.63%
RUS	11.79%	7.91%	3.97%	2.09%	-1.06%	-3.62%
SYR	30.81%	22.50%	12.99%	-		
TUR	-27.75%	-26.28%	-23.58%	17.48%	8.20%	-3.38%
USA	1.68%	-0.72%	-2.70%	62.16%	56.30%	49.92%
UZB	10.92%	8.19%	5.81%	-		
VNM	6.77%	3.90%	1.46%	1.20%	-3.49%	-8.85%
ZWE	11.52%	8.02%	4.57%	13.62%	10.30%	8.09%
ROW	14.95%	11.54%	8.23%	0.07%	-4.17%	-8.71%
Total	7.13%	4.71%	2.69%	7.13%	4.71%	2.69%

Appendix 2 - Table 2. Import Demand Elasticities Sensitivity Analysis, Change in Export and Import values

Country	Export value change			Import value change		
	Ex	2Ex	4Ex	Ex	2Ex	4Ex
AUS	11.17%	17.01%	25.21%	-		
BGD	29.77%	51.70%	85.14%	1.71%	1.53%	0.82%
BEN	12.52%	18.73%	27.60%	-		
BRA	0.09%	-6.92%	-14.71%	48.74%	58.88%	70.25%
BFA	11.69%	17.48%	25.71%	-		
TCD	12.73%	22.01%	38.57%	-		
CHN	25.80%	28.78%	32.35%	10.77%	10.01%	9.10%
CIV	12.65%	20.74%	34.12%	3.52%	4.00%	4.39%
EGY	11.63%	17.59%	27.82%	-13.81%	-35.90%	-86.16%
EUN	-45.46%	-105.35%	-237.67%	22.51%	41.19%	72.19%
IND	20.38%	27.60%	36.04%	-14.49%	-23.36%	-33.78%
IRN	20.05%	25.53%	30.54%	-		
KOR	10.56%	17.33%	28.47%	2.55%	2.45%	0.84%
MLI	11.86%	18.65%	29.18%	3.13%	-2.52%	-21.76%
MEX	10.79%	13.34%	17.80%	-5.97%	-8.93%	-12.68%
NGA	21.86%	28.34%	35.04%	9.99%	7.80%	7.87%
PAK	32.36%	42.33%	56.14%	1.74%	-3.65%	-12.14%
RUS	11.79%	20.57%	36.49%	2.09%	2.14%	1.83%
SYR	30.81%	43.60%	59.32%	-		
TUR	-27.75%	-61.10%	-115.38%	17.48%	29.53%	44.07%
USA	1.68%	0.30%	-0.32%	62.16%	55.76%	39.11%
UZB	10.92%	16.24%	23.53%	-		
VNM	6.77%	9.64%	14.25%	1.20%	-1.44%	-10.37%
ZWE	11.52%	18.61%	29.63%	13.62%	13.87%	13.69%
ROW	14.95%	24.25%	39.42%	0.07%	-2.12%	-6.83%
Total	7.13%	8.06%	8.66%	7.13%	8.06%	8.66%

Source: Extracted from GSIM results

Appendix 2 - Table 3. Substitution Elasticities Sensitivity Analysis, Change in Export and Import values

Country	Export value change					Import value change				
	Es	2Es	4Es	10Es	20Es	Es	2Es	4Es	10Es	20Es
AUS	11.17%	12.43%	12.98%	13.15%	13.02%	-				
BGD	29.77%	36.49%	41.23%	45.97%	50.06%	1.71%	1.97%	2.11%	2.09%	1.87%
BEN	12.52%	13.82%	14.43%	14.64%	14.52%	-				
BRA	0.09%	5.58%	22.64%	81.75%	183.50%	48.74%	83.52%	147.46%	332.05%	635.73%
BFA	11.69%	12.85%	13.37%	13.53%	13.40%	-				
TCD	12.73%	13.33%	13.47%	13.39%	13.19%	-				
CHN	25.80%	57.52%	123.07%	322.87%	656.62%	10.77%	12.71%	14.54%	16.89%	19.18%
CIV	12.65%	13.53%	13.83%	13.84%	13.66%	3.52%	3.39%	3.27%	3.16%	3.07%
EGY	11.63%	13.67%	16.16%	21.62%	29.62%	-13.81%	-12.61%	-8.35%	4.92%	26.36%
EUN	-45.46%	-49.13%	-49.94%	-46.79%	-39.63%	22.51%	25.63%	27.89%	31.13%	35.23%
IND	20.38%	27.13%	32.14%	35.83%	36.94%	-14.49%	-21.01%	-25.59%	-28.39%	-28.30%
IRN	20.05%	33.74%	47.79%	61.62%	67.06%	-				
KOR	10.56%	11.90%	12.61%	12.97%	12.93%	2.55%	2.52%	2.43%	2.14%	1.66%
MLI	11.86%	13.08%	13.67%	13.92%	13.83%	3.13%	2.57%	1.94%	0.31%	-2.39%
MEX	10.79%	10.66%	9.91%	8.50%	6.83%	-5.97%	-6.11%	-6.10%	-6.09%	-6.16%
NGA	21.86%	35.00%	48.49%	62.74%	70.49%	9.99%	22.22%	60.53%	203.99%	459.47%
PAK	32.36%	60.76%	112.55%	259.69%	500.04%	1.74%	1.47%	3.75%	15.53%	37.77%
RUS	11.79%	12.67%	13.13%	13.38%	13.32%	2.09%	2.34%	2.47%	2.53%	2.52%
SYR	30.81%	49.34%	69.81%	92.58%	102.82%	-				
TUR	-27.75%	-32.51%	-31.11%	-15.89%	13.64%	17.48%	20.59%	22.65%	24.76%	26.73%
USA	1.68%	0.39%	-0.42%	-0.56%	0.22%	62.16%	126.54%	254.83%	636.76%	1269.71%
UZB	10.92%	12.95%	14.13%	14.81%	14.85%	-				
VNM	6.77%	7.47%	7.67%	6.85%	4.85%	1.20%	1.40%	1.49%	1.38%	1.00%
ZWE	11.52%	12.81%	13.44%	13.92%	14.33%	13.62%	25.02%	47.18%	112.74%	221.25%
ROW	14.95%	17.23%	19.81%	26.29%	36.80%	0.07%	0.15%	0.84%	3.39%	7.79%
Total	7.13%	8.65%	10.68%	15.53%	23.05%	7.13%	8.65%	10.68%	15.53%	23.05%

