The Impact of the Doha Round on Kenya

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POLICY RESEARCH and ANALYSIS

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Acknowledgments

The conclusions are those of the authors and do not necessarily represent the views of the Carnegie Endowment for International Peace, the United Nations Economic Commission for Africa, the United Nations Development Programme, or the Kenya Institute for Policy Research and Analysis.

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Overview

Kenya's economy faces significant challenges. As in the past, trade will be a major factor in the country's capacity to overcome them. Developing countries have actively participated in the World Trade Organization's Doha negotiations in contrast with the more passive role they played during the preceding Uruguay Round. The global financial crisis and its consequences make their participation more important than ever. By analyzing the impact of the Doha Round on Kenya, this study contributes to the larger debate about the role of trade liberalization in development. The study uses two dynamic computable general equilibrium models to analyze the effects of a Doha negotiation package that came close to being agreed in July 2008.

The study finds that Kenya will see gains in agricultural products and processed food, but losses in manufacturing and mining. Secondary effects suggest that the output of services will also increase. Compared to a no-Doha scenario, average annual total production will be 2.7 and 0.7 percent higher for processed food and agricultural activities, respectively; 2.1 percent lower for manufacturing and mining activities; and 0.2 percent higher for services. On the whole, the liberalization of trade in goods will boost Kenya's annual GDP by 0.2 percent compared to a world without Doha. If Kenya's Doha gains are to be realized, policy makers need to ensure that the negotiations result in a significant reduction of developed countries' subsidies to agriculture and enough room to shelter selected manufacturing activities.

Doha would produce an overall positive impact on human development by:

- increasing the demand for low skilled workers—Kenya's most abundant resource—in rural and urban areas;
- reducing the incidence of poverty; and
- improving income distribution in rural areas.

On the downside:

- income distribution will worsen in urban settings; and
- the urban/rural income divide will deepen.

Doha's human development benefit to Kenya will be small, which underscores the need to accompany trade liberalization with strong human development policies that would further decrease poverty and improve income distribution.

The study also examines the adjustment costs of trade liberalization under Doha and suggests that the cost of foregone tariff revenue is likely to be moderate. However, production and employment costs are likely to be significant. The degree of adjustment in production might be equivalent to 4.5 percent for processed food activities; 2.5 percent in manufacturing and mining; and 0.8 percent in agriculture. In some activities, increases or decreases in output could be as large as 10 percent. The degree of job adjustment will be equivalent to 4.6 percent of total employment for unskilled workers, and close to 2 percent for skilled and semi-skilled workers. Consequently, the study suggests that Doha's trade liberalization should be complemented with adequately funded and well-targeted policies to compensate for the costs of adjustment.

A likely Doha Round scenario will lead Kenya to specialize even more greatly in agriculture and processed food. This is a positive step, as it will make use of Kenya's abundant low-skilled labor, but the country's long-term development cannot rest on these two activities alone. Kenya must aim to build comparative advantages in activities with higher value added if it wishes to support higher standards of living. In the context of the Doha negotiations, policy makers should seek to ensure a flexible enforcement of international trade provisions that are currently preventing countries from pursuing active sector-selective industrial policies, so that developing countries can preserve and increase their manufacturing capacities. In addition, domestic policies should aim to diversify Kenya's productive capacity toward higher-value-added activities.

The results also suggest that Kenya will be better off negotiating in concert with other African countries. Doha implies that Kenya's exports of agricultural products and processed foods will increase, but exports of manufacturing and mining goods will decrease. Simultaneously, imports of manufactured goods and processed foods will increase. These changes imply that Doha is likely to decrease the importance of Sub-Saharan African countries in Kenya's international trade. To the extent that trade facilitates broader regional development, Kenya should seek to negotiate in a bloc, both for its own sake and for that of other African countries.

The study shows that Doha's likely effects on Kenya will be significant, and that their scale will be linked, by and large, to the effectiveness of the negotiations. Policy makers must pay close attention to the process, as the consequences of non-participation would be harmful to key productive sectors and parts of the population. Negotiators need to ensure that the negative effects of a deal are neutralized or compensated for, and that the positive effects actually accrue to Kenya.

Introduction

As the first decade of the twenty-first century comes to an end, Kenya's economy is being confronted with a number of challenges that call for carefully crafted, well-informed policies. After fifteen years of stagnation—when the country witnessed zero increase in its gross domestic product (GDP) per capita and investment at levels below 20 percent of GDP—it has risen to become one of Africa's fast growing economies (see Arbache and Page 2008). Between 2004 and 2007, Kenya's economy showed signs of revitalization, and the average annual growth rate climbed above 5 percent, allowing Kenyans to finally enjoy an increase in GDP per capita.[1] However, the political turmoil of 2008 slowed growth, and the current global financial and economic crisis has made it difficult to return to high growth rates. Thus, Kenya now faces shrinking export markets, rising protectionist measures worldwide, and meager financial flows.

In spite of the additional obstacles that the current global crisis imposes on the growth of developing countries, trade will be an important factor in Kenya's economic recovery. Trade has played an important role in the country's economic performance, and it will continue to do so. When the Doha Round of multilateral trade negotiations resumes, it should involve new and fresh approaches to trade. The global crisis has made it clear that governments need to assist and complement markets. The successful completion of the Doha Round will depend on the inclusion of strong prodevelopment features in the final agreement. If Kenyan policy makers and negotiators have better information about how Kenya would be affected by this agreement, it will help them design a strategy to participate in the Doha talks more fruitfully in a way that is consistent with Kenya's development objectives. This study seeks to help provide this information.

The study makes detailed estimates of the impact of the Doha Round on the Kenyan economy, including its effects on trade, income, consumption, labor, distribution, and adjustment. To accomplish this task, the study uses a com-

putable general equilibrium model and a detailed data set organized in a social accounting matrix. The rest of this introductory chapter briefly reviews the main features of Kenya's economy and its recent performance, including the role of trade and international trade agreements. The next chapter begins by looking at some of the other studies that have used general equilibrium models to estimate the impact of Doha on the Sub-Saharan African countries. It then turns to the study's modeling strategy, which includes a global model and a country model, and discusses the main features of the database used with the model. The third chapter presents the results of our simulation. The fourth and final chapter offers conclusions and considers the policy implications of this study's findings.

The Economy of Kenya

Kenya's rapid economic growth during the first half of the 2000s rested on three pillars: higher investment rates, access to exports markets, and the burgeoning sectors of tourism and communication services. Between 2003 and 2006, investment rates increased steadily, reaching almost 22 percent of GDP. During the same period, there was a rapid expansion of exports of some manufactured goods, notably apparel exports to the United States, and agricultural products, mainly tea and horticulture. These years saw rapid modernization, including better communication services and a strong international demand for tourism services. The tourism sector, for example, benefited from a rising number of visitors, increasing from 1.6 million to 2 million visits per year between 2003 and 2007, which resulted in sizable contributions to the economy, on the order of 12 percent of GDP and 9 percent of wage employment (Ministry of Tourism data).

The 2007 political turmoil in Kenya and the current global financial crisis have weakened each one of these pillars. Returning to growth will require bold and well-executed policies. Investment flows will not only have to recover their high rates of the past, but they will also need to go even higher to overcome the 24 percent high mark of the 1980s and settle above the minimum recommended ratio of 25 percent.[2] Because foreign direct investment will most likely be weaker for the next several years, domestic sources will need to be mobilized. It is doubtful that Kenya can regain and sustain its 2000–2006 growth rates for manufactured exports. Questions about the sustainability of such rates are being raised even without considering the world economic crisis. Because the acceleration of manufactured exports coincided with a decrease in overall manufacturing investment and newly acquired preferential access to U.S. markets, particularly for textiles, the speed at which exports increased during these years rested on weak fundamentals and temporary conditions. The current crisis will most likely cause a decrease in international tourism for a number of years. Kenya will need to restore its image, and it will need to invest significant amounts of money to recover and expand its place in world tourism.

Like most African economies, the Kenyan economy is full of contrasts. Though the country has well-organized, export-oriented agricultural industries and tourist services, the majority of Kenyans live in rural areas and work in traditional agriculture and farm activities.[3] Thus, poverty reduction and the betterment of living standards greatly depend on the performance of the agricultural sector. After the nation gained its independence in 1963, its rising productivity in agriculture and the implementation of various trade and production promotion policies brought prosperity to its people, though not for very long. As the "independence bonus" faded, investment faltered, and the cost of inputs suffered from the oil-price shocks of the 1970s; the pace of the increase in productivity slowed in the second half of the 1970s and practically ceased in the early 2000s (see Pollin and others 2008). Within this overall context of stagnation, Kenya has nevertheless made significant inroads in world agricultural markets to become a prominent supplier of tea, cut flowers, and horticultural goods to European consumers.

The horticulture industry has grown rapidly during the past twenty years. In 1990, Kenya exported only $79 million in fruits and vegetables and $13 million in cut flowers; by 2006, it was exporting $322 million and $313 million, respectively. Most of these exports are destined for the European Union. The industry is a significant source of employment for rural farm laborers as well as urban workers employed in packaging, and it thereby contributes to poverty reduction.[4] The horticulture success story is particularly impressive considering the managerial skills and infrastructure that were rapidly developed to ensure on-time delivery and high-quality products.

Another export success story is tea. Exports of tea have sustained a strong pace for a number of years, driven not only by a natural comparative advantage but also by the institutions that Kenya has developed to foster the industry. In 1964, the Kenyan government founded the Kenya Tea Development Agency (KTDA) to assist small landholders with tea production. The KTDA, which was partially privatized in 2000, represents about 43,000 growers and covers several key functions. It provides seedlings, fertilizer, and credit; trains farmers; supervises cultivation, harvesting, and transportation; controls the quality of tea leaves; and facilitates information sharing among its various members (see Pollin and others 2008). Kenya is one of the world's leading tea exporters. In 2008, it sent almost 346 million kilograms of tea, 22 percent of the world's exports, to more than forty-five market destinations.

In contrast to these successes, the coffee industry has thus far not been able to reap the benefits of potential comparative advantages. After a brief period of booming exports, sales abroad have declined, as has productivity. This decline may be at least partially due to the notable absence of any national institution providing producer services and infrastructure for production comparable to that offered for tea by the KTDA. The contrasts between the two industries suggest that effective government intervention and insti-

tution building can facilitate productivity gains by enabling businesses to exploit returns to scale and by absorbing the initial costs of improving infrastructure to overcome such factors affecting productivity as agricultural stagnation, dependence on rainfall, and the associated risks of drought (see Pollin and others 2008).

Kenya has also sought to industrialize its economy, experimenting with various policies, but with mixed results. After independence, it made use of import substitution policies and succeeded in creating manufacturing capacity in various sectors. Starting in the mid-1980s, these policies were progressively replaced by export promotion and trade liberalization strategies. These strategies succeeded in capitalizing, modernizing, and increasing the exports of some manufactured goods, but they failed to maintain, let alone increase, the share of manufacturing in GDP (see Gertz 2008 and Mbithi 2008).

One should not, however, underestimate the achievements of Kenyan manufacturing in export markets. Under the preferences granted by regional trade agreements, most Kenyan exports of manufactured goods were traditionally sold to its trading partner countries, notably Uganda and Tanzania. However, since the enactment of the U.S. African Growth and Opportunity Act (AGOA), exports to these markets have been eclipsed by a strong increase in exports of textiles and apparel to the United States.[5] During the first years of the 2000s, Kenyan export-processing zones were supplying 10 percent of total manufactured exports, mostly in the textile and apparel sectors. However, this boom was short-lived and soon faced setbacks. The 2004 expiration of the Multi-Fiber Agreement, which had limited competition from China, negatively affected exports of these goods.

Finally, the contribution of the services sector to the Kenyan economy is significant, in terms of both employment creation and foreign exchange earnings (KIPPRA 2005). Transportation, tourism, and telecommunications services are the country's top three service exports, and financial insurance, transportation, and tourism are its top three service imports.

International Trade

An important factor in Kenya's development has been its interaction with various regional trading partners. The geography of its international trade varies significantly, depending on the type of good, and is closely associated with the presence of international trade agreements. It exports most of its agricultural products to the European Union and most of its manufactured goods to Sub-Saharan African countries, mainly to members of the Common Market for Eastern and Southern Africa. In 2007, its top five export markets were Uganda, the United Kingdom, Tanzania, the Netherlands, and the United States, which together accounted for 46 percent of its total exports. Its other important African trading partners include Sudan, Somalia, the

Democratic Republic of the Congo, Rwanda, Zambia, and Ethiopia, which together accounted for 28 percent of its total exports in 2007.

The bulk of Kenya's non-oil imports are manufactured goods. The three major countries of origin are India, China, and the United States, accounting together for one-third of non-oil exports. Kenya actively imports goods from other developing countries; South Africa and Indonesia account for one-third of its non-oil imports. Developed countries are significant suppliers of Kenyan imports, although their importance is dwindling. The United States, Japan, the United Kingdom, Germany, and France together account for another one-third of Kenya's non-oil imports. In contrast to the large role they play as recipients of Kenyan exports, the Sub-Saharan African countries produced less than a tenth of all Kenyan imports in 2007. The Sub-Saharan African nations make up eleven of the top twenty-five recipients of Kenyan exports; yet only three Sub-Saharan African countries—South Africa, Tanzania, and Uganda—rank among the twenty-five largest sources of imports to Kenya.

Trade diplomacy has been a key factor in shaping the structure of Kenya's international trade flows. The country has negotiated a number of regional trade agreements that have shaped its international trade. Kenya is a founding member of the World Trade Organization (WTO) and a signatory to the African, Caribbean, and Pacific–European Union (ACP-EU) Cotonou Partnership Agreement. It is also a beneficiary of the Generalized System of Preferences and the AGOA initiative of the United States. Regionally, Kenya is a member of the East Africa Community, the Common Market for Eastern and Southern Africa, the Intergovernmental Authority on Development, and the Cross-Border Initiative. Kenya has also signed a number of bilateral trade agreements. We now briefly describe these agreements.

The East Africa Community

The East Africa Community (EAC) was relaunched in 1999 by Kenya, Uganda, and Tanzania, with the aim of widening and deepening political, economic, and social cooperation among partner states. The EAC launched a customs union in January 2005, with a three-band common external tariff regime: 0 percent for capital goods and raw materials, 10 percent for semiprocessed goods, and 25 percent for finished products. Rwanda and Burundi formally joined the EAC in July 2007, bringing its size to 115 million people and a combined GDP of $40 billion. The EAC constitutes Kenya's single largest export destination, accounting for about 23 percent of its total exports (from the COMTRADE Database, 2008, available at http://comtrade.un.org).

The Common Market for Eastern and Southern Africa

The Common Market for Eastern and Southern Africa (COMESA; formerly the Preferential Trade Area for Eastern and Southern African States) was established in 1994. With a membership of twenty countries, a combined

population of about 400 million, and a GDP of $270 billion, COMESA is the largest trading bloc in Africa.[6] The COMESA Free Trade Area, launched in December 2000, has thirteen member states. In 2008, membership in the COMESA Free Trade Area was extended to the EAC and to the Southern African Development Community. Member states have agreed on a three-band tariff regime: 0 percent for raw materials and capital goods, 10 percent for intermediate products, and 25 percent for finished products.

The African, Caribbean, and Pacific–European Union Cotonou Partnership Agreement

The ACP-EU Cotonou Partnership Agreement (formerly the Lomé Convention) was signed in 2000. Intensive negotiations for comprehensive economic partnership agreements (EPAs) between the EU and ACP countries during 2007 concluded with the signatures of forty-eight African countries and thirty-one Caribbean and Pacific countries. Though most CP countries signed the EPAs, twenty-four African countries did not sign them. Moreover, the EPA with the CP countries is more far reaching than the EPAs signed with the African countries. The EPA may present some challenges to the ACP. For example, it might force countries to manage expected losses in fiscal revenue without proper assistance, it might increase competition under the principle of reciprocity, and it might impose market access constraints for agricultural and nonagricultural products.

The Intergovernmental Authority on Development

The Intergovernmental Authority on Drought and Development was formed in 1986 with an initial mandate of issues concerning droughts and desertification. In 1996, it was revitalized and renamed the Intergovernmental Authority on Development (IGAD), with a broader mandate of conflict management and resolution, humanitarian affairs, infrastructure development, food security, and the environment.[7] IGAD's member states have committed to implementing COMESA's trade cooperation measures.

The Cross-Border Initiative

The Cross-Border Initiative (CBI) was established in August 1993 among fourteen participating countries in Eastern and Southern Africa and the Indian Ocean region, and with four multilateral cosponsors—the International Monetary Fund, the World Bank, the European Union, and the African Development Bank. The CBI's common policy framework aims to facilitate cross-border economic activity by eliminating barriers to the flow of goods, services, labor, and capital. It also works to help integrate markets by coordinating reform programs in several key structural areas, supported by specific macroeconomic policies. Within the CBI, Kenya has indicated a desire to accelerate tariff reductions and to reduce the number of nonzero tariff bands to no more than three.

Bilateral Trade Agreements

Kenya has signed a number of bilateral trade agreements in pursuit of market access for its products. Its bilateral trading partners include Algeria, Argentina, Bangladesh, Belarus, Canada, China, Comoros, the Democratic Republic of the Congo, Cyprus, Djibouti, Eritrea, India, Iraq, Lesotho, Liberia, Malaysia, Mauritius, Nigeria, Pakistan, Russia, Rwanda, Saudi Arabia, Somalia, South Korea, Sudan, Swaziland, Tanzania, Thailand, Turkey, Ukraine, Zambia, and Zimbabwe. Some of Kenya's agreements with these nations have been reviewed in light of subsequent regional and multilateral trade commitments.

The African Growth and Opportunity Act

The AGOA, which was enacted in 2000 by the U.S. government, offers Sub-Saharan countries, including Kenya, unilateral access to the U.S. market. In 2002, AGOA exports constituted more than 77 percent of Kenya's total exports to the United States, with textiles and apparels as the dominant category (AGOA 2007). A July 2004 amendment to AGOA extends its preferential access until September 2015.

The Generalized System of Preferences

The Generalized System of Preferences (GSP) aims to promote economic growth in developing countries by granting tariff reductions (which might go as low as zero) that are better than most-favored-nation (MFN) rates for beneficiary countries. Currently, there are thirteen national GSP schemes. Kenya is a beneficiary of eleven GSP schemes, with Bulgaria, Canada, Estonia, the European Union member states, Japan, New Zealand, Norway, Russia, Switzerland, Turkey, and the United States.