Appendix 2 - Table 4. Summary of Effects: 2Es = 10

	Welfare					Other			
	Producer surplus USD'000	Consumer surplus USD'000	Tariff revenue USD'000	Change in subsidy payments USD'000	Net welfare effect USD'000	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	per-cent	per-cent	Per-cent	per-cent
AUS	30934.1	0.0	0.0	0.0	30934.1	0.00%	5.4%	6.71%	6.71%
BGD	554.5	-58861.2	0.0	0.0	-58306.7	6.05%	4.4%	5.45%	5.45%
BEN	10755.2	-791.7	0.0	0.0	9963.5	7.00%	5.6%	7.00%	7.00%
BRA	-172803.1	-82876.4	-10645.5	276998.3	10673.3	6.42%	-9.9%	-12.31%	7.30%
BFA	19556.1	0.0	0.0	0.0	19556.1	0.00%	5.5%	6.93%	6.93%
TCD	4493.0	0.0	0.0	0.0	4493.0	0.00%	5.7%	7.18%	7.18%
CHN	-419281.8	-151919.8	-236816.1	560694.1	-247323.6	0.98%	-2.9%	-3.65%	1.18%
CIV	4565.6	0.0	-0.1	0.0	4565.6	-3.64%	5.8%	7.28%	7.28%
EGY	21338.8	-14170.0	0.0	0.0	7168.8	7.64%	5.4%	6.80%	6.80%
EUN	-262917.9	-74917.6	0.0	380900.7	43065.2	9.48%	-53.5%	-66.92%	14.06%
IND	300076.2	-225101.7	-192.8	0.0	74781.6	5.27%	4.1%	5.15%	5.15%
IRN	4385.8	-3726.2	0.0	0.0	659.7	3.31%	2.7%	3.31%	3.31%
KOR	285.5	-24059.6	0.0	0.0	-23774.2	7.70%	5.1%	6.43%	6.43%
MLI	13195.2	-112.9	-160.8	0.0	12921.5	3.31%	5.6%	7.05%	7.05%
MEX	4786.7	-49255.2	-73.8	6530.6	-38011.6	8.28%	2.3%	2.84%	7.05%
NGA	6117.0	-5167.4	-13.9	0.0	935.7	3.53%	2.8%	3.54%	3.54%
PAK	31813.7	-43559.9	-32425.4	0.0	-44171.5	1.52%	1.1%	1.42%	1.42%
RUS	991.7	-16406.5	0.0	0.0	-15414.9	6.58%	5.5%	6.83%	6.83%
SYR	10809.3	-9780.0	0.0	0.0	1029.3	3.09%	2.5%	3.09%	3.09%
TUR	-289701.6	-227725.8	0.0	446909.5	-70517.9	10.26%	-32.6%	-40.74%	12.84%
USA	-496737.1	-113747.4	-1001.8	928557.8	317071.4	8.50%	-7.2%	-8.96%	8.58%
UZB	82094.5	-12578.4	0.0	0.0	69516.0	6.11%	4.9%	6.11%	6.11%
VNM	1092.1	-22226.1	0.0	0.0	-21134.0	7.92%	5.5%	6.89%	6.89%
ZWE	7493.6	-224.6	-13.0	0.0	7256.0	6.33%	5.4%	6.70%	6.70%
ROW	122587.8	-216410.8	0.0	0.0	-93823.0	7.39%	5.5%	6.85%	6.85%

Appendix 2 - Table 5. Summary of Effects: 4Es = 20

	Welfare					Other			
	Producer surplus USD'000	Consumer surplus USD'000	Tariff revenue USD'000	Change in subsidy payments USD'000	Net welfare effect USD'000	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	per-cent	per-cent	per-cent	per-cent
AUS	32297.5	0.0	0.0	0.0	32297.5	0.00%	5.6%	7.00%	7.00%
BGD	635.8	-63972.8	0.0	0.0	-63337.0	6.56%	5.0%	6.23%	6.23%
BEN	11224.6	-826.0	0.0	0.0	10398.5	7.29%	5.8%	7.29%	7.29%
BRA	-182119.2	-72440.4	-10645.5	276998.3	11793.2	5.63%	-10.4%	-13.04%	6.41%
BFA	20343.9	0.0	0.0	0.0	20343.9	0.00%	5.8%	7.20%	7.20%
TCD	4540.7	0.0	0.0	0.0	4540.7	0.00%	5.8%	7.25%	7.25%
CHN	-446628.1	-124163.3	-236816.1	560694.1	-246913.5	0.80%	-3.1%	-3.89%	0.92%
CIV	4667.2	0.0	-0.1	0.0	4667.2	-3.88%	6.0%	7.44%	7.44%
EGY	22579.1	-13861.9	0.0	0.0	8717.2	7.47%	5.8%	7.19%	7.19%
EUN	-265223.4	-66319.2	0.0	380900.7	49358.1	8.42%	-54.3%	-67.85%	10.85%
IND	355630.8	-263145.3	-192.8	0.0	92292.6	6.14%	4.9%	6.07%	6.07%
IRN	6174.2	-5238.8	0.0	0.0	935.4	4.64%	3.7%	4.64%	4.64%
KOR	302.5	-22819.1	0.0	0.0	-22516.5	7.31%	5.4%	6.80%	6.80%
MLI	13787.9	-60.7	-160.8	0.0	13566.4	1.79%	5.9%	7.35%	7.35%
MEX	5133.5	-46817.5	-73.8	6530.6	-35227.2	7.89%	2.4%	3.04%	7.26%
NGA	8363.3	-7055.0	-13.9	0.0	1294.4	4.81%	3.9%	4.81%	4.81%
PAK	41807.0	-53805.1	-32425.4	0.0	-44423.5	1.88%	1.5%	1.86%	1.86%
RUS	1027.4	-17368.6	0.0	0.0	-16341.1	6.96%	5.7%	7.07%	7.07%
SYR	15197.5	-13733.9	0.0	0.0	1463.7	4.32%	3.5%	4.32%	4.32%
TUR	-295973.4	-197314.8	0.0	446909.5	-46378.7	8.92%	-33.7%	-42.07%	10.32%
USA	-520237.5	-106508.5	-1001.8	928557.8	300809.9	7.97%	-7.5%	-9.41%	8.05%
UZB	89553.9	-13714.3	0.0	0.0	75839.6	6.65%	5.3%	6.65%	6.65%
VNM	1121.3	-21259.4	0.0	0.0	-20138.1	7.58%	5.7%	7.07%	7.07%
ZWE	7799.8	-234.4	-13.0	0.0	7552.4	6.60%	5.6%	6.97%	6.97%
ROW	127912.3	-214307.7	0.0	0.0	-86395.4	7.32%	5.7%	7.14%	7.14%

Appendix 2 - Table 6. Summary of Effects: 10Es = 50

	Welfare					Other			
	Producer surplus USD'000	Consumer surplus USD'000	Tariff revenue USD'000	Change in subsidy payments USD'000	Net welfare effect USD'000	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	per-cent	per-cent	per-cent	per-cent
AUS	32717.6	0.0	0.0	0.0	32717.6	0.00%	5.7%	7.08%	7.08%
BGD	689.0	-67092.6	0.0	0.0	-66403.6	6.88%	5.4%	6.74%	6.74%
BEN	11389.9	-838.1	0.0	0.0	10551.8	7.40%	5.9%	7.40%	7.40%
BRA	-189775.7	-63708.0	-10645.5	276998.3	12869.2	4.96%	-10.9%	-13.64%	5.68%
BFA	20589.1	0.0	0.0	0.0	20589.1	0.00%	5.8%	7.28%	7.28%
TCD	4514.4	0.0	0.0	0.0	4514.4	0.00%	5.8%	7.21%	7.21%
CHN	-474894.3	-92349.4	-236816.1	560694.1	-243365.7	0.60%	-3.3%	-4.15%	0.66%
CIV	4671.0	0.0	-0.1	0.0	4671.0	-4.13%	6.0%	7.44%	7.44%
EGY	23314.8	-13667.3	0.0	0.0	9647.5	7.37%	5.9%	7.42%	7.42%
EUN	-266698.0	-60403.1	0.0	380900.7	53799.6	7.68%	-54.8%	-68.46%	8.77%
IND	395484.5	-290185.4	-192.8	0.0	105106.3	6.76%	5.4%	6.73%	6.73%
IRN	7912.8	-6705.8	0.0	0.0	1207.1	5.92%	4.7%	5.92%	5.92%
KOR	311.2	-21680.6	0.0	0.0	-21369.4	6.95%	5.6%	6.99%	6.99%
MLI	14036.8	-28.1	-160.8	0.0	13847.9	0.83%	6.0%	7.48%	7.48%
MEX	5137.8	-44516.4	-73.8	6530.6	-32921.8	7.52%	2.4%	3.05%	7.26%
NGA	10515.4	-8858.7	-13.9	0.0	1642.8	6.02%	4.8%	6.02%	6.02%
PAK	49828.1	-61713.2	-32425.4	0.0	-44310.5	2.15%	1.8%	2.22%	2.22%
RUS	1046.8	-17816.2	0.0	0.0	-16769.4	7.13%	5.8%	7.20%	7.20%
SYR	20019.4	-18067.9	0.0	0.0	1951.4	5.66%	4.5%	5.66%	5.66%
TUR	-300205.8	-175633.5	0.0	446909.5	-28929.8	7.96%	-34.4%	-42.99%	8.57%
USA	-540478.4	-100281.5	-1001.8	928557.8	286796.1	7.51%	-7.8%	-9.79%	7.60%
UZB	93775.8	-14356.6	0.0	0.0	79419.2	6.96%	5.6%	6.96%	6.96%
VNM	1127.1	-20475.3	0.0	0.0	-19348.2	7.31%	5.7%	7.11%	7.11%
ZWE	7888.3	-237.3	-13.0	0.0	7637.9	6.68%	5.6%	7.05%	7.05%
ROW	129788.5	-210404.9	0.0	0.0	-80616.5	7.19%	5.8%	7.24%	7.24%

Appendix 2 - Table 7. Summary of Effects: 20Es = 100

	Welfare					other			
	Producer surplus USD'000	Consumer surplus USD'000	Tariff revenue USD'000	Change in subsidy payments USD'000	Net welfare effect USD'000	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	per-cent	per-cent	per-cent	per-cent
AUS	32397.8	0.0	0.0	0.0	32397.8	0.00%	5.6%	7.02%	7.02%
BGD	699.6	-67385.1	0.0	0.0	-66685.5	6.90%	5.5%	6.84%	6.84%
BEN	11294.4	-831.1	0.0	0.0	10463.2	7.34%	5.9%	7.34%	7.34%
BRA	-193550.0	-59286.7	-10645.5	276998.3	13516.0	4.62%	-11.2%	-13.94%	5.31%
BFA	20391.8	0.0	0.0	0.0	20391.8	0.00%	5.8%	7.21%	7.21%
TCD	4444.9	0.0	0.0	0.0	4444.9	0.00%	5.7%	7.10%	7.10%
CHN	-494809.2	-66959.2	-236816.1	560694.1	-237890.4	0.43%	-3.5%	-4.32%	0.47%
CIV	4610.0	0.0	-0.1	0.0	4610.0	-4.31%	5.9%	7.35%	7.35%
EGY	23320.4	-13468.3	0.0	0.0	9852.1	7.27%	5.9%	7.42%	7.42%
EUN	-267260.4	-57669.3	0.0	380900.7	55971.1	7.34%	-54.9%	-68.69%	7.96%
IND	405515.1	-296744.0	-192.8	0.0	108578.3	6.91%	5.5%	6.89%	6.89%
IRN	8592.4	-7278.2	0.0	0.0	1314.2	6.42%	5.1%	6.42%	6.42%
KOR	310.2	-20972.2	0.0	0.0	-20662.0	6.73%	5.6%	6.97%	6.97%
MLI	13948.1	-14.7	-160.8	0.0	13772.7	0.43%	5.9%	7.44%	7.44%
MEX	4964.5	-43089.4	-73.8	6530.6	-31668.1	7.29%	2.4%	2.94%	7.16%
NGA	11341.5	-9549.7	-13.9	0.0	1777.9	6.48%	5.2%	6.48%	6.48%
PAK	51423.4	-62760.4	-32425.4	0.0	-43762.4	2.19%	1.8%	2.29%	2.29%
RUS	1042.3	-17739.6	0.0	0.0	-16697.3	7.10%	5.7%	7.17%	7.17%
SYR	22168.8	-19996.4	0.0	0.0	2172.3	6.25%	5.0%	6.25%	6.25%
TUR	-301889.1	-165980.9	0.0	446909.5	-20960.5	7.53%	-34.7%	-43.36%	7.87%
USA	-551973.5	-96748.3	-1001.8	928557.8	278834.1	7.25%	-8.0%	-10.00%	7.34%
UZB	94048.4	-14398.1	0.0	0.0	79650.3	6.98%	5.6%	6.98%	6.98%
VNM	1114.1	-19953.7	0.0	0.0	-18839.6	7.13%	5.6%	7.03%	7.03%
ZWE	7807.8	-234.8	-13.0	0.0	7559.9	6.61%	5.6%	6.98%	6.98%
ROW	128704.8	-206243.4	0.0	0.0	-77538.6	7.05%	5.7%	7.19%	7.19%

Appendix 3. Supply and Demand elasticities

Appendix 3 - Table 1. Supply and Demand elasticities

Country	Abbreviation	Supply elasticity	Demand elasticity
Australia	AUS	0.8	-0.6
Bangladesh	BGD	1.2	-0.6
Benin	BEN	0.8	-0.6
Brazil	BRA	1.2	-0.6
Burkina Faso	BFA	0.8	-0.6
Chad	TCD	0.8	-0.6
China (mainland)	CHN	1.2	-1
Cote d'Ivoire	CIV	0.8	-0.6
Egypt	EGY	0.8	-0.6
European Union	EUN	0.8	-0.6
India	IND	1.2	-0.8
Iran (Islamic Republic)	IRN	0.8	-0.6
Republic of Korea	KOR	0.8	-0.6
Mali	MLI	0.8	-0.6
Mexico	MEX	1	-1.3
Nigeria	NGA	0.8	-0.6
Pakistan	PAK	1.2	-1
Russia	RUS	0.8	-0.6
Syria	SYR	0.8	-0.6
Turkey	TUR	1.2	-0.6
United States of America	USA	0.8	-0.6
Uzbekistan	UZB	0.8	-0.6
Vietnam	VNM	0.8	-0.6
Zimbabwe	ZWE	0.8	-0.6
Rest of the World	ROW	0.8	-0.6