Kenya's Development Challenges

Kenya has made significant progress in human development. It ranks among those countries at the medium level of human development and has a higher UN Human Development Index than most of its neighbors. The World Bank estimates that 20 percent of Kenyans survived with incomes lower than $1 a day in 2003. According to Kenyan official figures, 45.9 percent of the total population survives below the poverty line (Government of Kenya 2007). The national figure masks large regional variations. Although poverty indexes in the Rift Valley, Nairobi, and Central provinces range between 15 and 35 percent, the proportion of poor people in the Northeastern, Western, and Nyanza provinces is as high as 60 percent (Government of Kenya 2005). Incomes are lower in rural areas, and the incidence of poverty is correspondingly higher.

Income inequality is a persistent problem in Kenya. Despite attempts by the Kenyan government to address income disparities, the poorest 10 percent of the population receives only 2.5 percent of total income, while the top 10 percent receives 33.9 percent. In fact, in 2000 the top 10 percent received a larger portion of total income than did the bottom 60 percent of the distribution (Government of Kenya 2005).

Kenya's long-term economic stagnation has made progress in human development difficult, so meeting the UN Millennium Development Goals remains a challenging task. Halving the number of its people living in poverty, as well as achieving other targets and goals, will require continued growth and better-designed and -implemented policies. The extent of poverty is, of course, closely linked to labor conditions. Kenya's employment landscape is dominated by traditional agriculture and farming activities in rural areas, while informal chores are an abundant source of employment in urban areas. Unemployment is high, particularly among youth and women. Good jobs are mostly limited to urban areas in manufacturing activities, in some services, and in the government. Modern production units in rural areas provide some good jobs, yet most private sector urban workers still earn about twice as much as rural workers in the same job category (Zepeda 2007). The ability of development policies to eliminate poverty and promote human development hinges on their capacity to generate good employment opportunities.

Notes

1. GDP per capita grew at an annual rate of about 2 percent during these years, according to data from the World Bank (2008b).
2. See Commission on Growth and Development (2008), and Mbithi (2008) on Kenya's investment record.
3. Almost 80 percent of the population lives in rural areas and largely derives their livelihoods from agriculture. The agricultural sector absorbs about 60 percent of the labor force, contributes 60 percent of export earnings, and accounts for 41 percent of merchandise exports. In agriculture, smallholders and subsistence farmers play a key role, contributing 70 percent of market agricultural production.
4. See Dolan and Sutherland (2002); McCullock and Ota (2002); and Humphrey, McCulloch, and Ota (2004).
5. The AGOA allows duty-free and quota-free access to American markets in certain product lines to most Sub-Saharan African countries, including Kenya. Under this arrangement, apparel exports to the United States increased from $44 million to $277 million in just four years.
6. The COMESA member states are Angola, Burundi, Comoros, Djibouti, the Democratic Republic of the Congo, Egypt, Ethiopia, Eritrea, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Sudan, Seychelles, Swaziland, Uganda, Zambia, and Zimbabwe.
7. The members of IGAD are Djibouti, Ethiopia, Eritrea, Kenya, Somali, Sudan, and Uganda.

Modeling the Impact of the Doha Round

I n this chapter we discuss the methodology to estimate the impact of the Doha Round on Kenya. To simulate Kenya's economy, we use a computerized general equilibrium (CGE) model, which reproduces in a set of equations some of the most important relationships that make up an economy. Thus, this CGE model can serve as a powerful tool for assessing the impact of specific changes in policies and economic conditions. Such changes are introduced in CGE models as external shocks, that is, as changes that do not depend on the set of relationships that constitute the model. The results are computed by taking into account all the interactions established in the model and thereby correspond to a new equilibrium in the economy. Rather than forecasting what would happen in real time to an economy undertaking a specific change, a CGE model indicates what would happen to that economy if only the change in question occurred. In this study the policy change is a likely Doha Round negotiation package. In the remainder of this chapter, we first review studies using CGE models to analyze the effect of Doha on Sub-Saharan countries, then present the models used in the study, the Doha scenario, and the data.

CGE Models and Sub-Saharan Africa

Studies of trade agreements and the Doha Round trade negotiations frequently use CGE models and data from the Global Trade Analysis Project (GTAP) to quantify their potential effects. Several of these studies have modeled the global impact of potential Doha agreements on the Sub-Saharan African region as a whole and on individual African countries, but few have modeled the impact of trade agreements on Kenya. This omission has been largely due to data limitations.

Analyzing the impact of trade on the Sub-Saharan African countries poses particular challenges. Because these countries do not participate much in

global trade, their liberalization has only a small effect on the global economy. Nevertheless, trade liberalization in developed and large developing countries does have consequences for these countries. Also, studies looking at the implications of Doha for the Sub-Saharan African nations give conflicting results. Some estimates are positive, while others predict negative outcomes. The same studies, however, indicate that the impact of Doha on these countries' welfare, terms of trade, and exports is consistently small. The few studies that look at the implications of Doha for labor markets find small increases in employment and minor increases in wages. Not surprisingly, most studies report that Doha causes little or no change in poverty.

A World Bank study estimates separately the effects of a partial Doha agreement in only agriculture and of a full Doha agreement in both agricultural and nonagricultural products (Anderson, Martin, and Van der Mensbrugghe 2005b). With only agricultural liberalization, the rest of Sub-Saharan Africa experiences a slight increase in welfare of 0.02 percent. However, when sensitive and special product lines are not part of the agreement, the region's small welfare gain turns into a larger loss of 0.13 percent. When liberalization applies to both agricultural and nonagricultural products, the rest of Sub-Saharan Africa loses 0.02 percent. Only a more inclusive, full Doha agreement has a positive effect on the rest of Sub-Saharan Africa's welfare, increasing it by 0.13 percent.

However, both full Doha agreements bring about declines in the region's terms of trade, by 0.05 percent with the standard full Doha agreement and by 0.13 percent with the more inclusive agreement (Anderson, Martin, and Van der Mensbrugghe 2005a). Further, the 0.4 percent increase in agricultural exports associated with a standard Doha agreement is canceled out by a 0.4 percent decrease in exports of other merchandise, resulting in no net change in overall exports. Finally, most scenarios show no change in poverty; at best, poverty only decreases marginally in the most ambitious and least realistic scenario—a Doha agreement in which developing countries participate fully (Anderson, Martin, and Van der Mensbrugghe 2005b).[1]

A study by the UN Economic Commission for Africa uses a global dynamic general equilibrium model to examine the implications of possible outcomes from the ongoing agriculture negotiations on African economies in the Doha Round (Bchir and others 2007). The study attempts to capture some of the key modalities of the negotiations by designing scenarios that vary in the deepness of tariff cuts, the structuring of tariff tiers, and the definition of sensitive products by both developed and developing economies. The results suggest that Doha will increase the prices of agricultural products, particularly the prices of the most protected goods, such as cereals and sugar. The results also indicate that the increase in world prices will be much higher when export subsidies are totally eliminated. Because gains in this model depend on the capacity to take advantage of the new prices to increase production for domestic and export markets above the increase in

the import bill of agricultural and food products, the Sub-Saharan African countries win the most when negotiation scenarios feature ambitious coefficients in tariff formulas and limited allowances for sensitive products. In turn, because the capacity to increase production depends on the degree of integration of agriculture and processed food, countries with a diversified food sector benefit the most from ambitious reforms.

Another study by the UN Economic Commission for Africa looks at the impact of Doha, according to the 2008 negotiations, on poverty in a large group of African countries (Bchir and Chemingui 2008): Botswana, Egypt, Madagascar, Malawi, Morocco, Nigeria, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe. The results indicate that poverty might decrease slightly in most of these countries but might increase in Nigeria, Zambia, and Morocco. Such ambivalent outcomes underscore the need to assess the impact of Doha on a country-by-country basis. The study also takes into account various ways to compensate governments for the loss of tariff revenue due to trade liberalization and suggests that only when governments adopt less-stringent fiscal compensation schemes does the poverty impact of Doha become significant.

A study by the Centre d'Études Prospectives et d'Informations Internationales similarly finds that a realistic Doha agreement has negative or negligible effects on Sub-Saharan Africa as a whole (Decreux and Fontagne 2006). It estimates that the region's welfare would decline by 0.37 percent; that job creation in the farming sector, where many have predicted great benefits to trade for Sub-Saharan Africa, would be smaller than 2 percent; and that unskilled wages might rise by 1 percent. A more ambitious Doha agreement gives better, yet still very small, results. The region's welfare drops by 0.02 percent, and unskilled wages rise slightly, by more than 1 percent.

The least-developed countries (LDCs) are currently privy to some tariff reductions below MFN status, as offered by certain preferential agreements, such as the United States' AGOA and the EU's Everything But Arms initiative. These targeted tariff reductions give LDCs a competitive edge by allowing them to offer their goods at a relatively cheaper price than other nations whose goods are subjected to higher MFN tariff rates. Because any likely Doha agreement would lower MFN tariff rates closer to those currently offered in preferential agreements, the competitive edge granted by the preferential treatment to LDCs would be eroded. Indeed, Bouet, Fontagne, and Jean (2005) find that the positive impact of Doha in Sub-Saharan countries either decreases significantly or turns negative when the analysis takes into account the erosion of such preferences. In particular, welfare gains drop by 0.02 percent, gains in terms of trade fall from 0.17 to 0.03 percent, and the increase in exports drops from 0.61 to 0.08 percent. In the labor domain, the reduction of –0.01 percent in the wages of skilled workers worsens, to –0.05 percent, and the 0.15 percent increase in the wages of unskilled workers turns into a drop of –0.24 percent.

Modeling Doha

To simulate the impact of the Doha Round on Kenya's economy, we follow a two-step, top-down CGE modeling technique. This approach allows us to take into account both the global implications of Doha and the relevant details of the Kenyan economy. In the first step, we use a global model to estimate the impact of Doha on world prices and demand for the period 2009–2015. In the second step, we shock the economy with the changes in world prices resulting from the global model and with Kenya's own reductions in tariffs and use the country model to estimate the impact on Kenya's income, welfare, trade, and employment.[2] This procedure is consistent with the findings of several studies showing that most of the effects of the Doha Round on African countries come from changes in world prices. By following this two-step approach, we are able to examine the global implications of Doha and also take advantage of using detailed country information.

The Global Model and the Country Model

The global model, MIRAGE, is a recursive, dynamic CGE model. Using a sequence of static equilibrium states, the model links periods through dynamic variables such as population and labor growth, capital accumulation, and productivity (see the appendixes). It employs data from two sources: world data from the most recently released GTAP data set (version 6.0); and multilateral trade protection data, as defined at the Harmonized System at the 6-digit level (HS6), from MacMap. It features five factors of production: capital, land, natural resources, and skilled and unskilled labor; all are fully employed. Whereas capital, land, and skilled and unskilled labor are perfectly mobile across sectors within each region, natural resources are perfectly immobile. As is common among modern CGE models, MIRAGE employs the Armington Assumption, which features imperfect substitution between domestic products and foreign products, as well as between products coming from developing countries and those coming from developed countries.

CGE models must be simplified to adjust to data limitations and computability requirements. To facilitate computation and interpretation, the models need to aggregate some of the countries and/or sectors included in the global database. We choose to include as many sectors as possible (as opposed to including a large number of countries). Thus, the model uses data for twenty-eight sectors—thirteen in agriculture, four in processed food, nine in nonfood industries, and two in services—and for eleven countries (see table A.9 in appendix A). Because the available GTAP database, on which the global model is run, does not disaggregate data for Kenya, this choice of greater sector detail over country detail is a good estimation strategy for a two-step simulation of the impact of Doha on a small country. Opting for more sector prices and quantities demanded for a large number of countries provides a rich source of information for the second step of the

simulation—a choice that is superior to what would be obtained by choosing few sectors and many countries.

In the second step, we use the new world prices resulting from the global model and Kenya's committed tariff reductions under Doha to shock the Kenyan economy. The impact of these changes is estimated using the country model, which is an adapted version of the DIVA model to the characteristics of Kenya. DIVA is a recursive, dynamic, multisector model originally designed by Bchir and others (2007) to simulate trade for a single country carrying the characteristics of African economies. To generate a detailed baseline for the Kenyan economy, we employed the Kenya 2003 Social Accounting Matrix (SAM), constructed by the Kenya Institute for Public Policy Research and Analysis (KIPPRA) and the International Food Policy Research Institute (IFPRI), which describes all receipts and expenditures by all actors in the Kenyan economy for 2003 (for the details, see Kiringai, Thurlow, and Wanjala 2006). To overcome some of the limitations of this SAM, as developed by KIPPRA and IFPRI, we made a few changes to better serve our purposes (see the appendixes).

DIVA features separate urban and rural labor markets. To account for unemployment, the model assumes that all labor markets are not perfectly competitive. In the model, wages adjust to changes in macroeconomic variables. Households have two types of consumption—market consumption and self-consumption—to reflect the significance of subsistence livelihoods in Kenya. Though public investment is exogenous, private investment is endogenous and depends on the profitability of the sector, the degree of diversification of the economy, and the level of public investment. All activities in the model are assumed to operate in perfectly competitive markets. Similar to the global analysis, the country model also utilizes the Armington Assumption. Finally, in DIVA, the diversification of the economy renders productivity gains in agriculture and in the formal economy.

The Doha Scenario

Kenya has been an active participant of the Doha Round, and it became one of the key African actors in negotiations. This keen interest is consistent with the perception that any Doha agreement would affect its trade relations with both its developed and developing trading partners. The Doha Round negotiations have been lengthy and cumbersome. Changes in the governments of key country players and the world financial and economic crisis have blurred the outlook for negotiations. Though it remains apparent that disagreements have persisted as recently as mid-2009, it is also clear that the WTO's members have not abandoned the task of defining multilateral rules for international trade. It is, therefore, useful to simulate the impact of a plausible Doha outcome on Kenya.

The precise terms of such an agreement remain open. We have crafted a simulation that attempts to capture the main threads of the proposals under consideration during 2008 (WTO 2008a, 2008b). Our scenario covers changes to tariffs and subsidies in the agricultural and nonagricultural sectors. (As discussed below, we do not simulate the liberalization of trade in services.) An assessment of the proposals considered in the Doha negotiations as of July 2008 indicates that developed countries would reduce their applied tariffs for manufactured goods by 35 percent and that developing countries would reduce them by 25 percent, once allowed flexibilities are taken into account (WTO 2008a, 2008b). Our Doha scenario is broadly consistent with these findings, but it is much more detailed and provides more specific tariff reductions. The Doha scenario we use is based on the three pillars of agricultural liberalization—export subsidies, domestic support, and market access—and on the Non-Agricultural Market Access (NAMA) framework for nonagricultural goods.

The simulation of agricultural liberalization in the area of domestic support hinges on the accepted tiered formula, with subsidy cuts that represent the average of some of the most representative tabled positions, yielding cuts of 80, 70, or 55 percent, depending on region-specific thresholds, and cuts of 70, 60, or 45 percent, depending on regions (see tables A.1 and A.2 in appendix A). To simulate the liberalization of market access, we apply the accepted four-tiered formula, which defines tiers, tariff cuts, and caps to tariff cuts specific to developed and developing countries, while exempting LDCs from tariff reductions (see table A.3 in appendix A). The modeling of special and sensitive products, not subject to tariff cuts, assumes that between 5 and 7 percent of tariff lines can be designated as sensitive products by developed countries, and between 7 and 9 percent by developing countries. This procedure renders 0, 5, and 10 percent reductions, respectively, for tariff bands of 50, 25, and 25 percent pertaining to special products (see table A.4 in appendix A). Finally, the modeling of liberalization of export subsidies to agriculture simply assumes that these are eliminated in 2013, as agreed to at the Hong Kong WTO Ministerial Conference in December 2005.

The liberalization of nonagricultural products uses the *Swiss formula*, which ensures a narrow final range of tariffs regardless of the initial tariffs and determines a maximum final tariff rate. This formula has a key parameter, known as the *coefficient*, which determines the size of the resulting tariff cuts; a lower coefficient results in lower final tariffs. The coefficient is not the same for developed and developing countries. According to the Doha negotiations, the coefficient is set at a level of five for developed countries and a level of 25 for developing countries, while LDCs apply no cuts to unbound tariffs. The simulation also incorporates the interplay of binding coverage and tariff cuts and takes into account paragraph 8B of the Hong Kong Decision, whereby 5 percent of NAMA tariff lines are excluded from the formula cuts (see appendix A).

To implement the market access aspects of the Doha agriculture liberalization scenario described above, we use a methodology that incorporates the binding tariff overhang and the status of binding on the Harmonized System data at 6 digits of the MacMap. To address the *sensitivity criteria*, we apply the above provisions to binding tariffs and take the modeling of *export subsidies* directly from the MIRAGE model, which sets subsidies as equal to 0 at once in 2013 and thereafter. The modeling of *domestic support* mechanisms takes into account dynamic effects by linking the different fiscal instruments contained in the MIRAGE model to the amber, blue, and green boxes (see appendix A).

We do not include services in the simulation of trade liberalization. Some of the reasons for this exclusion have been discussed by Polaski (2006) and by Polaski and others (2008, 2009). First, there is little confidence in the data available to estimate protection in the services sectors. Second, CGE models are based on changes in prices and quantities demanded, but trade in services is regulated by a web of policies and measures that include, for instance, visa and temporary entry restrictions, regulations on investments, and financial services. These transactions cannot be effectively expressed as changes in prices and quantities. Nevertheless, we acknowledge that the liberalization of trade in services could have either positive or negative effects on multilateral trade agreements for some countries. The sizes of the gains or losses would depend on a host of factors, including the degree of liberalization and its modality, the sectors included, and the relevance of trade in services for a particular economy. It is unclear whether further liberalization of trade in services would benefit Kenya. Nor do we attempt to simulate trade facilitation. The reasons for not doing it are similar to those advising not to simulate the liberalization of services—the patchy state of data and its shaky quality, but also the difficulty in identifying the type of barriers defined as part of trade facilitation, estimating their cost to trading, and the assumptions made to finance them.

The Structure of the Kenyan Economy

The data used for the Kenya country model are organized in a social accounting matrix. SAMs are an assemblage of data that report all the economic transactions (flows of receipts and expenditures) made by all actors in the economy for a particular year, including the production sectors, groups of households, firms, government, and the foreign sector. Economic flows occur when actors buy or sell commodities for the purposes of consumption, intermediate use, investment, and the like, and when actors transfer commodities among them. The SAM we use corresponds to 2003. The SAM might differ from data reported in other official government sources, but its advantage is that it reconciles data originating from different sources. These data reveal an economy dominated by household consumption, representing more than three-quarters of GDP. There is a modest investment rate

Table 2.1 Macroeconomic Conditions for Kenya's Economy, 2003

Component	Kenyan Shillings	Percent of GDP
Consumption*	879,558	77.41
Exports	281,116	28.79
Imports***	416,892	42.69
Investment**	196,554	20.13
Government	218,359	22.36

Source: Kenya SAM.
* Consumption by households.
** This investment figure excludes the accumulation of stocks.
*** *World Development Indicators 2008* (World Bank 2008b) gives significantly smaller figures for exports and, particularly, imports, representing 24.0 and 28.4 percent of GDP, respectively.

and there is a moderate share of government expenditures, each accounting for about one-fifth of GDP. The production for export markets is almost 30 percent of GDP, underscoring the strategic importance of access to foreign markets. Import penetration is significant. According to the SAM, imports are almost 50 percent larger than exports and are equivalent to more than 40 percent of GDP. Such sizable import penetration indicates the need to strengthen domestic production (table 2.1). The large proportion represented by imports is the result of import-export manufacturing activities. The share of private investment is very low.