Source: ATPSM

Appendix 4: Simulations main results

Appendix 4 - Table 1. Simulation 1 - Core model solutions

	Bench-mark prices	New prices	Change in supply	change in demand	Producer prices
AUS	0.0000	0.0189	0.0151	0.0151	0.0189
BGD	0.0000	0.0165	0.0132	0.0132	0.0165
BEN	0.0000	0.0155	0.0124	0.0124	0.0155
BRA	0.0000	0.0152	0.0122	0.0122	0.0152
BFA	0.0000	0.0159	0.0127	0.0127	0.0159
TCD	0.0000	0.0330	0.0264	0.0264	0.0330
CHN	0.0000	0.0105	0.0084	0.0084	0.0105
CIV	0.0000	0.0266	0.0213	0.0213	0.0266
EGY	0.0000	0.0256	0.0205	0.0205	0.0256
EUN	0.0000	0.1532	-0.5324	-0.5324	-0.6655
IND	0.0000	0.0103	0.0082	0.0082	0.0103
IRN	0.0000	0.0075	0.0060	0.0060	0.0075
KOR	0.0000	0.0284	0.0227	0.0227	0.0284
MLI	0.0000	0.0220	0.0176	0.0176	0.0220
MEX	0.0000	0.0233	0.0186	0.0186	0.0233
NGA	0.0000	0.0077	0.0062	0.0062	0.0077
PAK	0.0000	0.0109	0.0087	0.0087	0.0109
RUS	0.0000	0.0353	0.0282	0.0282	0.0353
SYR	0.0000	0.0085	0.0068	0.0068	0.0085
TUR	0.0000	0.0331	0.0265	0.0265	0.0331
USA	0.0000	0.0474	-0.0974	-0.0974	-0.1218
UZB	0.0000	0.0166	0.0133	0.0133	0.0166
VNM	0.0000	0.0343	0.0274	0.0274	0.0343
ZWE	0.0000	0.0258	0.0206	0.0206	0.0258
ROW	0.0000	0.0247	0.0198	0.0198	0.0247

Appendix 4 - Table 2. Simulation 1 – Trade at world prices – change in values

		Destination																							
		AUS	BGD	BEN	BRA	BFA	TCD	CHN	CIV	EGY	EUN	IND	IRN	KOR	MLI	MEX	NGA	PAK	RUS	SYR	TUR	USA	UZB	VNM	ZWE	ROW
Origin	AUS	0.0	0.0	0.0	0.0	0.0	0.0	-2624.2	0.0	0.0	691.9	-68.1	0.0	2880.7	0.0	0.0	0.0	-171.7	0.0	0.0	121.3	0.0	0.0	356.4	0.0	14209.2
	BGD	0.0	145.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.7	-1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	BEN	0.0	13.8	67.1	67.6	0.0	0.0	-125.4	0.0	0.0	1420.1	-145.9	0.0	36.8	0.0	0.0	-7.9	-5.3	0.0	0.0	286.2	0.0	0.0	528.6	0.0	2061.2
	BRA	0.0	16.6	0.0	15954.1	0.0	0.0	-15.6	0.0	7.0	2304.5	0.0	0.0	6668.2	0.0	0.0	0.0	-62.8	0.0	0.0	1582.0	0.0	0.0	948.4	0.0	14393.6
	BFA	0.0	58.9	0.0	58.4	0.0	0.0	-489.0	0.0	0.0	1816.2	-193.1	0.0	0.0	0.0	0.0	0.0	-30.2	0.0	0.0	628.6	0.0	0.0	0.0	0.0	6058.0
	TCD	0.0	-261.8	0.0	0.0	0.0	0.0	-553.5	0.0	0.0	4641.4	-57.2	0.0	9.8	0.0	0.0	0.0	-228.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118.4
	CHN	0.0	25.4	0.0	0.0	0.0	0.0	221077.7	0.0	22.1	50.5	11.8	0.0	10.4	0.0	0.0	0.0	8.9	0.0	0.0	0.0	0.2	0.0	514.3	0.0	810.3
	CIV	0.0	-11.9	0.0	-87.6	0.0	0.0	-703.7	0.0	0.0	2545.7	-113.8	0.0	0.0	0.0	0.0	0.0	-67.6	0.0	0.0	22.9	0.0	0.0	737.1	0.0	633.6
	EGY	0.0	-62.3	0.0	-253.8	0.0	0.0	-931.2	0.0	10749.4	6759.2	-3443.9	0.0	376.1	0.0	60.5	0.0	-1159.8	0.0	0.0	1340.8	370.0	0.0	0.0	0.0	432.1
	EUN	0.0	-2652.6	0.0	0.0	0.0	0.0	-1448.4	0.0	-14288.9	-98816.9	-1300.1	0.0	-4547.2	-487.8	0.0	0.0	-15013.8	-153.3	0.0	-64969.6	-2.5	0.0	-17405.6	0.0	-26137.0
	IND	0.0	8833.2	0.0	0.0	0.0	0.0	16995.3	0.0	0.0	2835.7	28447.7	0.0	983.5	0.0	0.0	0.0	4438.1	2.0	0.0	17900.2	30.8	0.0	5820.7	0.0	18899.1
	IRN	0.0	558.2	0.0	0.0	0.0	0.0	33.4	0.0	188.0	38.7	4.7	328.5	0.0	0.0	0.0	0.0	64.9	0.0	0.0	9.5	0.0	0.0	329.7	0.0	204.1
	KOR	0.0	-44.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	245.4	0.0	2.4
	MLI	0.0	-131.3	0.0	-156.8	0.0	0.0	-908.9	0.0	0.0	4528.1	-112.7	0.0	0.0	0.0	0.0	0.0	-720.1	0.0	0.0	132.2	0.0	0.0	1772.2	0.0	2890.5
	MEX	0.0	0.0	0.0	0.0	0.0	0.0	-1210.2	0.0	0.0	57.6	0.0	0.0	17.3	0.0	6838.4	0.0	-77.1	0.0	0.0	0.0	0.0	0.0	410.9	0.0	1008.3
	NGA	0.0	368.2	0.0	0.0	0.0	0.0	70.5	0.0	0.0	304.3	2.3	0.0	0.0	0.0	0.0	449.0	258.4	0.0	0.0	22.3	0.0	0.0	525.9	0.0	366.2
	PAK	0.0	781.2	0.0	0.0	0.0	0.0	40.3	0.0	767.3	4483.9	2.2	0.0	3.7	507.9	0.0	0.0	35570.7	1.6	0.0	0.0	123.3	0.0	251.4	0.0	1230.2
	RUS	0.0	-14.9	0.0	0.0	0.0	0.0	0.0	0.0	630.6	346.2	0.0	0.0	0.0	0.0	0.0	0.0	-50.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
	SYR	0.0	65.0	0.0	0.0	0.0	0.0	76.2	0.0	1105.1	864.0	0.0	0.0	52.2	0.0	0.0	0.0	6.5	0.0	1049.9	731.3	0.0	0.0	15.0	0.0	1327.5
	TUR	0.0	-132.7	0.0	-2.7	0.0	0.0	-600.3	0.0	38.2	6367.9	-185.7	0.0	0.0	0.0	0.0	0.0	-432.7	-34.9	0.0	51513.5	286.4	0.0	3.2	0.0	29.6
	USA	0.0	-5932.3	0.0	-5770.1	0.0	0.0	-220073.6	0.0	5.3	6114.5	-12775.5	0.0	-6015.8	0.0	-15783.4	0.0	-22251.5	0.0	0.0	-1318.9	21996.7	0.0	625.5	0.0	-52951.0
	UZB	0.0	6996.4	0.0	3.4	0.0	0.0	-1876.7	0.0	950.0	15723.2	-12.2	0.0	1923.4	0.0	0.0	0.0	-142.5	2838.6	0.0	5450.2	0.0	1312.5	411.7	0.0	6011.3
	VNM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	966.5	0.0	0.0
	ZWE	0.0	-110.8	0.0	0.0	0.0	0.0	-577.1	0.0	0.0	3056.2	-7.4	0.0	339.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.1	2380.5
	ROW	0.0	-2338.3	0.0	-1054.3	0.0	0.0	-5037.3	0.0	849.2	38468.9	-1622.9	0.0	134.4	0.0	0.0	-0.2	-2130.6	-651.6	0.0	12019.7	6.3	0.0	4998.6	7.1	34624.6