The services sector dominates the Kenyan economy, accounting for more than half of total output (table 2.2).[3] Within services, the most important activities are tourism and hotels, which account for almost 20 percent of total output. Next in importance are agriculture and manufacturing, each accounting for one-fifth of total production. Agricultural activities produce for both the domestic and export markets. The two most important crops are maize and tea, each accounting for about 7 percent of production (table 2.3). Though maize cultivation is almost entirely geared toward domestic consumption, with almost no imports, tea cultivation is primarily oriented toward export markets. Manufacturing represents about one-fifth of total production. One-half of the manufacturing output originates in processed

Table 2.2 Production by Sector, 2003

Sector	Millions of Kenyan Shillings	Percent
Agriculture	363,040	19.25
Processed food	160,171	8.49
Nonfood industries	255,497	13.55
Services	1,107,541	58.72

Source: Kenya SAM.

Table 2.3 Production of Top Nonservice Commodities, 2003

Commodity	Millions of Kenyan Shillings	Percentage of Nonservice Production
Maize	56,109	7.21
Tea	51,419	6.60
Meat and dairy processing	49,722	6.39
Beverages and tobacco	42,199	5.42
Milled grain products	41,333	5.31
Dairy products	35,019	4.50
Refined oil	35,432	4.50
Nonmetallic products	34,335	4.41
Vegetables	32,256	4.14
Oil seeds and pulses	30,710	3.94
Chemicals	23,369	3.00
Printing	19,474	2.50
Memo:		
Printing and publishing; petroleum and chemicals	72,133	9.26

Source: Kenya SAM.

food industries, underscoring the importance of agricultural production. The bulk of processed goods is associated with meat, diary, beverages and tobacco, and grain milling.

Manufacturing, other than processed food, is concentrated in nonmetallic products, metal products, machinery, and chemicals. This concentration reflects the relevance of Kenya's natural resources to its manufacturing activity. Because the mining sector only represents less than 0.5 percent of total output, the importance of Kenya's natural resources is mostly reflected in its manufacturing activity. Oil refining is an important economic activity, accounting for 4.5 percent of total output. It relies on imports of crude oil and neighboring markets for its sales. For purposes of consistency and proper modeling of the oil industry, the SAM we use aggregates three sectors of the KIPPRA-IFPRI original SAM: oil, chemicals, and printing and publishing. Together, these three account for almost 10 percent of total production (table 2.3).

Businesses in Kenya export agricultural commodities primarily to advanced economies, mainly in Europe, and manufactured commodities, primarily to Kenya's African neighbors. Tea is by far Kenya's most significant export, accounting for more than a fifth of total non-oil, nonservice exports (table 2.4). Exports of cut flowers have grown in recent years, climbing to almost 10 percent of total non-oil, nonservice exports. Again, the primary market for exports of cut flowers is the European Union. Although a lack of competitiveness has decreased coffee's importance as a share of Kenya's total exports, it still represents almost 6 percent of total exports. These three activities are almost fully geared toward export markets; together, they rep-

Table 2.4 Top Exported Agricultural Commodities, 2003

Commodity	Millions of Kenyan Shillings	Percent*
Tea	50,071	22.75
Cut flowers	21,667	9.85
Coffee	12,846	5.84
Oil seeds and pulses	8,523	3.87
Vegetables	8,323	3.78

Source: Kenya SAM.
* Percentage of non-oil, nonservice exports.

resent three-fourths of total foreign agriculture sales. Other important agricultural exports are oil seeds and vegetables.

Kenya's most important manufactured exports include processed foods and nonprocessed food goods. Exports of metal products, machinery and equipment, and chemicals are significant, each accounting for 7 percent of total exports. The metal products, machinery, and equipment industry is heavily geared toward export markets; these account for 60 percent of the industry's total sales. Conversely, the most important exports of processed food are meat and beverages and tobacco. These are domestic industries that also happen to be an important source for export markets. Finally, mining activities are almost fully oriented toward markets abroad; exports account for 96 percent of their total sales. However, the total sales of mined products are not very large compared with other activities (table 2.5).

Underscoring Kenya's incipient industrialization, most imports consist of manufactured goods, other than processed food, crude oil, and services. Three-quarters of Kenya's imports correspond to nonfood industry goods and oil, while services account for almost one-fifth of total imports. Two categories of manufactured goods, metal products and machines, and chemicals, account for more than half of the total import bill (table 2.6). The two

Table 2.5 Top Exported Manufactured Commodities, 2003

Commodity	Millions of Kenyan Shillings	Percent*
Metals, machinery, and equipment	15,924	7.24
Chemicals	15,878	7.21
Meat	15,325	6.96
Beverages and tobacco	13,425	6.10
Wood and paper	9,217	4.19

Source: Kenya SAM.
* Percentage of non-oil, nonservice exports.

Table 2.6 Top Imported Manufactured Commodities, 2003		
Commodity	Millions of Kenyan Shillings	Percent*
Metals and machines	74,045	27.81
Chemicals	72,201	27.12
Printing and publishing	10,913	4.10
Textile and clothing	9,271	3.48
Baked goods	3,991	1.50

Source: Kenya SAM.
* Percentage of non-oil, nonservice exports.

most significant agricultural imports are wheat and rice, two staples that are not part of the typical Kenyan diet; together, they represent about 5 percent of total imports. Imports of maize, the basic staple, are marginal (table 2.7).

In the SAM framework, labor is defined by occupational status—skilled, semiskilled, or unskilled. The skilled category includes professional and managerial workers; the semiskilled category comprises workers in clerical, technical, and manual occupations in nonagricultural activities; and the unskilled category captures all other occupations, including agricultural and elementary workers. Most agricultural employment is unskilled, with few semiskilled or skilled workers actually employed in this sector. The large majority of semiskilled and skilled workers are in the nonfood industries and services. Processed food activities employ few skilled workers (table 2.8). Informal employment, abundant in urban services and in subsistence agriculture, goes largely unrecorded in the SAM.

Mean wages by skill category reflect the presence of large disparities in the labor market (see Zepeda 2007). The mean wage of skilled workers is six times that of semiskilled workers, and this in turn is seven times the wage of unskilled workers. The wage gap between skilled and unskilled workers is

Table 2.7 Top Imported Agricultural Commodities, 2003		
Commodity	Millions of Kenyan Shillings	Percent*
Wheat	10,067	3.78
Rice	4,917	1.85
Sugarcane	2,223	0.84
Maize	838	0.31
Vegetables	494	0.19

Source: Kenya SAM.
* Percentage of non-oil, nonservice exports.

Table 2.8 Employment by Sector and the Skill Level of Labor (percent*), 2003			
Sector	Skilled Labor	Semiskilled Labor	Unskilled Labor
Agriculture	2.9	2.3	37.9
Processed food	3.3	1.6	7.6
Nonfood industries	17.9	10.4	7.2
Services	76.0	85.6	47.2

Source: Kenya SAM.
* Percent of total employment by skill level.

wide; the mean wage of skilled workers is forty times that of unskilled workers (table 2.9).

The SAM includes monetary income for twenty household groups, ten in rural areas and ten in urban areas. These income figures do not include those originating in informal activities. Nevertheless, the data show that income disparities are acute. The top 5 percent of the population, almost all urban households, accounts for about 40 percent of total income. The income per capita of urban residents is, as expected, higher than that of rural residents. According to the SAM data, the urban mean income is 42 percent higher than the rural mean income. The mean income of the five poorer rural deciles is higher than the corresponding figure for urban dwellers.[4] This relation is inverted when we compare the incomes of the upper half of the rural distribution with those of the corresponding segment of the urban distribution. Here, urban incomes are clearly higher, and the gap increases as we ascend the income ladder (figure 2.1).

Typical of a developing country, half of Kenya's government revenue is raised through sales taxes and only one-third through direct taxes (figure 2.2). Tariff revenue, in turn, contributes 10 percent to government revenue, suggesting that trade agreements resulting in lower tariff rates may force the government to dip into its foreign savings or to increase tax rates on other groups. This study explores several forms of tariff revenue replacement.

Table 2.9 Wage per Worker, by Skill Level, 2003	
Skill Level	Wage in Kenyan Shillings
Skilled	402,147
Semiskilled	65,045
Unskilled	9,206

Source: Kenya SAM.

Figure 2.1 Total Household Income by Deciles and Region, 2003

BILLIONS OF KSH
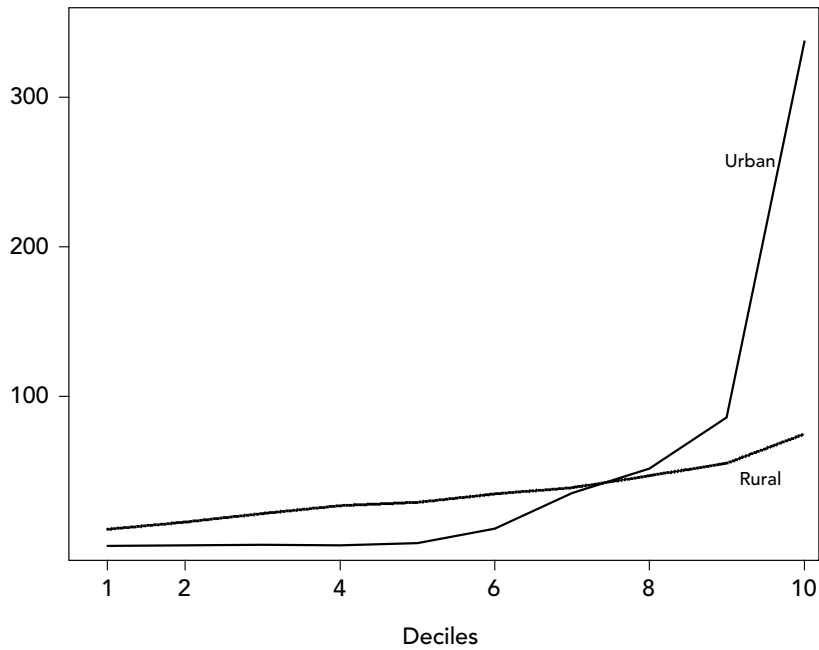
Source: Constructed based on data from the Kenya SAM.

Figure 2.2 The Composition of Government Revenue
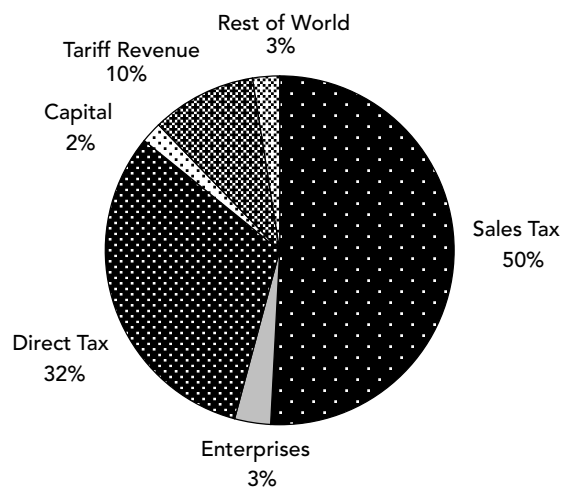
Source: Kenya SAM.

Notes

1. The proportion of the population living under $1 and $2 a day drops from 38.4 to 38.1 percent and from 69.2 to 68.9 percent, respectively.

2. Because our global modeling stops in 2015, we use the 2015 new world prices for 2016 to 2020.

3. The SAM represents the Kenyan economy in forty-three sectors. Of these, twenty-two are in agriculture, five are in the manufacturing of food, seven are in non-processed food industries, and nine are in service activities. Of the forty-three sectors, twenty-seven engage in trade and twenty-one in both exports and imports. Due to data limitations, our database includes a "hybrid" sector that comprises oil, chemicals, and wood.

4. Due to the need to reconcile household data with national accounts and the inability to handle informality, it is very likely that the SAM underestimates income at the lower end of the urban distribution, where informality is high. Data from the 1998–1999 Labour Force Survey, which served as the base for the 2003 SAM, indicate that rural incomes (including income from traditional and informal activities) are higher than urban incomes only for the poorest 10 percent of each area.

The Economic Impact
of the Doha Round

In this chapter we briefly present the results of the global model and discuss in detail the results of the country model. The discussion of the global model highlights the effects of the Doha Round on Sub-Saharan Africa and sets the context for the analysis of the country results. The discussion of the country model focuses on both the average impact and the timing of the effects; it covers the macroeconomic, sector, and activity dimensions of the economy; and it includes an analysis of the impact on trade, production, labor, income distribution, and the cost of adjustment.

The Impact on Sub-Saharan Africa: The Global Model

The results of our global simulation suggest that the Doha Round is likely to have a small positive impact on Sub-Saharan Africa. Given that our scenario for agricultural goods stops far from total liberalization and the fact that many Sub-Saharan African countries will not reduce tariffs, which might increase welfare, it is not surprising that Doha has only a small effect on GDP and welfare. The positive impact on GDP is initially very small, growing to 0.25 percent a few years later, and then decreasing again to 0.10 percent several years after the start of implementation (table 3.1). The positive impact on welfare is also small, increasing by 0.10 percent in the first year; in addition to being small, the positive impact is now limited to the first years. Six years after implementation, welfare decreases by 0.20 percent (table 3.2).

Despite the fact that we are simulating the removal of subsidies to agriculture in developed countries and are incorporating NAMA exemptions to LDCs, our simulation suggests that by 2016, developed countries increase their GDP and welfare while Sub-Saharan Africa experiences reductions in both.[1] These results contrast with earlier studies showing more favorable results for LDCs and developing countries. The difference in results can be

Table 3.1 The Impact of the Doha Round on Gross Domestic Product

PERCENT CHANGE

Region	2010	2011	2016
African countries			
North Africa	0.00	0.00	–0.07
Southern African Customs Union	0.01	–0.03	–0.23
Southern African Development Community	0.02	0.06	–0.14
Rest of Sub-Saharan Africa	0.04	0.25	0.09
Other developing countries			
China	–0.03	–0.15	–0.15
India	–0.10	–0.04	–0.21
Rest of developing countries	0.02	0.02	–0.10
Developed countries			
European Union (all current members)	–0.01	0.04	0.22
United States	–0.02	0.04	–1.00
Japan	–0.01	0.33	1.05
Rest of developed countries	0.00	0.28	0.62

Source: Authors' computation using the global model.

partly explained by the more realistic and detailed Doha scenario underlying our simulation. Because our simulation features modest commitments by developed countries in the areas of market access and domestic support and uses bound tariff rates instead of applied rates, the potential benefits that Doha could bring to the Sub-Saharan African countries are likely to be smaller than the results from other simulations.

Table 3.2 The Impact of the Doha Round on Welfare

PERCENT CHANGE

Region	2010	2011	2016
African countries			
North Africa	–0.03	–0.03	–0.26
Southern African Customs Union	0.01	–0.03	0.04
Southern African Development Community	0.01	0.02	–0.11
Rest of Sub-Saharan Africa	0.01	0.04	–0.18
Other developing countries			
China	–0.04	–0.12	–0.22
India	0.00	–0.01	–0.05
Rest of developing countries	0.00	–0.02	–0.19
Developed countries			
European Union (all current members)	–0.01	0.00	0.07
United States	0.00	0.01	0.16
Japan	–0.01	0.11	0.33
Rest of developed countries	–0.01	0.09	0.12

Source: Authors' computation using the global model.

Another important difference in the results might be explained by the way economies react to the change in incentives. The reduction of subsidies and domestic support to agricultural products reduces the production of these goods in developed countries and increases their production in developing countries and LDCs. Simultaneously, the reduction of tariffs on NAMA products benefits manufacturing activities in developed countries and some developing countries. The final effect of all these is a changed pattern of output and welfare that does not vary much between developed and developing countries, along with LDCs (see the first two columns of table 3.1). As economies continue to adjust to high agricultural prices, the extended use of land and technical progress push the prices of these goods down, leading to output and welfare losses in the developing world. By 2016, the picture is different; aided by further specialization in high-value-added activities, developed countries emerge as winners, while developing and African countries find themselves on the losing side (see the third column of table 3.1).

The Impact on Kenya: The Country Model

We now turn to our country model in order to probe how the Kenyan economy reacts to the new international prices resulting from the Doha Round and to Kenya's tariff reductions under Doha.[2] Liberalization begins in 2010, with the reduction of tariffs and domestic support to agriculture phased in over four years. Then, in 2013, we introduce the elimination of export subsidies to agriculture by developed countries as a single event. Although no shock or change is introduced after 2015, the modeling continues until 2020 to account for further reallocations of resources.

This series of shocks increases the world prices of agricultural commodities and processed food by about 0.7 percent, on average, and the prices of products of nonfood industries by 0.01 percent, a very small change. These shocks also lead to a fall in the price of services of –0.06 percent, on average. A number of agricultural and processed food commodities experience price increases larger than 1 percent; among these, we single out the increases in the prices of meat and beef, which between 2013 and 2015 rise on average by more than 2 percent (see tables A.11 and A.12 in appendix A). The changes in these prices will turn out to be relevant to Kenya. The price changes are fed into the model, along with Kenya's own tariff reductions. According to exemptions, Kenya only needs to reduce tariffs on oil seeds (from 13.1 to 9.5 percent), mined products (from 10.8 to 6.0 percent), and milled grain products (from 113.8 to 19.6 percent). These reductions are gradually entered into the model between 2010 and 2012 (see table A.7 in appendix A).

We present the model's results in two forms. To give an overall view of the impact of Doha, we choose to look at average changes. These are estimated by taking the across-years average values of the baseline and Doha sce-

Table 3.3 The Change in Macroeconomic Indicators

PERCENT*

Indicator	Change
Consumption	2.29
Exports	3.73
Gross domestic product	0.18
Imports	2.46
Investment	1.41
Terms of trade	2.54

Source: Authors' computation using the country model.
Note: This table presents results using the foreign savings closure. All the subsequent tables and figures always refer to the results of the foreign savings closure.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline, all at constant prices.

narios and comparing them on a percentage basis. Our Doha simulation liberalizes trade across time. It is therefore important to look at how the timings of the different Doha provisions affect the Kenyan economy. We thus look at the changes between the Doha and the baseline scenarios in each year and graphically display them as percentage changes.