Appendix 4 - Table 3. Simulation 1 - Summary of Effects

	Welfare					Other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
AUS	8546.0	0.0	0.0	0.0	8546.0	0.00%	1.5%	1.89%	1.89%
BGD	165.1	-17836.9	0.0	0.0	-17671.8	1.86%	1.3%	1.65%	1.65%
BEN	2330.0	-172.4	0.0	0.0	2157.6	1.55%	1.2%	1.55%	1.55%
BRA	23274.6	-21685.5	-623.9	-7640.0	-6674.8	1.70%	1.2%	1.52%	1.52%
BFA	4390.1	0.0	0.0	0.0	4390.1	0.00%	1.3%	1.59%	1.59%
TCD	2034.9	0.0	0.0	0.0	2034.9	0.00%	2.6%	3.30%	3.30%
CHN	123829.1	-236006.5	-15416.3	-10621.0	-138214.6	1.52%	0.8%	1.05%	1.05%
CIV	1639.6	0.0	0.0	0.0	1639.6	1.05%	2.1%	2.66%	2.66%
EGY	7900.7	-8230.7	0.0	0.0	-330.0	4.48%	2.0%	2.56%	2.56%
EUN	-262007.4	-53890.5	0.0	380900.7	65002.8	6.87%	-53.2%	-66.55%	15.32%
IND	58530.0	-48391.9	-130.0	0.0	10008.1	1.15%	0.8%	1.03%	1.03%
IRN	977.4	-832.5	0.0	0.0	144.9	0.75%	0.6%	0.75%	0.75%
KOR	124.4	-10124.4	0.0	0.0	-10000.0	3.28%	2.3%	2.84%	2.84%
MLI	4047.9	-313.1	1.0	0.0	3735.8	9.03%	1.8%	2.20%	2.20%
MEX	3919.0	-24942.0	4.2	-276.9	-21295.7	4.30%	1.9%	2.33%	2.33%
NGA	1314.6	-1117.0	-0.4	0.0	197.3	0.77%	0.6%	0.77%	0.77%
PAK	24354.3	-42929.5	-1888.4	0.0	-20463.6	1.50%	0.9%	1.09%	1.09%
RUS	505.6	-5314.1	0.0	0.0	-4808.4	2.16%	2.8%	3.53%	3.53%
SYR	2939.3	-2665.3	0.0	0.0	274.0	0.85%	0.7%	0.85%	0.85%
TUR	31743.4	-94348.8	0.0	-26996.5	-89601.9	4.32%	2.6%	3.31%	3.31%
USA	-665978.0	-62581.6	100.2	928557.8	200098.4	4.73%	-9.7%	-12.18%	4.74%
UZB	21977.8	-3382.0	0.0	0.0	18595.8	1.66%	1.3%	1.66%	1.66%
VNM	536.1	-12568.6	0.0	0.0	-12032.5	4.52%	2.7%	3.43%	3.43%
ZWE	2834.8	-89.9	0.2	0.0	2745.1	2.56%	2.1%	2.58%	2.58%
ROW	43438.1	-91749.0	0.0	0.0	-48310.9	3.17%	2.0%	2.47%	2.47%

Appendix 4 - Table 4. Simulation 2 – Core model solutions

		MARKET CLEARING CONDITIONS Relative price changes				
		bench-mark prices	**new prices**	**change in supply**	**change in demand**	**Producer prices**
Origin	AUS	0.0000	0.0337	0.0270	0.0270	0.0337
	BGD	0.0000	0.0269	0.0216	0.0216	0.0269
	BEN	0.0000	0.0301	0.0240	0.0240	0.0301
	BRA	0.0000	0.0809	-0.0933	-0.0933	-0.1167
	BFA	0.0000	0.0304	0.0243	0.0243	0.0304
	TCD	0.0000	0.0486	0.0389	0.0389	0.0486
	CHN	0.0000	0.0303	-0.0151	-0.0151	-0.0189
	CIV	0.0000	0.0428	0.0342	0.0342	0.0428
	EGY	0.0000	0.0400	0.0320	0.0320	0.0400
	EUN	0.0000	0.1790	-0.5264	-0.5264	-0.6581
	IND	0.0000	0.0195	0.0156	0.0156	0.0195
	IRN	0.0000	0.0120	0.0096	0.0096	0.0120
	KOR	0.0000	0.0412	0.0330	0.0330	0.0412
	MLI	0.0000	0.0375	0.0300	0.0300	0.0375
	MEX	0.0000	0.0415	0.0005	0.0005	0.0006
	NGA	0.0000	0.0124	0.0099	0.0099	0.0124
	PAK	0.0000	0.0182	0.0146	0.0146	0.0182
	RUS	0.0000	0.0481	0.0385	0.0385	0.0481
	SYR	0.0000	0.0140	0.0112	0.0112	0.0140
	TUR	0.0000	0.1513	-0.3163	-0.3163	-0.3954
	USA	0.0000	0.0662	-0.0848	-0.0848	-0.1060
	UZB	0.0000	0.0296	0.0236	0.0236	0.0296
	VNM	0.0000	0.0481	0.0385	0.0385	0.0481
	ZWE	0.0000	0.0414	0.0331	0.0331	0.0414
	ROW	0.0000	0.0419	0.0336	0.0336	0.0419