Developing countries are rightly concerned about how to compensate for the loss of public revenues that follows a reduction of tariffs. Kenya is no exception. Our simulation deals with this issue in three ways. We first assume that taxes remain constant and that the revenue shortfall is covered by foreign savings, implying a constant ratio of the public deficit to GDP. Our second and third methods cover the shortfall with direct taxes in one case and indirect taxes in the other, but both assume that the ratio of the public deficit to GDP remains constant. In principle, the choice of either of these financing methods influences the impact of Doha on the economy. However, because Kenya's anticipated revenue loss is moderate, due to the limited tariff reductions the country is committed to undertake, the three model closures give similar results. The loss of revenue triggers an increase in foreign inflows on the order of 2 percent and increases in taxes of between 1.7 and 3.0 percent. These changes amount to less than 0.25 percent of GDP, so the choice of closure does not significantly change the results. Thus, for the sake of simplicity, we only discuss the simulation that assumes the entire revenue loss is covered by foreign savings.

The Impact on Trade and Welfare

Doha-induced liberation has the effect of increasing Kenya's trade. Averaged across years, annual exports are 4 percent higher and imports are 3 percent higher in the Doha scenario compared with the baseline scenario (table 3.3). Because lowering import tariffs decreases the price of Kenyan imports while reducing subsidies to agriculture increases the price of Kenyan exports,

Kenya is able to buy more imports with the same volume of exports. Doha thus brings an improvement in the terms at which Kenya trades.

The jump in exports and the improvement in the terms of trade partially explain the increase in Kenya's consumption, production, and welfare. The realignment of world prices and the change in domestic prices induced by Kenya's own tariff reductions create opportunities for investment; so as resources are reallocated, efficiency increases. However, gains are notably small.[3] Compared with the baseline, Doha causes annual consumption to rise by an average of 2.3 percent and investment by 1.4 percent. The increase in GDP is small, on the order of 0.2 percent. General equilibrium estimates of the impact of trade reforms usually render small changes, positive or negative, in welfare. However, the improvements that Doha brings to Kenya's economy are particularly small.

There are four main reasons why these results are so small. First, these figures are highly aggregated. They are the result of adding changes in different directions that sometimes offset each other. These very small results should not be taken as meaning that everything will basically remain the same in Kenya after Doha. In fact, in the section below on Doha's adjustment costs, we argue that Kenya is likely to face significant adjustments. Doha is a complex and comprehensive endeavor that should be analyzed in detail. Second, the results are small because Kenya is already an economy where tariffs are moderate and because it has been granted NAMA exemptions. Thus, the Kenyan economy does not face large "distortions" and will not change much as a result of Doha. Third, our detailed simulation for bound tariffs produces more muted results compared with the often-used procedure of simulating reductions on applied tariffs.[4] Fourth, to reflect the conditions of the Kenyan economy, our modeling strategy introduces unemployment and some rigidity in the mobility of factors. One consequence of this is that the effects are small compared with the results of models that, unrealistically, assume a greater degree of factor mobility.

The dynamic features of our model allow us to see the impact of Doha over time and to follow the sequence of liberalization. The effect of Doha on the Kenyan economy is spread unevenly over time. Doha results in minute changes in both exports and imports during the first four years of implementation; between 2010 and 2012, when exports and imports vary by about 0.5 percent relative to their level in the baseline scenario (figure 3.1). In contrast, the removal of export subsidies, which is assumed to take effect in 2013, produces a noticeable and immediate increase in trade in the same year the shock is introduced. Two factors help explain why the elimination of export subsidies has such a strong effect. First, actions supporting exports are likely to have a stronger impact on world prices than domestic support measures. Second, export subsidies are totally eliminated, compared to only a partial reduction in domestic support and tariffs. After 2013, when subsidies and the reduction in tariffs and domestic support have been completely eliminated,

Figure 3.1 The Impact of the Doha Round on Trade and Gross Domestic Product

PERCENT CHANGE
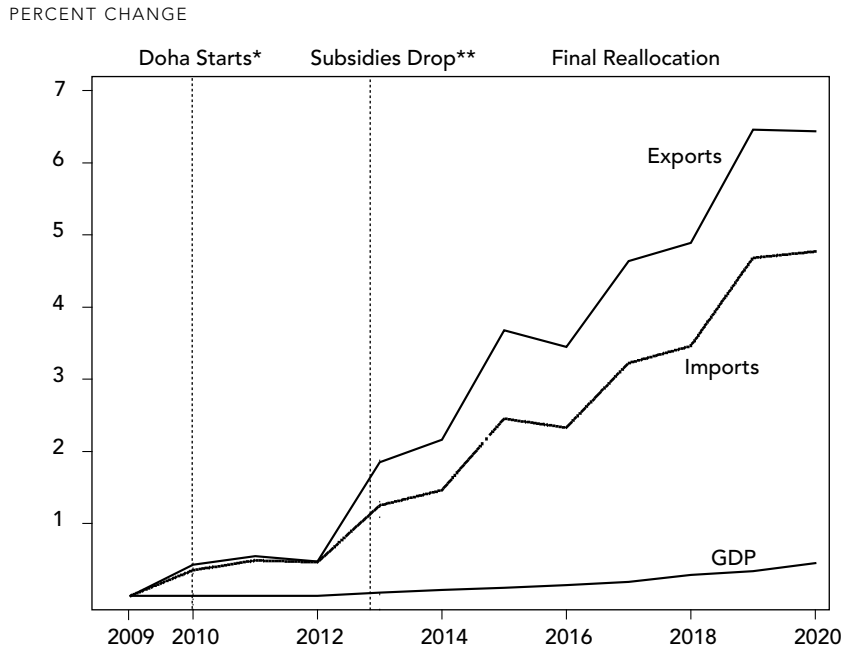
Source: Constructed based on the results of the country model.

the dynamic repercussions of these shocks and the further reallocation of resources amplify the impact of the Doha Round on the economy. By 2020, exports and imports are almost 7 and 5 percent higher, respectively, compared with a no-Doha scenario.

The impact of Doha on the terms of trade also follows a clear time sequence. The initial tariff reductions pull the prices of imports down and generate a gain in terms of trade of 1.5 percent by 2012 (figure 3.2). The 2013 removal of export subsidies to agriculture initially takes the improvement in the terms of trade to a local maximum. After this, the terms of trade remain at a relatively high level for few years. In subsequent years, as Kenyan producers react to the change in prices and investment flows in, the improvement in the terms of trade regains its rising trend. By 2020, the Kenyan terms of trade are more than 2.5 percent better compared with what they would have been in the absence of Doha. Such an improvement in the terms of trade brings a welcome welfare increase to Kenya.

Because Kenya will not significantly change the level of protection of its domestic economy, the impact of Doha on GDP is small when compared with its impact on exports and imports (see figure 3.1). Nevertheless, the changes in trade and GDP follow similar patterns across time. Doha produces no visible gain in GDP between 2010 and 2012, and only after 2013

Figure 3.2 The Impact of the Doha Round on the Terms of Trade

DIFFERENCE OF THE EXPORT TO IMPORT PRICE RATIO (%)
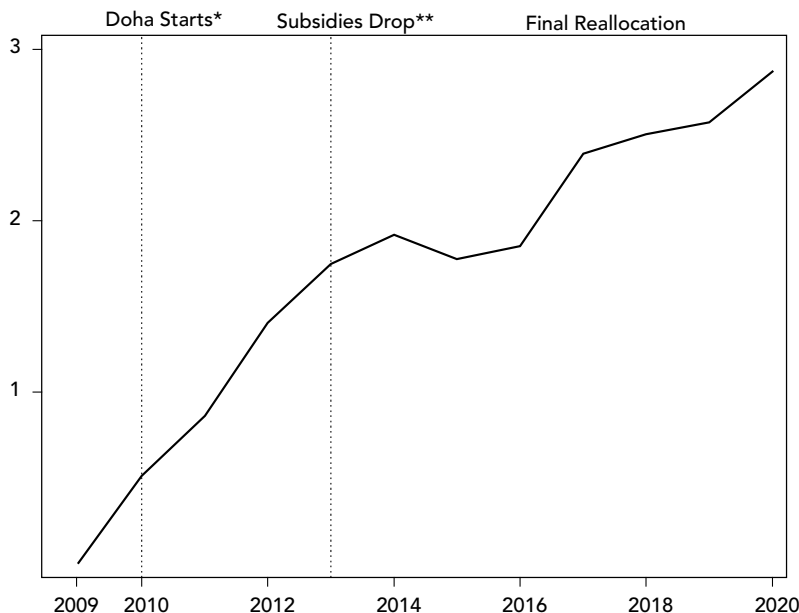
Source: Constructed based on the results of the country model.
Note: The change in the terms of trade is estimated as the log difference between the ratio of prices of exports over imports in the Doha scenario and the baseline, keeping the volumes of exports and imports constant.

does the positive impact on GDP become noticeable, as shown in figure 3.3. Then, the economic opportunities opened to Kenya through the 2013 reduction of subsidies result in larger GDP figures each year, particularly during the final years. Yet the positive impact of Doha on GDP is always small; the highest increase in GDP, which occurs in 2020, is 0.5 percent.

Figure 3.3 also makes apparent that the positive effects on consumption and investment are both important factors in the rise of GDP. It also shows that the pace at which investment increases relative to the baseline is stronger during the last four years. In general, one should expect sharper effects once all reforms have been implemented and the use of production factors is better aligned with the structure of comparative advantages. This is particularly true in the case of Kenya. Because Kenya's comparative advantages might lie in agriculture and processed food products, and because the relevant liberalization measures come later on, changes in investment will be expected to be more prominent toward the end of the simulation period.

The Impact on Sectors

Further insights into the impact of the Doha Round on the Kenyan economy can be gained by shifting the attention from national aggregates to changes

Figure 3.3 The Impact of the Doha Round on Gross Domestic Product

PERCENT CHANGE
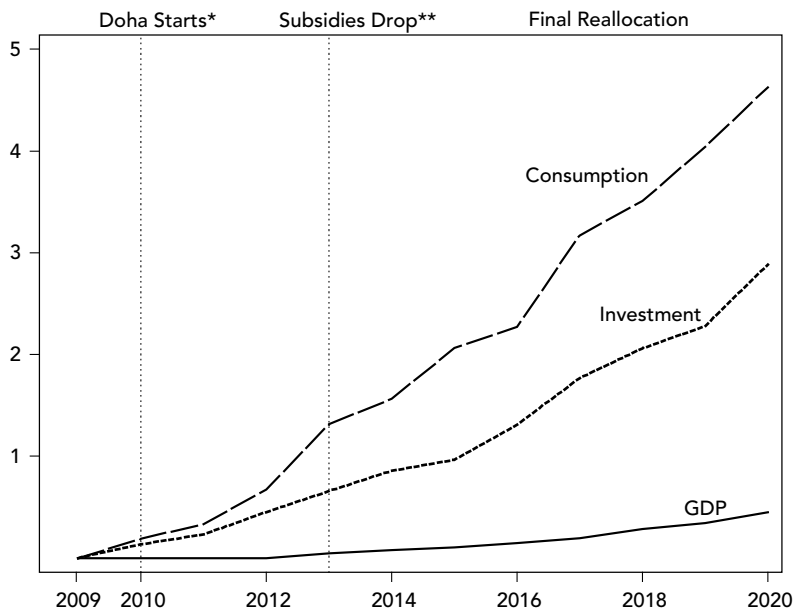
Source: Constructed based on the results of the country model.

by sector of activity. The most direct impact of Doha falls on businesses whose activities involve international trade, such as the exporters of goods or importers of inputs; then on those businesses making products that compete with imported goods; and, finally, on the consumers of imported goods. Subsequently, all businesses and consumers react to these initial changes, and further adjustments take place in the production and consumption of goods and services.

The impact of Doha on the economic activity of Kenya is primarily felt in the agriculture and processed food sectors (table 3.4). On average, the Doha scenario increases annual agricultural output by 0.7 percent, relative to the baseline scenario. This small increase results from the combined effect of larger export and smaller import volumes, each on the order of 3.0 and –2.1 percent. The impact on processed food is larger, because total annual output increases by 2.7 percent over that of the baseline scenario. This increase in output can be partially attributed to a 13.4 percent increase in export volumes, relative to the annual average in the baseline scenario. However, the effect on production of such a strong increase in exports is partially neutralized by the similarly strong rise in imports of food. The simulated effect of Doha on processed food underscores Kenya's overall competitive advantage in processed food, but also makes apparent that the reduced protection of some of these industries will clearly increase imports.

Table 3.4 The Change in Demand, Exports, Imports, and Production by Commodity

PERCENT*

Sector	Demand	Exports	Imports	Production
Agriculture	–0.10	3.00	–2.10	0.70
Processed food	–0.70	13.40	23.90	2.70
Nonfood industries	–0.80	–4.10	1.30	–2.10
Services	0.40	–4.10	4.00	0.20
Total	2.50	0.20	0.14	0.56

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.

Next in importance is the effect on nonprocessed food industries. Doha lowers the output volume of this sector by –2.1 percent, relative to the baseline scenario. This reduction results from a combination of three main negative effects: (1) a reduction in Kenya's share of export markets for manufactured goods, as the lack competitiveness leads to a loss of markets; (2) an increase in imports of manufactured goods that now replace some of the domestic production that flourished under the protection of tariffs; and (3) a reduction in the demand for these products, reflecting the reallocation of resources to agriculture and processed food industries. Kenya also loses in the production of resource-based products. Driven by reductions in Kenyan tariffs and a more competitive world market, exports of mined goods decrease and imports increase. These changes result in a –10.3 percent fall in mining output, relative to the baseline scenario (see table B.3 in appendix B).

Even though we do not model the liberalization of trade in services, our simulation of Doha does bring changes to the services sector. Relative to the baseline, exports of services decrease, imports increase, and domestic demand also increases. As a result, the output of services experiences a small increase of 0.2 percent over its volume in the baseline scenario.

Doha affects a number of individual agriculture activities. Notably, the liberalization of trade induces increases in exports of oil seeds and coffee that lead to significant increases in the output of these activities, revealing a comparative advantage in these products[5] Although the effect of Doha on output is small, it is useful to look at its impact on maize, Kenya's main staple. The effects of the liberalization of trade confirm that Kenya possesses a comparative advantage in the production of maize; the pre-Doha small import volumes become smaller, while the small export volumes become larger, and the net effect is an increase of about 0.4 percent in output (table 3.5).[6] In general, Doha has a positive impact on Kenyan agricultural activities.

Table 3.5 The Change in Demand, Exports, Imports, and Production for Selected Agricultural Goods

PERCENT*

Good	Demand	Exports	Imports	Production
Oil seeds	−2.85	18.84	−1.47	2.10
Coffee	0.00	1.22	—	1.01
Maize	−0.41	81.55	−31.38	0.39

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.

Only in a few cases does Doha not favor Kenyan agriculture; rice is one, and barley and cotton are the other two.

The changes in Kenya's agriculture are particularly sensitive to the removal of export subsidies in developed countries. Looking at the timing of simulated changes on trade in key agriculture products reveals that, indeed, the changes either start or become stronger when the removal of export subsidies is introduced in 2013. For example, the production of cut flowers, fruit, and vegetables increases significantly only after 2013 (figures 3.4 and 3.5). The elimination of export subsidies does not directly affect the production of cut flowers, fruit, or vegetables; these products do not receive subsidies. However, the removal of subsidies to products such as wheat or maize and the ensuing increase in prices leads to a heightened competition for production factors among all agriculture activities, regardless of whether or not subsidies are removed to their products. As output increases in products benefiting from the withdrawal of subsidies in developed countries, production factors are used more intensively and returns to factors increase. As part of the increase in returns to factors, the incomes of farmers also increase, leading to increases in the output of products not directly related to the withdrawal of subsidies.

In some cases, the reduction of tariffs on agricultural goods is an important factor affecting production. Thus some agricultural products are also sensitive to the reduction of tariffs and domestic support of the first years. For example, this is the case for oil seeds. The start-up of Doha's implementation leads to an immediate increase in the world price of oil seeds. This improves the competitive position of Kenyan producers and leads to a continuous increase of exports and production over the entire simulation period (figure 3.5).

In the aggregate, Doha increases Kenya's agricultural output, but the magnitude of change varies with time. Though the increase is small during the first years, the changes become larger in 2013 and continue to enlarge thereafter. The initial Doha reductions of tariffs and domestic support do have an

Figure 3.4 The Impact of the Doha Round on Exports of Selected Agricultural Activities

PERCENT CHANGE
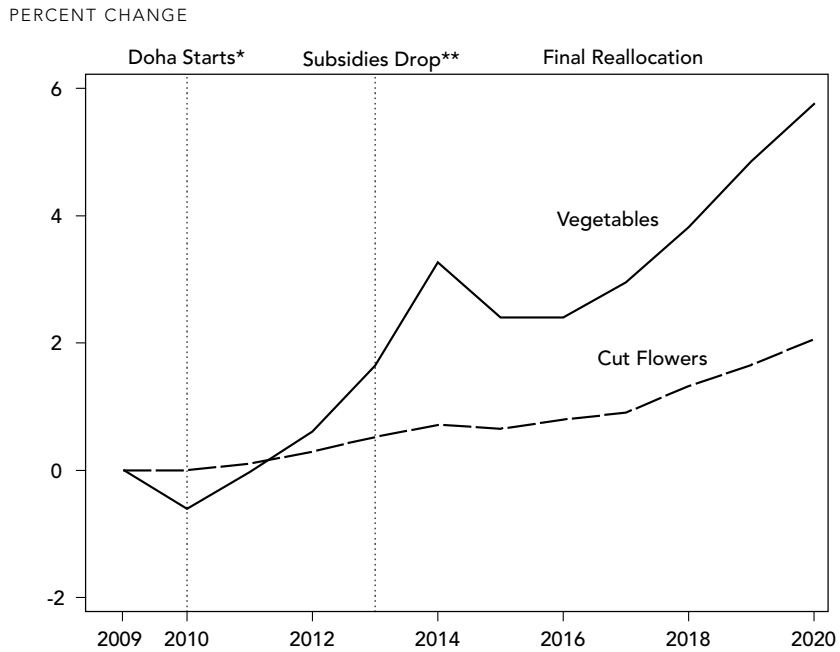
Source: Constructed based on the results of the country model.