Appendix 4 - Table 5. Simulation 2 – Trade at world prices – change in values

		Destination																							
		AUS	BGD	BEN	BRA	BFA	TCD	CHN	CIV	EGY	EUN	IND	IRN	KOR	MLI	MEX	NGA	PAK	RUS	SYR	TUR	USA	UZB	VNM	ZWE	ROW
Origin	AUS	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	849.6	-118.8	0.0	5895.7	0.0	0.0	0.0	-383.8	0.0	0.0	338.2	0.0	0.0	420.0	0.0	20689.7
	BGD	0.0	292.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	198.3	-1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
	BEN	0.0	13.1	127.2	1181.4	0.0	0.0	1249.7	0.0	0.0	1733.6	-346.4	0.0	69.6	0.0	0.0	-18.9	-50.5	0.0	0.0	746.6	0.0	0.0	619.1	0.0	2873.9
	BRA	0.0	-163.6	0.0	14518.2	0.0	0.0	-7078.1	0.0	-3.4	818.3	0.0	0.0	-4712.9	0.0	0.0	0.0	-14919.9	0.0	0.0	1574.5	0.0	0.0	-369.5	0.0	-19942.8
	BFA	0.0	57.0	0.0	1157.5	0.0	0.0	2201.0	0.0	0.0	2222.5	-426.7	0.0	0.0	0.0	0.0	0.0	-175.5	0.0	0.0	1653.7	0.0	0.0	0.0	0.0	8524.3
	TCD	0.0	-295.7	0.0	0.0	0.0	0.0	-469.3	0.0	0.0	5944.1	-73.9	0.0	68.0	0.0	0.0	0.0	-303.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	567.2
	CHN	0.0	11.4	0.0	0.0	0.0	0.0	171054.1	0.0	21.1	57.0	-62.8	0.0	15.7	0.0	0.0	0.0	-10.4	0.0	0.0	0.0	0.2	0.0	524.9	0.0	893.7
	CIV	0.0	-15.8	0.0	465.7	0.0	0.0	-566.0	0.0	0.0	3143.0	-165.4	0.0	0.0	0.0	0.0	0.0	-104.5	0.0	0.0	77.5	0.0	0.0	865.7	0.0	1083.5
	EGY	0.0	-65.7	0.0	1646.3	0.0	0.0	-568.8	0.0	12258.9	8548.3	-4650.5	0.0	1039.8	0.0	73.0	0.0	-1651.6	0.0	0.0	4505.0	466.6	0.0	0.0	0.0	790.6
	EUN	0.0	-2969.5	0.0	0.0	0.0	0.0	-1570.5	0.0	-15942.9	-101727.6	-1487.6	0.0	-4460.3	-567.5	0.0	0.0	-17196.2	-168.5	0.0	-43917.6	-2.7	0.0	-19024.4	0.0	-27922.7
	IND	0.0	13493.4	0.0	0.0	0.0	0.0	51190.5	0.0	0.0	3637.7	42551.5	0.0	1886.5	0.0	0.0	0.0	5473.3	3.3	0.0	45123.2	39.9	0.0	7478.6	0.0	28949.2
	IRN	0.0	987.3	0.0	0.0	0.0	0.0	95.7	0.0	247.5	51.6	10.5	526.3	0.0	0.0	0.0	0.0	114.5	0.0	0.0	24.0	0.0	0.0	452.1	0.0	335.1
	KOR	0.0	-37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	330.9	0.0	5.9
	MLI	0.0	-226.2	0.0	2226.1	0.0	0.0	-498.1	0.0	0.0	5569.0	-177.4	0.0	0.0	0.0	0.0	0.0	-1279.9	0.0	0.0	395.2	0.0	0.0	2084.4	0.0	4391.8
	MEX	0.0	0.0	0.0	0.0	0.0	0.0	-1180.6	0.0	0.0	68.1	0.0	0.0	36.9	0.0	6441.5	0.0	-155.2	0.0	0.0	0.0	0.0	0.0	442.3	0.0	1336.5
	NGA	0.0	652.0	0.0	0.0	0.0	0.0	204.9	0.0	0.0	405.7	5.1	0.0	0.0	0.0	0.0	726.3	456.6	0.0	0.0	56.4	0.0	0.0	720.4	0.0	601.1
	PAK	0.0	1376.2	0.0	0.0	0.0	0.0	151.2	0.0	979.2	5886.4	7.6	0.0	7.4	581.3	0.0	0.0	61749.5	2.9	0.0	0.0	165.6	0.0	336.0	0.0	1996.2
	RUS	0.0	-13.8	0.0	0.0	0.0	0.0	0.0	0.0	847.5	471.9	0.0	0.0	0.0	0.0	0.0	0.0	-57.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2
	SYR	0.0	113.8	0.0	0.0	0.0	0.0	228.7	0.0	1437.2	1145.1	0.0	0.0	103.5	0.0	0.0	0.0	11.3	0.0	1727.1	1853.6	0.0	0.0	20.3	0.0	2162.0
	TUR	0.0	-1389.4	0.0	-14.4	0.0	0.0	-4501.0	0.0	-239.4	-9032.0	-1306.8	0.0	0.0	0.0	0.0	0.0	-3448.6	-467.0	0.0	-176389.2	-1424.8	0.0	-18.7	0.0	-2100.1
	USA	0.0	-7108.5	0.0	3647.2	0.0	0.0	-227088.3	0.0	-1.8	7945.8	-16343.9	0.0	691.7	0.0	-20015.9	0.0	-28854.1	0.0	0.0	158072.8	31875.0	0.0	887.9	0.0	-42860.3
	UZB	0.0	9735.5	0.0	94.6	0.0	0.0	5226.7	0.0	1095.6	19683.0	-20.3	0.0	3899.1	0.0	0.0	0.0	-379.5	4666.5	0.0	14821.4	0.0	2284.0	505.0	0.0	9076.8
	VNM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1363.0	0.0	0.9
	ZWE	0.0	-141.0	0.0	0.0	0.0	0.0	-421.3	0.0	0.0	3797.5	-10.6	0.0	909.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.0	4073.1
	ROW	0.0	-4024.9	0.0	7551.3	0.0	0.0	-4408.8	0.0	865.4	46395.5	-2608.4	0.0	318.3	0.0	0.0	-0.4	-3756.9	-707.8	0.0	37802.6	7.3	0.0	5596.1	7.0	50866.9

Appendix 4 - Table 6. Simulation 2 - Summary of Effects

	Welfare					Other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
AUS	15362.1	0.0	0.0	0.0	15362.1	0.00%	2.7%	3.37%	3.37%
BGD	271.3	-30571.0	0.0	0.0	-30299.7	3.17%	2.2%	2.69%	2.69%
BEN	4548.8	-336.1	0.0	0.0	4212.6	3.01%	2.4%	3.01%	3.01%
BRA	-164426.0	-100564.2	1556.8	276998.3	13564.8	7.76%	-9.3%	-11.67%	8.09%
BFA	8440.8	0.0	0.0	0.0	8440.8	0.00%	2.4%	3.04%	3.04%
TCD	3014.2	0.0	0.0	0.0	3014.2	0.00%	3.9%	4.86%	4.86%
CHN	-219581.5	-534539.4	-13273.2	560694.1	-206699.9	3.40%	-1.5%	-1.89%	3.03%
CIV	2652.7	0.0	0.0	0.0	2652.6	3.03%	3.4%	4.28%	4.28%
EGY	12418.2	-11219.8	0.0	0.0	1198.4	6.07%	3.2%	4.00%	4.00%
EUN	-260117.0	-73635.1	0.0	380900.7	47148.6	9.32%	-52.6%	-65.81%	17.90%
IND	111348.5	-89164.4	-148.8	0.0	22035.4	2.11%	1.6%	1.95%	1.95%
IRN	1579.5	-1344.7	0.0	0.0	234.8	1.20%	1.0%	1.20%	1.20%
KOR	181.4	-19400.6	0.0	0.0	-19219.2	6.24%	3.3%	4.12%	4.12%
MLI	6924.7	-376.2	0.7	0.0	6549.3	10.79%	3.0%	3.75%	3.75%
MEX	102.4	-36215.5	5.1	6530.6	-29577.4	6.17%	0.0%	0.06%	4.15%
NGA	2125.8	-1806.8	-1.0	0.0	318.0	1.24%	1.0%	1.24%	1.24%
PAK	40802.9	-72720.1	-3333.6	0.0	-35250.8	2.53%	1.5%	1.82%	1.82%
RUS	693.2	-9259.3	0.0	0.0	-8566.1	3.74%	3.9%	4.81%	4.81%
SYR	4887.3	-4429.3	0.0	0.0	458.1	1.40%	1.1%	1.40%	1.40%
TUR	-283838.6	-227283.2	0.0	446909.5	-64212.3	10.24%	-31.6%	-39.54%	15.13%
USA	-583554.6	-88384.8	-92.0	928557.8	256526.4	6.64%	-8.5%	-10.60%	6.62%
UZB	39220.4	-6027.7	0.0	0.0	33192.7	2.96%	2.4%	2.96%	2.96%
VNM	756.2	-17721.8	0.0	0.0	-16965.7	6.35%	3.8%	4.81%	4.81%
ZWE	4577.4	-146.2	0.2	0.0	4431.3	4.15%	3.3%	4.14%	4.14%
ROW	74254.6	-150424.2	0.0	0.0	-76169.6	5.17%	3.4%	4.19%	4.19%

Appendix 4 - Table 7. Simulation 3 – Core model solutions

MARKET CLEARING CONDITIONS Relative price changes						
		bench-mark prices	**new prices**	**change in supply**	**change in demand**	**Producer prices**
Origin	AUS	0.0000	0.0604	0.0484	0.0484	0.0604
	BGD	0.0000	0.0425	0.0340	0.0340	0.0425
	BEN	0.0000	0.0635	0.0508	0.0508	0.0635
	BRA	0.0000	0.0847	-0.0909	-0.0909	-0.1136
	BFA	0.0000	0.0631	0.0505	0.0505	0.0631
	TCD	0.0000	0.0686	0.0549	0.0549	0.0686
	CHN	0.0000	0.0148	-0.0269	-0.0269	-0.0337
	CIV	0.0000	0.0682	0.0546	0.0546	0.0682
	EGY	0.0000	0.0615	0.0492	0.0492	0.0615
	EUN	0.0000	0.1992	-0.5218	-0.5218	-0.6522
	IND	0.0000	0.0388	0.0310	0.0310	0.0388
	IRN	0.0000	0.0199	0.0159	0.0159	0.0199
	KOR	0.0000	0.0572	0.0458	0.0458	0.0572
	MLI	0.0000	0.0641	0.0513	0.0513	0.0641
	MEX	0.0000	0.0640	0.0177	0.0177	0.0222
	NGA	0.0000	0.0224	0.0179	0.0179	0.0224
	PAK	0.0000	0.0092	0.0074	0.0074	0.0092
	RUS	0.0000	0.0637	0.0510	0.0510	0.0637
	SYR	0.0000	0.0195	0.0156	0.0156	0.0195
	TUR	0.0000	0.1699	-0.3085	-0.3085	-0.3857
	USA	0.0000	0.0927	-0.0671	-0.0671	-0.0839
	UZB	0.0000	0.0518	0.0414	0.0414	0.0518
	VNM	0.0000	0.0643	0.0514	0.0514	0.0643
	ZWE	0.0000	0.0607	0.0485	0.0485	0.0607
	ROW	0.0000	0.0620	0.0496	0.0496	0.0620