Figure 3.5 The Impact of the Doha Round on Exports of Selected Agricultural Activities
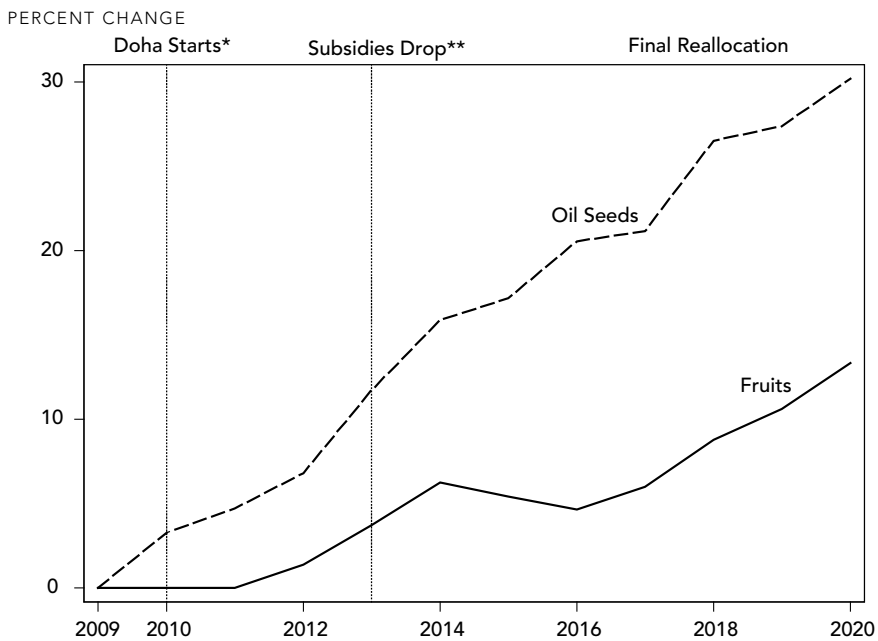
PERCENT CHANGE

Source: Constructed based on the results of the country model.

Figure 3.6 The Impact of the Doha Round on Kenya's Agriculture

PERCENT CHANGE
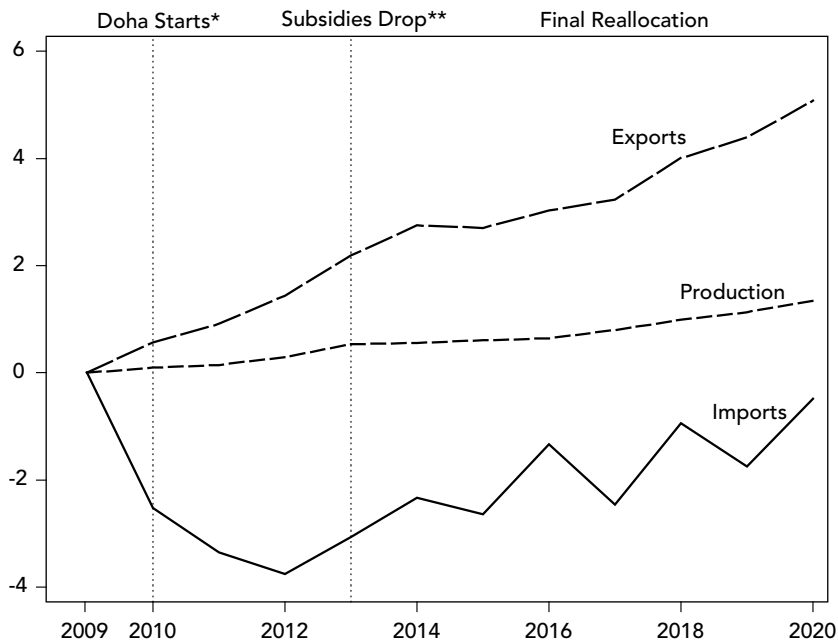
Source: Constructed based on the results of the country model.

impact on Kenya's trade. Exports increase by about 1 percent, and imports decrease by about 3 percent. The change in production that follows from these changes in trade is correspondingly small. The 2013 elimination of export subsidies, in turn, triggers larger increases in exports and somewhat smaller reductions in imports, resulting in larger increases in output. The further reallocation of resources after 2013 enlarges exports and shrinks imports even more. The timing of these changes suggests that the removal of export subsidies in developed countries constitutes a major driving force for the increase of production and the reallocation of resources to agriculture.[7] However, one should not lose sight of the fact that all these changes in production are small; at the height of the trend, in 2020, agricultural output in the Doha scenario is only 1.4 percent higher than that of the baseline.

To the extent that trade liberalization improves the competitive stance of Kenya's agriculture, its production of processed food also becomes more competitive, increasing exports and local sales. Our simulation indicates that Kenya's competitive position in baked goods and meat products improves noticeably, as evidenced by the reduction of imports and the increase of exports and production (table 3.6). Conversely, the simulation also reveals weaknesses in the ability of some of these industries to compete in more liberalized markets, as suggested by the increases in imports of beverages and tobacco, and of milled grains. If we net out the winning and losing sectors,

Table 3.6 The Change in Demand, Exports, Imports, and Production for Selected Processed Food Commodities

PERCENT*

Commodity	Demand	Exports	Imports	Production
Baked goods	2.43	18.60	−7.78	5.22
Meat and dairy processing	−0.61	26.46	−12.87	10.53
Beverages and tobacco	−0.02	−3.14	26.90	−1.13
Milled grain products	−4.27	—	442.91	−3.60

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.

the effect of Doha on the production of processed foods is positive, albeit somewhat small.

As expected, exports, imports, and the output of processed food are sensitive to the sequencing of Doha's trade liberalization. As in the case of agriculture, the changes only become significant after the 2013 removal of subsidies in developed countries. For example, the changes in exports, imports, and the production of baked goods and meat—which are activities associated with strongly subsidized goods and face market access problems—become very significant after 2013. The importance of the elimination of developed countries' export subsidies for these activities is made apparent in figures 3.7 and 3.8.

The effect on beverages and tobacco is more nuanced. These goods are protected by a 26 percent tariff that Doha gradually reduces to 18 percent. The producers of these goods export 30 percent of them, according to the SAM data, and up to 7 percent of domestic demand for them is satisfied by imports. The committed tariff reduction for these goods causes an increase in imports of more than 20 percent immediately after the start-up of implementation (figure 3.9). At the same time, as tariffs in other countries decrease, exports of these goods also increase. Because the impact on imports is larger, output decreases. The 2013 removal of export subsidies and the accumulated reallocation of resources result in a continued increase of imports and a continued decline of exports. By 2020, total output ends up being 2 percent smaller, compared with a no-Doha scenario, because resources have shifted to activities that can use them more efficiently.

The impact of the Doha Round on all food-processing activities shows an initial strong increase in imports, a small increase in exports, and a marginal reduction in output (figure 3.10), This suggests that the reduction of Kenya's tariffs does increase the imports of processed foods, but at a small cost to domestic production, and that the reduction of domestic support and world tariffs have a positive but moderate impact on Kenyan exports. The 2013

Figure 3.7 The Impact of the Doha Round on Exports, Imports, and the Production of Baked Goods

PERCENT CHANGE

Source: Constructed based on the results of the country model.

Figure 3.8 The Impact of the Doha Round on Exports, Imports, and the Production of Meat

PERCENT CHANGE
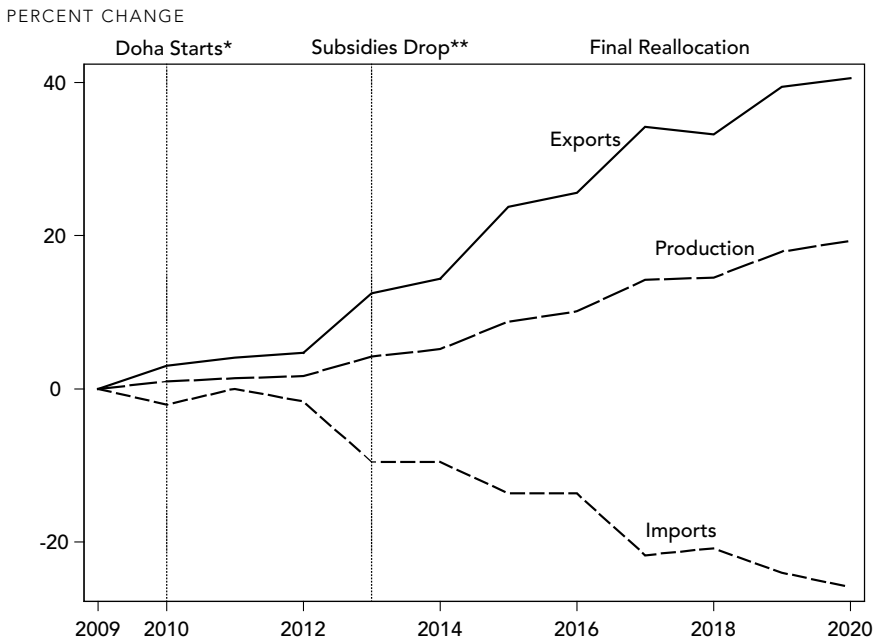
Source: Constructed based on the results of the country model.

Figure 3.9 The Impact of the Doha Round on Exports, Imports, and the Production of Beverages and Tobacco

PERCENT CHANGE
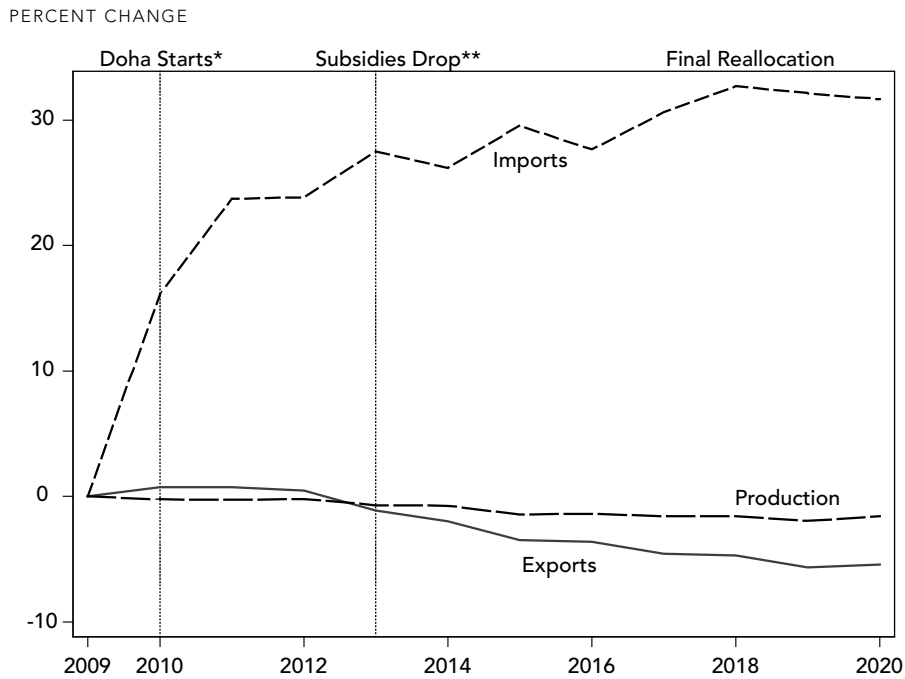
Source: Constructed based on the results of the country model.

elimination of export subsidies has an additional positive impact on exports while lessening the magnitude of the increase in imports of processed foods caused by Doha. Overall, the change in output tends to increase with time but remains moderate during the entire period.

The Doha NAMA provisions give preferences to LDCs. Although not an LDC, Kenya partially receives this treatment. In our simulation, such preferential treatment means that changes in Kenyan nonfood industries are mainly driven by the effect of Doha on world prices. The Doha-induced reduction of world prices for these goods and the second-round economic effects induce increases in imports of all nonfood industrial commodities, underscoring Kenya's weak competitive position in the domestic market for manufactured and mined goods. The most notorious of these increases is the 3.5 percent hike in imports of textiles (table 3.7). At the same time, the fall in world prices renders Kenyan manufacturing less competitive in international markets and causes a reduction in exports of all but one activity. Reductions are significant. At constant prices, exports of footwear and textiles fall, respectively, by –5.9 and –5.5 percent. These are goods that are primarily exported to developed countries under preferential access conditions. Exports of the "other" manufactured goods fall by –2.5 percent, but the extent of the fall of these goods is such that it accounts for half the total reduction of foreign revenue due to the fall in exports of manufactured

Figure 3.10 The Impact of the Doha Round on Kenya's Processed Food Industry

PERCENT CHANGE

Doha Starts*   Subsidies Drop**   Final Reallocation

Imports

Exports

Production

2009   2010   2012   2014   2016   2018   2020

Source: Constructed based on the results of the country model.
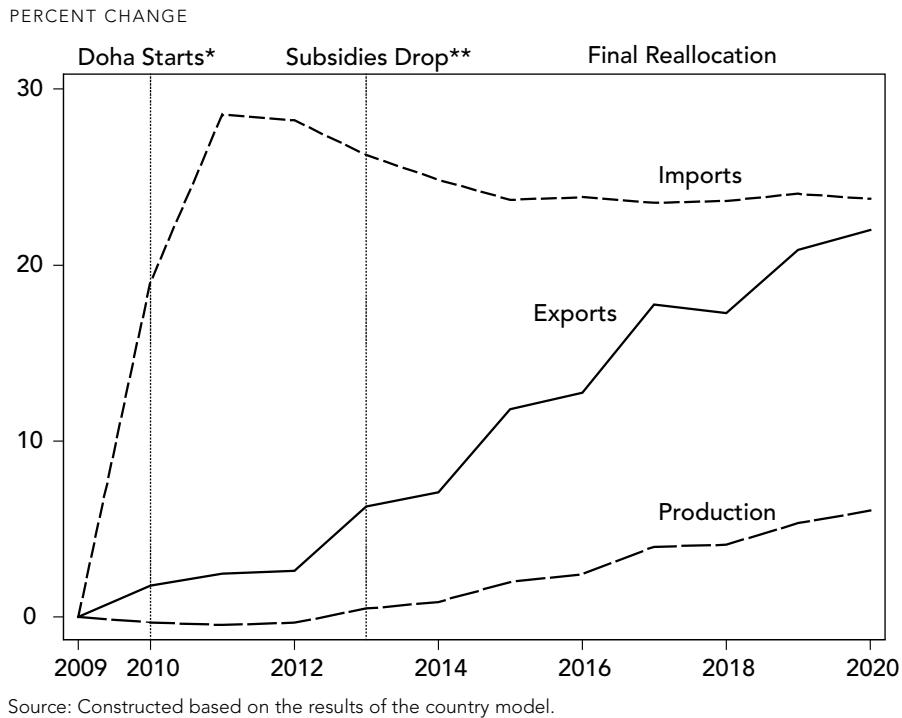
goods. Unlike textiles and footwear, "other" manufactured goods are likely to be exported to neighboring countries under the auspices of regional trade agreements.

Our simulation only includes the change in world prices derived from Doha-induced changes in tariffs and subsidies and Kenya's own changes in tariffs. It does not explicitly include the fall in preferences for current exports. If

Table 3.7 The Change in Demand, Exports, Imports, and Production for Selected Nonprocessed Food Industries

PERCENT*

Industry	Demand	Exports	Imports	Production
Textiles and apparel	–0.50	–5.46	3.53	–2.55
Leather and footwear	–1.79	–5.93	1.01	–3.01
Other manufactures	–0.59	–2.46	1.02	–1.23

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.
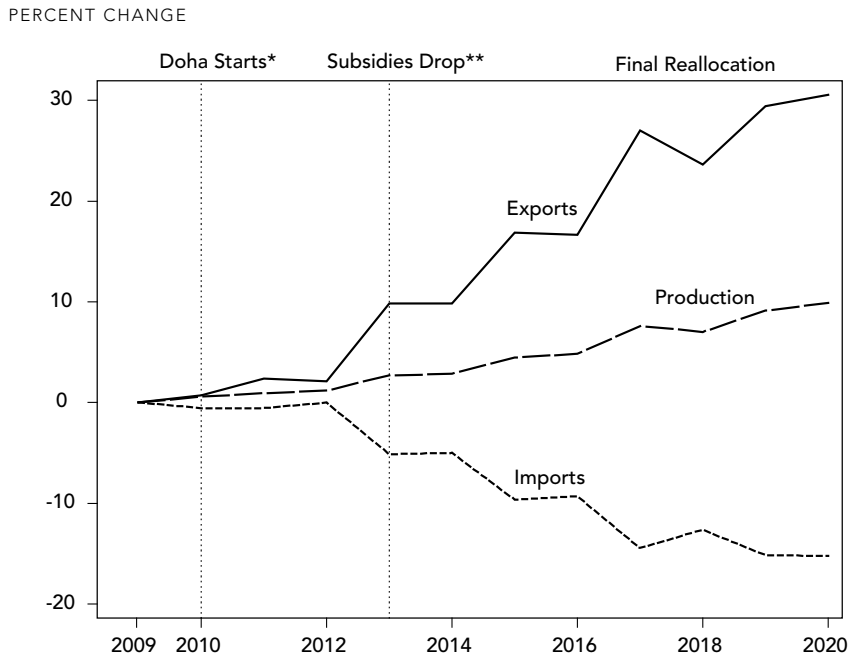
Figure 3.11 The Impact of the Doha Round on Kenya's Nonfood Industries

PERCENT CHANGE
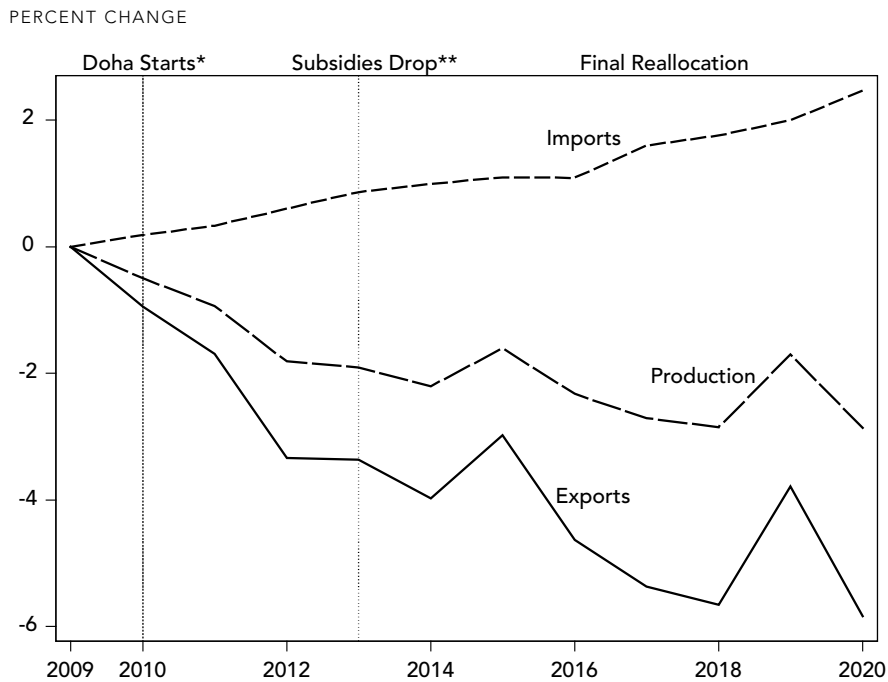
Source: Constructed based on the results of the country model.

Doha implies the phasing out of tariff preferences by developed countries, the negative impact on Kenyan exports of textiles and footwear might be larger. By the same token, if exports to Kenya's neighboring countries that are signatories to regional trade treaties cease to enter these markets under preferential conditions, exports might fall further. This scenario is unlikely to occur in the case of LDC trading partners receiving Doha trade exemptions, but it could happen in the case of developing country trading partners that must comply with Doha tariff reductions.

The combined exports of mined and nonmetal mineral products fall by –1.2 percent, and exports of the composite activity of oil, chemicals, and printing fall by –6.9 percent (see table B.3 in appendix B). The implications of these reductions are clearer if one considers that the size of the fall in the sales of mined and nonmetal minerals ranges between the size of the fall of footwear sales and that of "other" manufactured goods; comparatively, the size of the fall in the export revenues from oil, chemicals, and printing is twice that from footwear, textiles, and other manufactured goods together. Doha's impact on exports and imports of nonfood industries results, expectedly, in falling output in most activities. The total output of these activities decreases by –2.1 percent (table 3.4).

Table 3.8 The Change in Demand, Exports, Imports, and Production for Selected Services

PERCENT*

Service	Demand	Exports	Imports	Production
Financial services	0.32	−3.44	3.12	0.19
Business services, rentals, and real state	0.86	−2.27	3.65	0.81
Trade, hotels, and transportation	0.28	−4.14	4.12	−0.38
Construction	1.35	—	—	1.35

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.

The timing of changes in nonfood industries indicates that the initial reduction of tariffs produces changes in world prices that lead to increases in imports of nonfood goods (figure 3.11). As the removal of the 2013 export subsidies positively affects the Kenyan economy and the reallocation of resources deepens, second-round effects take precedence and imports of nonfood goods increase. On the export side, the initial tariff reduction changes world prices, making it harder for Kenyan producers to sell in world markets, and exports fall. The 2013 elimination of export subsidies diverts resources away from nonfood activities and into food activities, decreasing exports of nonfood commodities even more when compared with a no-Doha scenario. The shifting of resources increases over time, as does the fall in exports. The alignment of Kenya with its comparative advantage results in a continuously increasing reduction in the output of nonfood industries.

Despite the fact that our simulation of Doha affects the services sector only indirectly, the economic activity in this sector is noticeably modified. Among traded services, triggered by a reduction of export and import prices, exports decrease and imports increase in finance, business services, and restaurants and hotels, pushing sales of these services down (table 3.8). However, because most service activities experience increases in demand, consistent with the overall increase in GDP, total sales of all services rise by 0.2 percent (table 3.4 above). The timing of changes in services is consistent with the second-round nature of the mechanics originating them. The effects are small at first but become more visible after several years (figure 3.12).

Figure 3.12 The Impact of the Doha Round on Kenya's Services

PERCENT CHANGE

Source: Constructed based on the results of the country model.
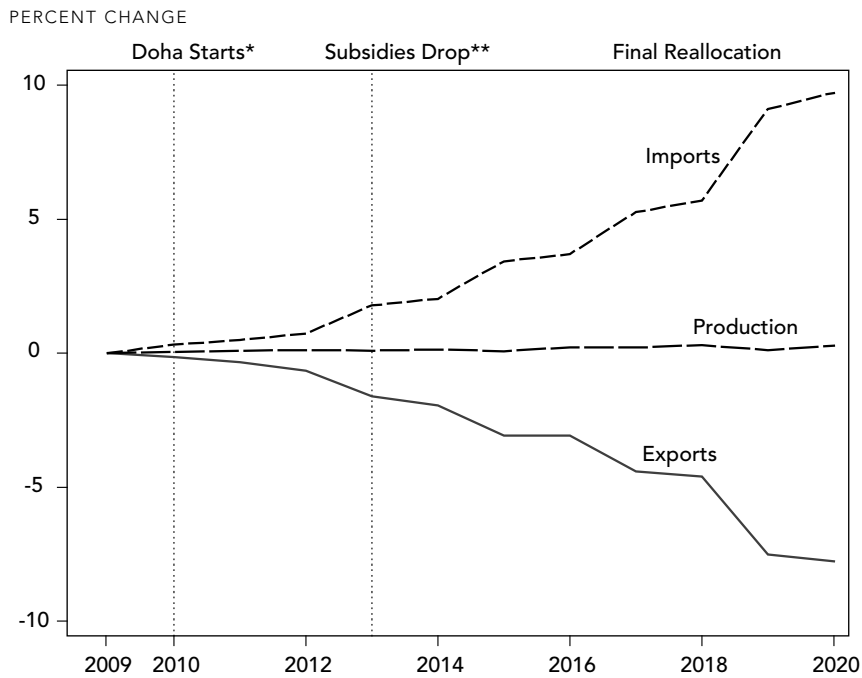
Notes

1. The Doha Round also decreases welfare and GDP in developing countries.

2. We did not use the new demand quantities resulting from the global model as part of the Doha Round country scenario because those changes were irrelevant for the Kenyan economy.

3. It is common for a CGE model to find small losses or gains from trade liberalization, but the gains are particularly small in our model. Differences between bound and applied tariffs might also lessen the size of impact.

4. The difference in results might also be explained by the effect of evasion in the measurement of applied tariffs. Berisha and others (2008) show that the rate of tariff evasion in Kenya might be among the highest in the world. This means that Kenya's applied tariffs will be low due to low protection but also due to tax evasion. Models based on applied tariffs do not separate these two factors and might render more positive results for Kenya. Our simulation procedure is not affected by tariff evasion.

5. The choice of closure results in similar percentage changes in the output of activities. In almost all cases, differences are smaller than one percentage point (see table B.2 in appendix B).

6. It is worth noting that although the proportional increase in foreign sales of already-successful export activities might not be large, their contribution to the rise in exports is significant. For example, while the 18.8 percent increase in exports of oil seeds accounts for 45 percent of the total increase in exports, the modest 1.2 and 0.9 percent increases in coffee and cut flowers, respectively, together account for 20 percent of the total increase in exports.

7. On average, in the baseline scenario, imports account for 10 percent of demand and are equivalent to 5 percent of the total production of the sector.

The Human Impact of the Doha Round

The Doha Round trade negotiations were dubbed the Development Round. It is thus pertinent to go beyond the strictly economic effects reviewed in the previous chapter and assess the impact of the Doha Round on key development variables such as employment, income distribution, and poverty. Evaluating these effects is vital because the rapid growth of trade in the last twenty years has bypassed the poor and failed to improve equity.[1] In this chapter we discuss the modeling results on employment, wages, and income distribution and also assess the adjustment costs that Kenya is likely to face.

The Impact on Labor

The Doha Round has an ambivalent, small aggregate impact on labor; it increases employment by 0.01 percent and decreases wages by 0.10 percent. This muted effect on labor is consistent with the small aggregate impact on output. When we distinguish workers based on their skill endowments, the effect on labor is amplified but remains small. Employment increases by 0.02 percent in the case of semiskilled workers, and wages decrease by –0.17 percent in the case of skilled and unskilled workers. What is important to note is that the direction of change is consistent with what could be considered Kenya's comparative advantage: skilled employment decreases, the number of semiskilled and unskilled jobs increases (table 4.1). It is easy to see that Doha's impact on employment follows from its impact on production by sector. As employment shifts from nonfood industries and services to agriculture and processed food activities, the demand for unskilled and semiskilled workers increases (our definition of semiskilled includes manual workers in urban areas). In particular, the positive effect on exports of agriculture-related products should also increase demand for semiskilled labor in rural and urban areas.

Table 4.1 Changes in Employment and Wage per Worker

PERCENT*

| Labor Type	Employment	Wage per Worker
Skilled	–0.01	–0.17
Semiskilled	0.02	–0.02
Unskilled	0.01	–0.17
All	0.01	–0.10

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.

Though still small, the largest changes in employment occur during the first years of Doha's implementation (figure 4.1). The 2013 elimination of export subsidies initiates a trend that dampens the effects of Doha on employment and continues until 2020. One possible explanation is that the initial changes in employment correspond to a period when businesses are adjusting to a changing environment by hiring semiskilled and unskilled workers and/or firing skilled workers without much investment. As the reallocation of resources takes place, the additional demand for semiskilled and unskilled workers slows down while the demand for skilled labor recovers.

Figure 4.1 The Impact of the Doha Round on Employment

PERCENT CHANGE

Source: Constructed based on the results of the country model.

Figure 4.2 The Impact of the Doha Round on Wages

PERCENT CHANGE

Doha Starts*   Subsidies Drop**   Final Reallocation

Semiskilled

Unskilled

Skilled

Source: Constructed based on the results of the country model.
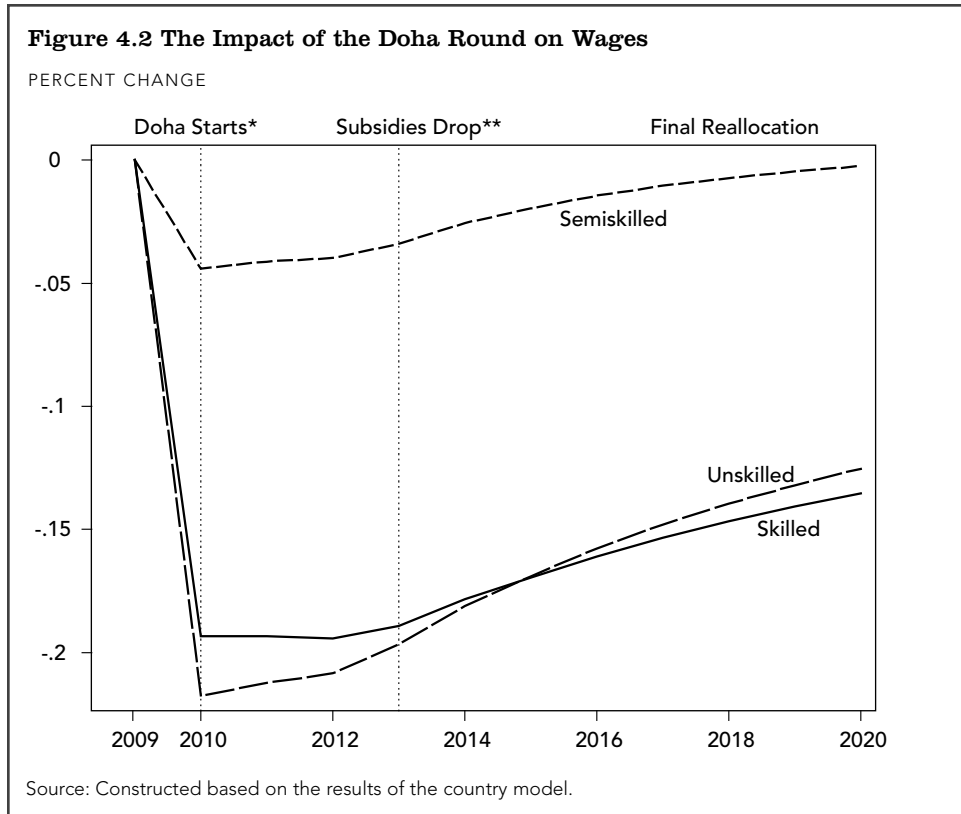
Doha's negative impact on wages is fully felt immediately after implementation begins. The largest reduction in wages occurs in the first year; after that, the negative impact softens continuously. This pattern of change is also consistent with a quick reaction of labor markets to the liberalization shock, which is later smoothed out by the reallocation of resources, particularly after the 2013 elimination of export subsidies (figure 4.2).

From a development perspective, such an impact on labor is positive. The increase in the demand for unskilled and semiskilled workers, which includes manual laborers in urban areas, would help to improve the income of poor workers by promoting the use of Kenya's most abundant resource—low-skilled workers in urban and rural areas. The problem, however, is the small size of the increase in employment. On the negative side, the reduction of wages will not help to improve the living conditions of workers already trapped by poverty—this is particularly the case for unskilled and semiskilled workers. To the extent that such reductions result from aligning wages and productivity, the policy implication of this result is that education and training need to be reinforced if the Doha Round is to have a positive development impact.

The Impact on Distribution

Trade policies are likely to influence income distribution. Guided by economic theory, early proponents of trade liberalization assumed that opening trade in developing countries would improve equity. However, studies reviewing the liberalization experiences of developing countries have questioned this view, uncovering a number of factors that explain why trade liberalization often worsens rather than improves income distribution in developing countries. Many of these factors are particularly relevant to the Kenyan economy, such as labor costs relative to trade competitors—that is, China and the presence of production sharing. Once we take into account the heterogeneity of the Kenyan economy, it is reasonable to expect a more complex impact of Doha on income distribution. To assess the distributional consequences of Doha, we look at changes in household consumption and income per capita by area of residence and by income bracket.

Doha has a small effect on the distribution of income in Kenya, but given its overall small impact on the economy, this comes as no surprise. A close inspection of changes in household income by income group and area of residence reveals several effects worth noting. Household income increases for all twenty income groups into which the total number of households is divided (see table B.5 in Appendix B). To facilitate the discussion, we aggregate the results for three income groups in both rural and urban areas: the top 20 percent, the middle 40 percent, and the bottom 40 percent (table 4.2). The changes shown in table 4.2 suggest three main effects. First, despite the fact that agriculture is the main winner in Doha, the urban/rural divide is amplified, as mean income in urban areas increases slightly more than mean income in rural areas.[2]

Second, income distribution appears to improve in rural areas. Again, although the differences are small, mean income at the low end of the rural distribution increases more than income at the higher end. One drawback, however, is that the income of middle-income rural households increases

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Table 4.2 The Change in Household Income per Capita, by Income Group

PERCENT*

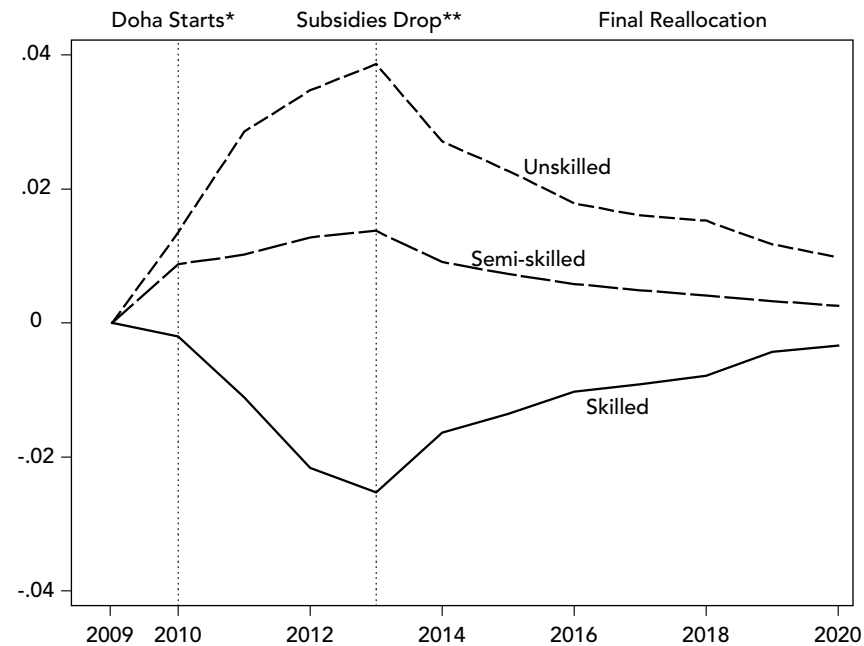| Group	Rural	Urban
Top 20 percent	2.21	2.42
Middle 40 percent	2.16	2.06
Bottom 40 percent	2.40	1.93
All groups	2.23	2.36

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.

Figure 4.3 The Impact of the Doha Round on Rural Income, by Income Group

PERCENT CHANGE

Source: Constructed based on the results of the country model.
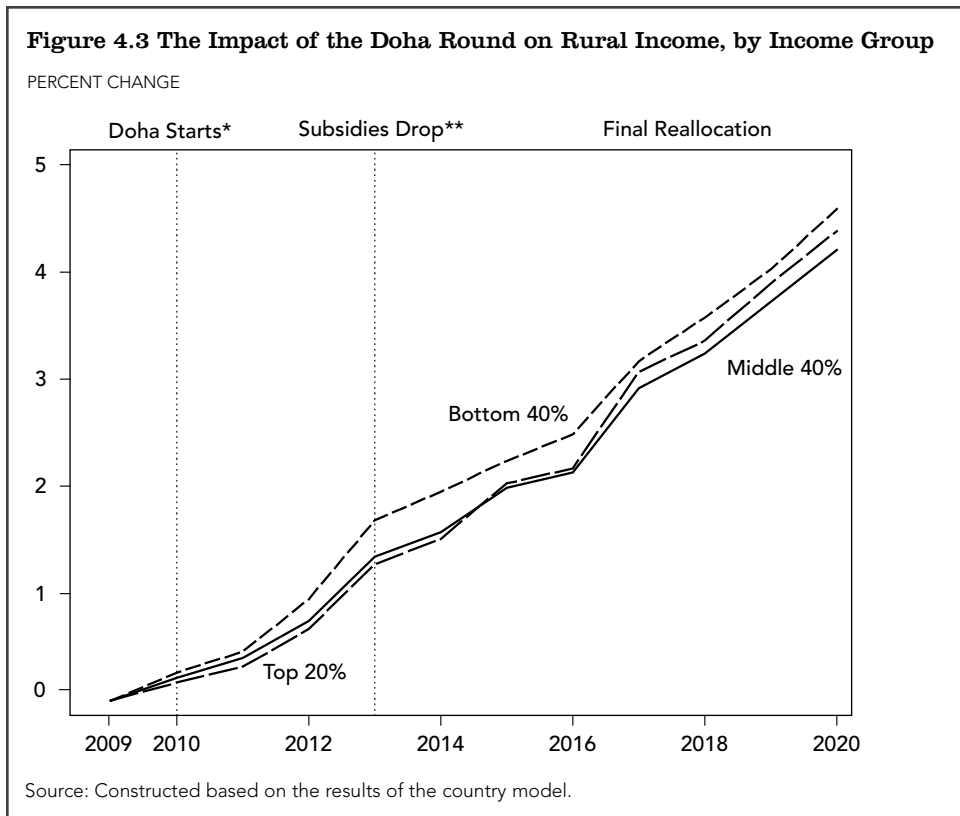
less than the income of the top-earning rural households. This result might appear to be at odds with changes in employment, but one possible interpretation is that workers benefiting from rising output in agriculture tend to come from low-income rural households rather than from middle-income ones.