Appendix 4 - Table 8. Simulation 3 – Trade at world prices – change in values

		Destination																							
		AUS	BGD	BEN	BRA	BFA	TCD	CHN	CIV	EGY	EUN	IND	IRN	KOR	MLI	MEX	NGA	PAK	RUS	SYR	TUR	USA	UZB	VNM	ZWE	ROW
Origin	AUS	0.0	0.0	0.0	0.0	0.0	0.0	24826.8	0.0	0.0	808.0	-191.7	0.0	5019.5	0.0	0.0	0.0	586.4	0.0	0.0	332.5	0.0	0.0	384.1	0.0	18410.8
	BGD	0.0	557.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	218.5	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
	BEN	0.0	-20.9	254.8	2736.0	0.0	0.0	10906.8	0.0	0.0	1494.7	-964.6	0.0	47.9	0.0	0.0	27.5	104.7	0.0	0.0	675.4	0.0	0.0	464.4	0.0	1857.0
	BRA	0.0	-99.8	0.0	-21316.4	0.0	0.0	1686.3	0.0	0.4	1570.1	0.0	0.0	1241.9	0.0	0.0	0.0	-2791.6	0.0	0.0	2630.9	0.0	0.0	200.8	0.0	-4097.6
	BFA	0.0	-91.9	0.0	2701.3	0.0	0.0	21116.1	0.0	0.0	1935.6	-1123.7	0.0	0.0	0.0	0.0	0.0	356.1	0.0	0.0	1508.8	0.0	0.0	0.0	0.0	5700.9
	TCD	0.0	-259.7	0.0	0.0	0.0	0.0	848.9	0.0	0.0	6248.5	-75.6	0.0	72.2	0.0	0.0	0.0	65.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	850.2
	CHN	0.0	109.6	0.0	0.0	0.0	0.0	-151409.9	0.0	41.9	85.7	208.1	0.0	30.5	0.0	0.0	0.0	111.8	0.0	0.0	0.0	0.9	0.0	1030.8	0.0	2211.5
	CIV	0.0	-23.0	0.0	1349.8	0.0	0.0	1714.2	0.0	0.0	3014.0	-214.3	0.0	0.0	0.0	0.0	0.0	32.4	0.0	0.0	77.1	0.0	0.0	797.5	0.0	961.8
	EGY	0.0	-59.4	0.0	4689.9	0.0	0.0	3055.4	0.0	12186.0	8772.0	-5122.5	0.0	1040.7	0.0	470.6	0.0	1335.9	0.0	0.0	4729.4	2688.6	0.0	0.0	0.0	919.8
	EUN	0.0	-3001.9	0.0	0.0	0.0	0.0	2446.5	0.0	-16270.2	-102691.7	-263.4	0.0	-4546.6	-583.1	0.0	0.0	-13615.5	-169.7	0.0	-43233.8	1.4	0.0	-19060.2	0.0	-27829.8
	IND	0.0	16431.7	0.0	0.0	0.0	0.0	198583.5	0.0	0.0	3826.5	58197.7	0.0	1992.9	0.0	0.0	0.0	32825.7	3.8	0.0	48157.9	155.2	0.0	8196.0	0.0	33172.4
	IRN	0.0	1634.3	0.0	0.0	0.0	0.0	319.3	0.0	310.1	60.3	23.6	860.8	0.0	0.0	0.0	0.0	451.5	0.0	0.0	28.1	0.0	0.0	577.5	0.0	460.5
	KOR	0.0	-3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	420.0	0.0	9.0
	MLI	0.0	-597.9	0.0	5906.1	0.0	0.0	4222.8	0.0	0.0	5274.3	-260.6	0.0	0.0	0.0	0.0	0.0	993.5	0.0	0.0	387.8	0.0	0.0	1880.9	0.0	3797.9
	MEX	0.0	0.0	0.0	0.0	0.0	0.0	4752.1	0.0	0.0	68.8	0.0	0.0	35.5	0.0	6877.0	0.0	90.9	0.0	0.0	0.0	0.0	0.0	458.7	0.0	1482.2
	NGA	0.0	1025.5	0.0	0.0	0.0	0.0	674.8	0.0	0.0	465.1	10.6	0.0	0.0	0.0	0.0	1238.5	1772.3	0.0	0.0	64.8	0.0	0.0	896.2	0.0	800.3
	PAK	0.0	3971.0	0.0	0.0	0.0	0.0	786.6	0.0	1577.0	8005.2	64.1	0.0	11.7	683.6	0.0	0.0	16826.6	6.9	0.0	0.0	690.0	0.0	542.9	0.0	3686.2
	RUS	0.0	-7.3	0.0	0.0	0.0	0.0	0.0	0.0	1110.0	534.9	0.0	0.0	0.0	0.0	0.0	0.0	24.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6
	SYR	0.0	208.7	0.0	0.0	0.0	0.0	843.4	0.0	1877.7	1370.1	0.0	0.0	134.4	0.0	0.0	0.0	52.9	0.0	2374.0	2214.3	0.0	0.0	27.0	0.0	3127.6
	TUR	0.0	-1379.2	0.0	4.7	0.0	0.0	-2672.4	0.0	-239.3	-8748.9	-1320.6	0.0	0.0	0.0	0.0	0.0	-2549.2	-461.2	0.0	-161847.7	1481.4	0.0	-18.2	0.0	-2037.9
	USA	0.0	-8364.8	0.0	19862.7	0.0	0.0	26914.3	0.0	-27.9	6965.0	-19308.7	0.0	-2465.0	0.0	-28032.4	0.0	-13010.3	0.0	0.0	149933.1	36655.5	0.0	-517.2	0.0	-57209.0
	UZB	0.0	9829.9	0.0	233.7	0.0	0.0	53662.3	0.0	1077.5	20009.3	-26.6	0.0	3856.2	0.0	0.0	0.0	1860.3	4927.1	0.0	15391.8	0.0	3861.3	525.6	0.0	9823.0
	VNM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1832.3	0.0	1.8
	ZWE	0.0	-85.4	0.0	0.0	0.0	0.0	1905.6	0.0	0.0	4027.7	-10.4	0.0	982.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	5377.6
	ROW	0.0	-2996.2	0.0	22366.9	0.0	0.0	17850.2	0.0	907.6	48650.2	-2665.1	0.0	334.9	0.0	0.0	0.3	2570.5	792.0	0.0	40428.3	44.5	0.0	6295.2	71.0	65052.1

Appendix 4 - Table 9. Simulation 3 - Summary of Effects

	Welfare					Other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
AUS	27802.9	0.0	0.0	0.0	27802.9	0.00%	4.8%	6.04%	6.04%
BGD	430.5	-50691.2	0.0	0.0	-50260.7	5.22%	3.4%	4.25%	4.25%
BEN	9741.8	-717.5	0.0	0.0	9024.3	6.35%	5.1%	6.35%	6.35%
BRA	-160370.4	-96517.0	-10645.5	276998.3	9465.4	7.46%	-9.1%	-11.36%	8.47%
BFA	17786.4	0.0	0.0	0.0	17786.4	0.00%	5.1%	6.31%	6.31%
TCD	4292.6	0.0	0.0	0.0	4292.6	0.00%	5.5%	6.86%	6.86%
CHN	-387500.8	-180877.3	-236816.1	560694.1	-244500.0	1.16%	-2.7%	-3.37%	1.48%
CIV	4270.5	0.0	-0.1	0.0	4270.5	-3.36%	5.5%	6.82%	6.82%
EGY	19230.0	-14873.9	0.0	0.0	4356.1	8.01%	4.9%	6.15%	6.15%
EUN	-258622.6	-90167.4	0.0	380900.7	32110.7	11.35%	-52.2%	-65.22%	19.92%
IND	224403.5	-172826.8	-192.8	0.0	51383.9	4.07%	3.1%	3.88%	3.88%
IRN	2623.2	-2231.5	0.0	0.0	391.7	1.99%	1.6%	1.99%	1.99%
KOR	253.3	-25599.3	0.0	0.0	-25346.0	8.18%	4.6%	5.72%	5.72%
MLI	11969.4	-213.6	-160.8	0.0	11595.1	6.21%	5.1%	6.41%	6.41%
MEX	3723.2	-52043.1	-73.8	6530.6	-41863.0	8.73%	1.8%	2.22%	6.40%
NGA	3856.3	-3262.0	-13.9	0.0	580.3	2.24%	1.8%	2.24%	2.24%
PAK	20502.4	-31802.8	-32425.4	0.0	-43725.8	1.11%	0.7%	0.92%	0.92%
RUS	923.3	-14524.5	0.0	0.0	-13601.2	5.84%	5.1%	6.37%	6.37%
SYR	6788.8	-6149.2	0.0	0.0	639.6	1.95%	1.6%	1.95%	1.95%
TUR	-278960.8	-277499.3	0.0	446909.5	-109550.6	12.42%	-30.9%	-38.57%	16.99%
USA	-465773.2	-123304.4	-1001.8	928557.8	338478.3	9.19%	-6.7%	-8.39%	9.27%
UZB	69305.6	-10628.5	0.0	0.0	58677.1	5.18%	4.1%	5.18%	5.18%
VNM	1016.1	-23809.8	0.0	0.0	-22793.7	8.47%	5.1%	6.43%	6.43%
ZWE	6766.0	-201.7	-13.0	0.0	6551.3	5.69%	4.9%	6.07%	6.07%
ROW	110648.1	-215945.1	0.0	0.0	-105297.0	7.38%	5.0%	6.20%	6.20%