Third, income distribution in urban areas appears to worsen. The magnitude of the increase in income is bigger the higher the household income. This pattern might originate in the loss of manufacturing jobs in losing industries, which tend to hire workers from low-income urban households.

In our simulation, we look at the pattern of change in household income for rural and urban areas over time. After some jittering in the early years, the increase in rural income is higher each year as a result of Doha. If, during the first years, income gains are less than 1 percent, in the last, say, five years, income gains are between 3 and 5 percent (figure 4.3). It needs to be noted that the mean income of the bottom 40 percent seems to benefit from larger income increases precisely at the time that Doha mandates the elimination of export subsidies in developed countries, and Kenyan agriculture wins the most. The impact of Doha on urban households follows a similar path to that of rural areas, as shown in figure 4.4.

Figure 4.4 The Impact of the Doha Round on Urban Income, by Income Group

PERCENT CHANGE

Source: Constructed based on the results of the country model.
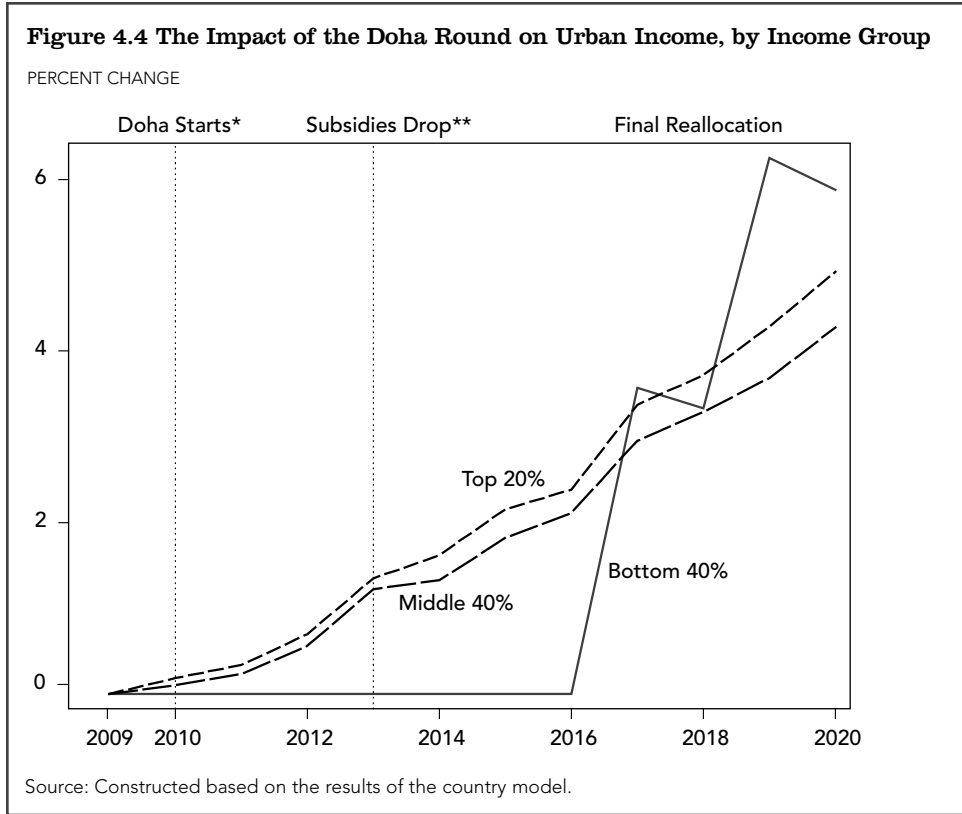
Figure 4.4 makes apparent that top-income urban households derive larger benefits toward the final years of the simulation. This is consistent with the pattern of change in skilled employment, which tends to recover during the last years of the simulation when the reallocation of resources is the driving force for changes. (Caution must be used when interpreting the erratic time pattern of changes of the bottom 40 percent of the distribution. We believe that such a pattern of change originates in weaknesses in the basic data used in the study.[3] Nevertheless, these data weaknesses do not invalidate the results discussed here and in other sections.)

In sum, the impact of the Doha Round on income distribution is complex. It improves income distribution in rural areas but worsens it in urban areas, amplifying the urban/rural income gap. The widening of the urban/rural gap also follows a nuanced pattern, for the two groups with the highest increase in income are the urban top 20 percent and the rural bottom 40 percent. To the extent that the incomes of all groups increase, Doha decreases poverty. The pattern of income change is clearly pro-poor in rural areas, as the bottom 40 percent receives the largest increases, but the opposite rule applies in urban settings; the bottom 40 percent receives the smallest increase. Social policies will need to be designed and implemented to further improve income distribution and to accelerate poverty reduction. One must remember that these estimates exclude income derived from

Figure 4.5 The Doha-Induced Loss in Fiscal Revenue

PERCENTAGE POINTS OF GDP

| Doha Starts* | Subsidies Drop** | Final Reallocation |

Source: Constructed based on the results of the country model.
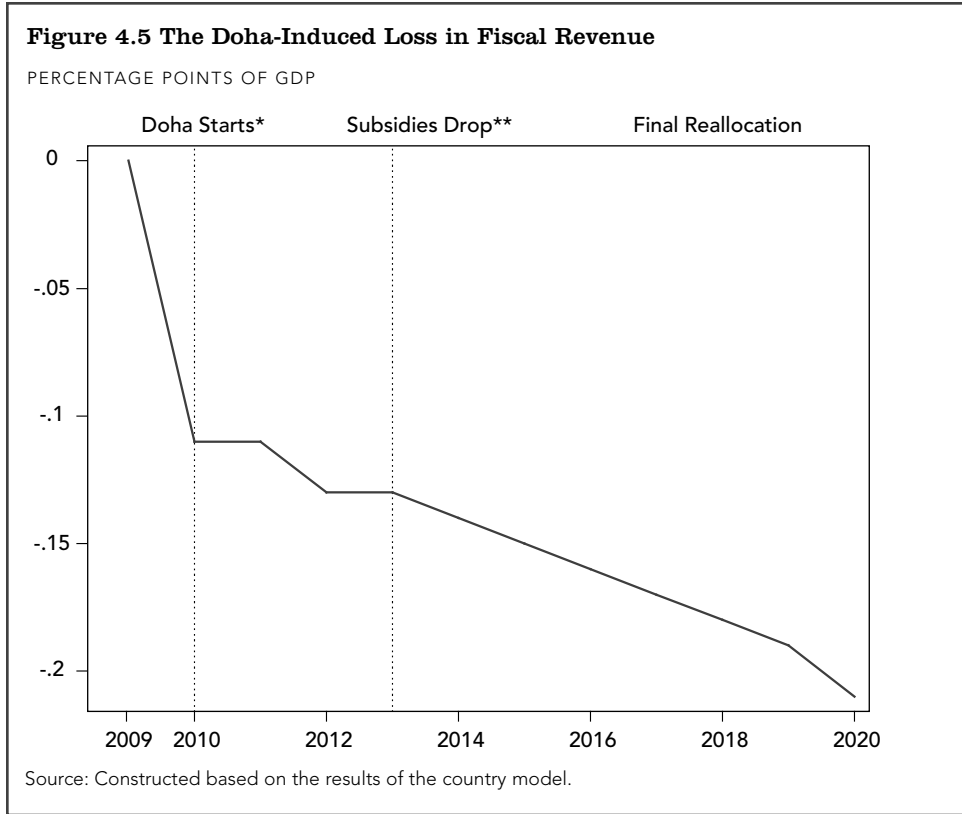
informal activities. Depending on how Doha affects the informal sector, its impact on income distribution might look different, necessitating additional social policies.

The Adjustment Costs of Doha

The positive overall impact of the Doha Round on the Kenyan economy comes at a cost. We look here at two types of cost: the cost of the forgone tariff revenue, and the cost of adjusting economic activity.

According to the Doha negotiations in 2008, Kenya only commits to small reductions in selected tariffs. The small size of tariff reductions and the precise degree of substitution between imports and domestic products assumed in the model explain why Doha causes some loss in Kenya's public revenues. The reduction in public revenue amounts, on average, to 0.15 percent of GDP. The first year of Doha implies a reduction of about 0.10 percent, whereas the loss does not go much higher than 0.20 percent of GDP by 2020 (figure 4.5). The public revenue cost of Doha is noticeable but not large.

More than public revenue, clearly the cost of economic adjustment is a cause for concern. Costs are incurred as existing firms and businesses react to

changes in prices and demand by adjusting production. In the process, new business opportunities emerge, but many other businesses are not able to compete and are likely to close down. Firms under stress and entrepreneurs seeking to take advantage of the new opportunities might need additional financing and government support to remain viable. During this process, the composition of employment changes as workers are laid off from noncompetitive businesses and sectors, and new jobs are created by competitive firms and in their sectors. Adding up changes in production and changes in employment and comparing them with the total output of the no-Doha scenario gives some sense of the degree of adjustment, but it fails to capture the fact that for any additional unit of output or any new fresh job created, production might increase or decrease for many businesses. Adjusting to trade might imply the closing down of an industry that supports the population of an entire township and the opening of a factory producing a different product in a different location.

One way to gauge some of the churning in output is to add the change in output without taking into account the direction of change and compare these sums with the total output in the baseline scenario. Applying this procedure to our data means that we are adding the absolute change in production of each of the forty-three activities. We are not counting the change in production of the existing businesses, the loss of output of businesses that closed down, nor the added output from new businesses. We are simply adding the net change of the churning that occurs within each activity. The reader should keep in mind, thus, that this measure is likely to underestimate the actual degree of adjustment.

Applying the proposed measure of adjustment to output indicates that Doha causes an adjustment equivalent to 1.3 percent of total production. Although small, the degree of adjustment implied is much larger than the 0.2 percent change in output suggests. Calculating the measure of adjustment by type of activity shows some variability. The largest degree of adjustment is in processed food activities and the smallest in services and agriculture (table 4.3). The change in output might be significant in some activities, ranging from a –10 percent reduction in mining and –4 percent reduction for oil, chemicals and printing, and milled grain products, to a 10 percent increase in meat and other grains and a 5 percent increase in baked goods (see table B.3 in the appendix B).

Looking at the degree of adjustment of employment by skill category reveals that unskilled workers are likely to experience twice as much job turmoil as workers in the other two categories (table 4.4). Labor policies that mandate the provision of training should concentrate on unskilled workers.

The timing of adjustments in production indicates that policies should escalate interventions as Doha is implemented, for the degree of adjustment increases with time. It also suggests that the burden of adjustment in the

Table 4.3 The Degree of Adjustment in Production

GAINS AND LOSSES OVER TOTAL PRODUCTION AND EMPLOYMENT IN THE BASELINE SCENARIO, PERCENT*

Sector	Degree of Adjustment (percent*)
Agriculture	0.75
Processed foods	4.48
Nonfood Industries	2.39
Services	0.62
All	1.32

Source: Authors' computation using the country model.
* These figures represent the sum of the absolute value of the change in production of each activity across sectors divided by the sum of production for the corresponding sector.

Table 4.4 The Degree of Adjustment in Employment

GAINS AND LOSSES OVER TOTAL EMPLOYMENT IN THE BASELINE SCENARIO, PERCENT*

Type of Labor	Degree of Adjustment
Skilled	1.89
Semiskilled	1.80
Unskilled	4.61
All	3.31

Source: Authors' computation using the country model.
* These figures represent the sum of the absolute value of the change in production of each activity across sectors divided by the sum of production for the corresponding sector.

initial years might be heavier for processed food and nonfood industries (figure 4.6).

The timing of adjustment by employment category suggests that during the first year, all workers, regardless of their skills, might experience similar job turmoil (figure 4.7). After 2013, however, the degree of adjustment among unskilled workers becomes increasingly larger relative to the adjustments that the other two categories might experience. The time pattern of adjustment suggests, thus, that policy makers taking care of adjustment costs will need to be alert and flexible to adequately track shifting adjustment intensities by activity and skill category.

As we have seen, the fiscal adjustment cost of implementing the Doha Round is not high for Kenya, but the cost of reallocating production and labor across activities may be significant. Policy makers should take into account the fact that public and private funds will need to be allocated to finance the adjustments, ensuring that resources shift smoothly from one activity to another and that the labor force receives adequate training.

Figure 4.6 Doha's Adjustment in Production*

TOTAL ABSOLUTE CHANGE/TOTAL PRODUCTION (PERCENT)
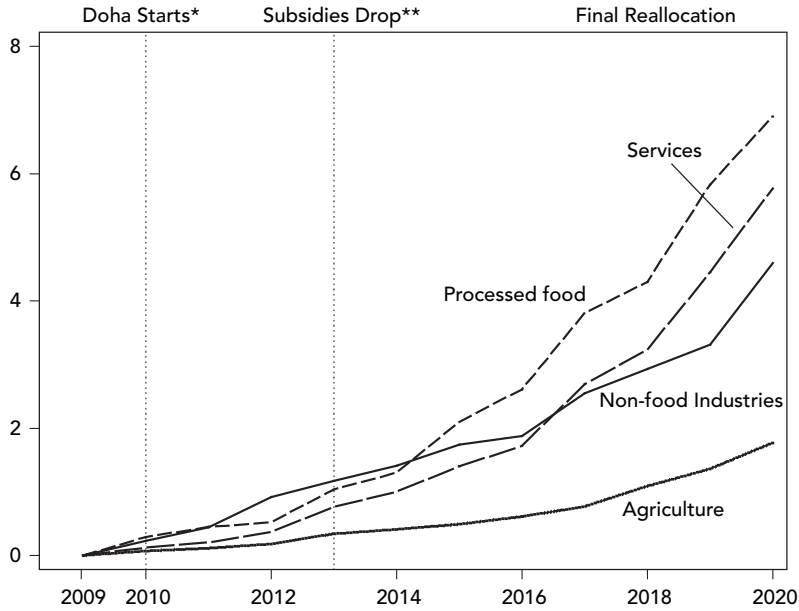
Doha Starts*   Subsidies Drop**   Final Reallocation

Services

Processed food

Non-food Industries

Agriculture

2009 2010 2012 2014 2016 2018 2020

Source: Constructed based on the results of the country model.
* These figures represent the sum of the absolute value of the change in production of each activity across sectors divided by the sum of production for the corresponding sector.

Figure 4.7 Doha's Adjustment in Employment*

ADJUSTMENT AS PERCENTAGE OF EMPLOYMENT BY SKILL
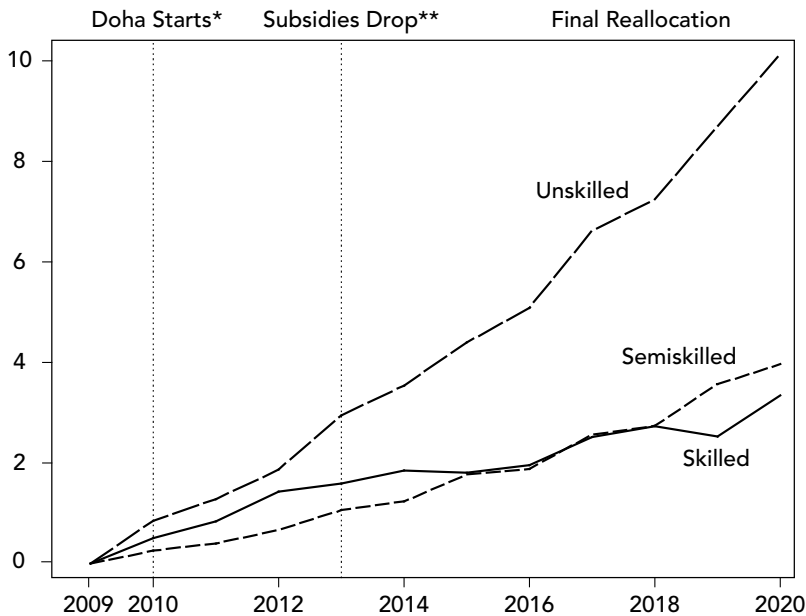
Doha Starts*   Subsidies Drop**   Final Reallocation

Unskilled

Semiskilled

Skilled

2009 2010 2012 2014 2016 2018 2020

Source: Constructed based on the results of the country model.
* These figures represent the sum of the absolute value of the change in employment across sectors for each skill category divided by the sum of employment by skill category.

Notes

1. The links between trade, development, and the Doha Round have been discussed extensively. See Hertel and Winters (2006), Ismail (2007), Newfarmer (2006), Polaski (2006), Stiglitz and Charlton (2005), UNDP (2003 and 2006).

2. We are limited to speculating on the link between changes in employment and changes in household income, for our data do not allow us to trace changes in employment back to the incomes of households by income bracket.

3. As indicated in the section presenting the SAM, low income urban households appear as having very low incomes.

Conclusions and Policy Implications

As the first decade of the twenty-first century comes to an end, Kenya's economy is being confronted with a number of challenges that call for policies and strategies carefully crafted from evidence. Restoring the economy to a sustained path of growth of 5 percent a year and ensuring that such growth effectively leads to progress in human development represents a big challenge. As of 2009, the Kenyan economy had not yet fully recovered from the political and social turmoil afflicting the country at the end of 2007, and today it faces a grim world outlook. Kenyans will need to struggle to sustain, let alone increase, exports to shrinking markets. They might also have to overcome protectionist measures. And they will have to do all this while the flow of funds needed to finance growth will be small.

Trade has played an important role in Kenya's economic performance and will continue to be an important part of any combination of factors leading to rapid economic growth. Due attention must be paid to the Doha Round negotiations—perhaps even more attention than was given before the negotiations stalled in mid-2008. The reopening of the Doha negotiations will most likely entail more than just a simple return to the July 2008 positions. New and fresh approaches to trade will be at play, and new negotiating positions might emerge from the bitter confrontation with the consequences of unfettered pro-market policies.

The objective of this study has been to analyze the impact of the Doha Round's trade liberalization on Kenya from a realistic perspective. With no analytical implication about the likely outcome of the Doha negotiations, the study assumed a negotiation package likely to have been agreed to in July 2008, with implementation beginning in 2010. We investigated its impact with the aid of general equilibrium models, a technique frequently used to assess the impact of trade liberalization. These models draw the economic implications of changes in factors, policy interventions, or shocks in isolation

from other economic variables. They are powerful tools for analyzing policies, but they are not predicting instruments. Thus, the model describes the changes that the Kenyan economy might experience as Doha is implemented, as defined in our exercise, while all other concurrent economic conditions remain the same. It does not tell how the Kenyan economy would actually have changed, had Doha started its implementation in 2010 (and other economic conditions would have simultaneously changed).

Our study uses a two-step, top-down strategy to model the impact of Doha on Kenya. Its distinct features include a detailed and carefully constructed Doha scenario, a recursive-dynamic model calibrated with the most recent available world data, and a country model that reflects some of the distinct features of African economies. The Doha scenario consists of a reduction of world tariffs and domestic support starting in 2010, with phasing periods spreading over a few years, and the elimination of export subsidies to agriculture in developed countries that is fully implemented in 2013. Our simulation limits its scope to the liberalization of trade in goods, avoiding imputations and concentrating attention on the areas where data and the available estimation techniques can provide solid results. The exercise starts by simulating the impact of Doha on the world economy using the global model MIRAGE. This shows us how Sub-Saharan African economies might be affected by Doha and provides us with the new world prices and quantities demanded corresponding to the Doha scenario. The second step uses the Doha world prices and Kenya's own reduction of tariffs to "shock" the economy. The effect of this shock is estimated using a version of the DIVA model tailored to this study. The simulation exercise starts in 2010 and ends in 2020.

The simulation of the global model shows that the gains for the Sub-Saharan African region are small—in fact, smaller than is usually assumed. There are benefits from engaging in world trade negotiations, but the region's countries should look carefully at what is tabled. The 2008 Doha package will benefit their economies, but it will do so on a very small scale.

The country model simulation tells a nuanced story that ends on a positive note. Kenya will gain in agricultural products and in processed food but will lose in manufacturing (excluding processed food) and mining. The model also indicates that Doha's liberalization in the trade of goods will have a positive impact on the output of the service sector. After adding all these sector effects, the balance for Kenya is positive. The Doha Round increases Kenya's GDP and welfare. But the benefits are small. Kenya's annual GDP is, on average, 0.18 percent higher in a world with Doha than in one without it.

At the macroeconomic level, the key to the gain in GDP is the positive response of exports and investment. Gains in GDP are not larger, among other things, because Doha also increases imports. Low-priced imports benefit consumers, but imports also displace domestic output and result in

layoffs. Kenya should view Doha positively, but it should also carefully consider what is being agreed to, for the benefits of liberalizing merchandize trade will be small if negotiations are resolved based on the 2008 package.

Sector results correspond to what Kenya's comparative advantages look like in a pre-Doha scenario. Kenya will gain in agricultural and agriculture-related activities but will lose in manufacturing and extractive activities. This pattern of results also follows from what was being negotiated up to 2008. The positive effect on agriculture and processed food is associated with world reductions in tariffs and domestic support but, for the most part, the positive impact is triggered by the elimination of export subsidies to agriculture in developed countries. Losses in nonprocessed food manufacturing and mining, in turn, can be traced back to the few commitments to reduce tariffs on the part of Kenya and to changes in world prices that exert competitive pressures on Kenyan business active in domestic and export markets.

Our exercise can guide policies aiming to cope with the effects of Doha. The most significant increases in output are other grains, oil seeds, and coffee in agriculture; and baked goods and meat in processed food activities. Not all agricultural and food-manufacturing activities increase their output, however. Doha reveals weaknesses in the competitive position of rice, cotton, and barley, as well as in milled grains and beverages and tobacco. The Doha NAMA provisions give preferences to LDCs and to some developing countries, including Kenya. This preferential treatment, however, is not enough to shield Kenya from output reductions in these activities. Only nonmetal products and machinery and equipment, out of the seven nonprocessed food industries considered in the study, increase output; moreover, the increase is in both cases smaller than 1 percent. Footwear and textiles are the most negatively affected activities; in the second case, the reduction is most likely associated with the erosion of preferences.

Given that Kenya exports a number of manufactured products to some African countries, policy makers and negotiators should pay close attention to the direct benefits and costs of concessions, granted or received, but also to the impact of agreed-on packages for trade with regional partners. Under the Doha scenario, Kenya increases its exports of agricultural goods, most of them sold in developed country markets, and decreases its exports of manufactured goods, several of them to regional trading partners. Doha is thus likely to diminish the importance of Kenya's regional trading partners in its total trade. If trade is to be used as an instrument of regional economic integration—as it should be—close attention must be given to these concerns in international negotiations. Our model does not estimate the implications of Doha for the geographic destinations and origins of Kenya's trade. Detailed studies with adequate data on this score should be developed to inform policy makers.

The dynamic features of our model and the specific sequencing of the Doha scenario we simulate help identify some of the factors behind the gains and losses and provide a sense of the timing of effects. The reduction in world tariffs, domestic support, and Kenya's own tariff reductions do not significantly change the aggregate performance of its economy. The increase in exports, imports, and GDP are small. In contrast, the reduction of export subsidies to agriculture by developed countries has a larger impact in Kenya. Only with the reduction of export subsidies to agriculture does the positive impact on GDP become larger than 0.1 percent. Large positive changes only occur during the last years of the simulation, once investments have been made and resources have been reallocated from declining to growing activities. In the last two years of the simulation, GDP is more than 0.4 percent greater in the Doha scenario.

This result confirms the centrality of ensuring an effective reduction of subsidies in developed countries, and it underscores the fact that benefits will only accrue if investments are made and there is a reallocation of resources. Our simulation shows that annual investment increases by less than 0.5 percent in the first years and by more than 2.0 percent in the last three years. These investments are crucial to delivering gains. But investments in real life depend on a variety of factors. Policies need to be in place to ensure that the simulated increases in investments can actually occur.

The aggregate impact of Doha on labor is small—smaller than the impact on GDP or investment. Nevertheless, it is important for certain groups of workers. The study shows that the Doha-induced shifting of resources to agriculture and processed food has an impact on the demand for unskilled labor. This is clearly a positive impact given the abundance of this factor in the Kenyan economy. While negative, the aggregate impact on wages is very small and with little differentiation by workers' skills.

The study does not attempt to give a summary estimate of inequality to compare the distribution of income between the Doha and no-Doha scenarios. However, it does provide insights on how Doha might affect the distribution of income. Changes in household income are generally small, regardless of the income group of the household or whether the households are in rural or urban areas. But because Doha shifts resources and jobs to agriculture and increases the demand for unskilled labor, income distribution in rural areas is likely to improve albeit slightly. Not all income changes improve the distribution of income. The changes resulting from Doha widen the rural/urban gap, because incomes in urban areas still increase slightly more than incomes in rural areas. And Doha tends to worsen the distribution of income in urban areas. Importantly, the impact on poverty points in the right direction. Because Doha increases the income of all 10 rural and 10 urban deciles, it decreases poverty. While small, it is an effect that points in the right direction. The pattern of change in income is virtuously pro-poor in rural areas, but biased in favor of high income groups in urban areas. Doha's

overall impact on income distribution and poverty is mixed and small. Social policies need to be implemented to even out results and enhance the human development impact of the Doha Round.

Even if the aggregate impact of Doha on key economic variables is small, it is not inconsequential. The impact of Doha in Kenya's economy depends on the shifting of resources from manufacturing and services to agriculture, and this shift inevitably has costs. The study does not calculate adjustment costs, but it attempts to give a sense of the degree of adjustment that Kenya might undergo. This report finds that foregone tariffs imply a reduction of public revenue of about 0.15 percent of GDP. This is not a small reduction, but is far from the size of losses that other developing countries might experience. According to a conservative estimate, Doha may cause adjustments on the order of 1.3 percent of output. This figure is seven times larger than the impact on GDP, and it suggests that adjustment costs might be significant. Adjustment costs vary across sectors. Some activities might experience adjustments as high as 10 or 5 percent of output in large and small activities. Policies dealing with the costs of adjustment should be very careful in identifying target groups. According to the study's results, the priority target groups should include low skilled workers in rural and urban areas.

The adjustment costs are also likely to be spread unevenly across time. The results suggest that adjustment peaks in different sectors at varying times. Though the first couple of years provoke small, evenly distributed adjustments, subsequent years induce higher adjustment costs, first in services and later in agriculture. These results indicate that policies attending the consequences of liberalization might be more effective if they are able to target the adequate sectors at the proper time. Though unskilled workers should be the focus of attention during the entire period of implementation, attention must intensify in later years to cope with the increasing degree of adjustment these workers might experience.

It would be wrong to conclude from the small aggregate impact of Doha that policy makers should make a better use of their time by turning to other pressing issues. On the contrary, the implication of this study's findings is that policy makers should pay close attention to what is negotiated at Doha. The small magnitude of Doha's simulated aggregate effect should also prevent policy makers from coming to the negotiations with over-optimistic expectations. Moreover, Doha's small and uneven effect on various economic sectors should alert policy makers to the need to pay close attention to details because the reported small aggregate effects are the result of aggregating positive and negative changes in different sectors (with important economic and welfare consequences) that offset each other.

To repeat one central result of our simulation, although processed food and agriculture are clearly winning activities, nonfood industries lose and services come out even. Policy makers should thus look carefully at the matters on

the Doha negotiating table to ensure that what has positive effects is pre-served in the final approved Doha package, and what has negative effects is lessened or properly compensated. For example, policy makers might con-sider ensuring that the final Doha accord includes both the agreed-on elimi-nation of agriculture export subsidies and also a more ambitious reduction of domestic support for agriculture in developed countries. This might also lead the Doha negotiators to allow for a flexible enforcement of those inter-national trade provisions that are currently preventing countries from pur-suing active, sector-selective industrial policies, so LDCs and developing countries can preserve and nurture their manufacturing capacity.

The results of this study can guide those designing policies to complement Doha-related initiatives. The impact of the Doha Round can lead the Kenyan economy to further specialize in agriculture and processed food. And spe-cialization in these activities can help Kenya make good use of its unskilled labor, its most abundant factor. But Kenya's long-term development cannot rest on only these two activities. Kenya must aim to build dynamic compara-tive advantages in activities with higher value added that can support higher standards of living. Trade can help, but trade by itself will not do the job. Policies must be developed to enable the diversification of Kenya's produc-tive capacity in a gradual process toward higher-value-added activities.

Doha Scenarios and Implementation

Definition of the Scenarios

Table A.1 The Proposed Liberalization Scenario for Overall Domestic Support			
Tariff Band (percent)	Threshold (billions of dollars)	Cut Interval (percent)	Proposed Cuts (percent)
3	> 60 (European Union)	75 or 85	80
2	10–60 (United States and Japan)	66 or 73	69.5
1	0–10 (All developed countries)	50 or 60	55

Table A.2 The Proposed Liberalization Scenario for the Amber Box		
Tariff Band (percent)	Threshold (billions of dollars)	Cut (percent)
3	> 20 (European Union)	70
2	12–20 (United States and Japan)	60
1	0–12 (All developed countries)	45

Table A.3 The Proposed Scenario for Market Access Liberalization				
Developed Countries		Developing Countries		Least-Developed Countries
Tier (percent)	Cut (percent)	Tier (percent)	Cut (percent)	
0–20	45	0–30	25	
20–50	55	30–80	30	No
50–75	65	80–130	35	liberalization
> 75	70	> 130	40	
Cap: 100 percent		Cap: 150 percent		

Table A.4 The Rate of Reduction for Special Lines

Tariff Band (percentage of special products)	Cut (percent tariff reduction)
50	0
25	5
25	10

Implementation of the Doha Scenarios

Table A.5 Mapping Between Boxes and MIRAGE Instruments

MILLION US$

Box	European Union	United States	Canada	Japan	Brazil
Amber box					
Output subsidies	3,653	8,859	249	667	481
Intermediate subsidies	1,101	1,051	67	223	0
Land-based subsidies	103	486	403	907	0
Capital-based subsidies	905	392	84	989	0
Blue box					
Output subsidies	0	0	0	750	0
Intermediate subsidies	22	0	0	0	0
Land-based subsidies	16,715	0	0	0	0
Capital-based subsidies	7,144	0	0	0	0
Green box					
Output subsidies	147	678	14	798	15
Intermediate subsidies	104	110	13	77	0
Land-based subsidies	4,137	15,102	1,460	67	0
Capital-based subsidies	5,950	36	6	180	0

Table A.6 Level of Applied Domestic Support by Boxes After Implementation

INITIAL LEVEL (MILLIONS OF DOLLARS)

	European Union	United States	Canada	Japan	Brazil
Amber box					
Bound	65,383	19,103	2,893	32,691	997
Current	36,791	14,413	472	5,220	27
Direct payments[a]	12,117	15,630	1,034	2,540	392
De minimis	411	7,043	846	555	379
Blue box	21,262	0	0	749	0
Percent value of agricultural production	93	0	0	1	0
Green box	19,452	50,672	1,129	21,023	2,422
Overall distorting support					
Bound	87,056	26,146	3,739	33,995	1,376
Current	58,464	21,456	1,318	6,524	406
Degree of overhang (percent)	33	18	65	81	70

LEVEL OF DOMESTIC SUPPORT AFTER SCENARIO IMPLEMENTATION (MILLIONS OF DOLLARS)

	European Union	United States	Canada	Japan	Brazil
Amber box					
Bound	23,415	9,441	1,591	16,476	398.8
Current	23,415	9,441	472	5,220	27
Direct payments[a]					
De minimis	206	3,522	423	278	190
Blue box	1,541				
Green box					
Overall distorting support					
Bound	25,161	9,425	1,683	11,818	619
Current	25,161	9,425	1,318	6,524	406
Degree of overhang	—	—	—	—	—

RATE OF DECREASE (PERCENT)

	European Union	United States	Canada	Japan	Brazil
Amber box					
Bound					
Current	64	66	100	100	100
Direct payments[a]					
De minimis					
Blue box (millions of dollars)	7	—	—	0	—
Green box					
Overall distorting support	—	—	—	—	—
Bound					
Current	57	56	100	100	100
Degree of overhang	—	—	—	—	—

Source: The agricultural support data for nonmarket price support protection in industrial countries are based on the estimation of the producer support equivalent calculated by OECD (2002). Walsh and others (2005) allocate the amount for each category of subsidies among the three boxes defined by the WTO.

a. In the GTAP database, the direct payments reported are allocated to four different categories: output subsidies, intermediate input subsidies, land-based payments, and capital-based payments.

Table A.7 Kenya's Tariff Cuts

PERCENT*

Commodity	2010	2010	2011	2012	2013**
Maize	9.95	9.95	9.95	9.95	9.95
Wheat	19.21	19.21	19.21	19.21	19.21
Rice	0.02	0.02	0.02	0.02	0.02
Sugarcane	4.01	4.01	4.01	4.01	4.01
Tea	8.62	8.62	8.62	8.62	8.62
Oil seeds and pulses	13.06	12.17	11.28	10.39	9.50
Vegetables	8.60	8.60	8.60	8.60	8.60
Others crops	3.39	3.39	3.39	3.39	3.39
Mining	10.78	9.58	8.39	7.19	6.00
Meat	10.39	10.29	10.19	10.10	10.00
Milled grain products	113.78	90.23	66.69	43.14	19.60
Baked goods, sugar, and confectionary	21.02	21.02	21.02	21.02	21.02
Beverages and tobacco	25.91	23.98	22.05	20.13	18.20
Other manufactured food	1.36	1.36	1.36	1.36	1.36
Textile and clothing	14.93	14.93	14.93	14.93	14.93
Leather and footwear	16.71	16.71	16.71	16.71	16.71
Printing and publishing, petroleum, and chemicals	3.59	3.59	3.59	3.59	3.59
Metals and machines	6.12	6.12	6.12	6.12	6.12
Non metallic products	9.50	9.50	9.50	9.50	9.50
Other manufactures	8.64	8.64	8.64	8.64	8.64

*The list does not include commodities with imports equal to zero in 2003.
** After 2013, tariffs maintain the same value.

Aggregation of Sectors in the Global and Country Models

The global model is used to estimate the effects of WTO scenarios based on proposed modalities in the current Doha Round, on world prices and external demand. For this reason, a limited regional disaggregation is adopted that takes into account the major international trade actors and allows a more important sectoral desegregation. The regional disaggregation takes into account eleven countries or regions. Three distinct categories of countries can be discerned from the regional disaggregation.

The first category is the developed countries or regions, including the European Union (all twenty-seven current members), the United States, Japan, and the rest of the developed countries. The second category is the African countries, including the North African region, the South African Customs Union, the Southern African Development Community, and the rest of Sub-Saharan Africa. The third category refers to the developing non-African countries and the regions that contain China, India, and the rest of the developing countries.

The sectoral desegregation is more important (table A.8). It has tried to isolate the major sectors of the Kenyan economy. The idea here is to map the global model sectors to the single country model sectors. The sectoral disaggregation takes into account twenty-two agricultural sectors, five processed food sectors, seven nonprocessed food industry sectors, and nine services sectors.

Table A.8 The Sectoral Disaggregation of the Global Model

Agriculture (13)	Processed Food (4)	Nonfood Industries (9)	Services (2)
Rice	Meat	Mining	Transportation services
Wheat	Baked goods, sugar, and confectionary	Textiles	Other services
Cereal grains nec	Beverages and tobacco	Footwear	
Vegetables, fruit, nuts	Other food manufactures	Wood and paper products	
Oil seeds		Petroleum	
Sugarcane		Chemicals	
Plant-based fibers		Nonmetallic manufactures	
Crops nec		Machinery	
Cattle, sheep, goats, horses		Other manufactures	
Animal products nec			
Dairy products			
Forestry			
Fishing			

Note: nec = not elsewhere classified.

Table A.9 Demand, Production, Imports, and Exports by Sectors in the SAM, 2003

MILLIONS OF KENYAN SHILLINGS

Commodity	Demand	Production	Imports	Exports
Administration	86,644	93,289	0	0
Baked goods, sugar, and confectionary	29,393	22,845	3,991	2,632
Barley	88	820	0	92
Beef	20,383	24,398	0	0
Beverages and tobacco	55,160	42,199	1,889	13,425
Coffee	0	13,550	0	12,846
Construction	4,018	164,160	0	0
Cotton	0	496	0	37
Cut flowers	0	21,668	0	21,667
Dairy products	6,661	35,019	0	0
Electricity	7,011	19,838	0	0
Finance	35,704	96,091	7,565	1,440
Fishing	5,278	4,964	0	0
Forestry	8,921	7,773	0	0
Fruits	6,756	21,651	0	2,153
Health and education	130,832	131,034	0	0
Leather and footwear	9,987	17,145	1,498	3,875
Maize	28,006	56,109	838	296
Meat and dairy processing	45,592	49,722	1,155	15,325
Metals and machines	1,862	28,236	74,045	15,924
Milled grain products	34,389	41,333	472	0
Mining	0	6,386	361	6,645
Nonmetallic products	0	34,335	3,953	4,331
Oil seeds and pulses	12,886	30,710	459	8,523
Other cereals	16	88	0	39
Other livestock	2,789	3,975	0	0
Other manufactured food	3,665	4,072	25,816	3,143
Other manufactures	21,697	75,514	40,551	24,020
Other services	58,609	138,408	0	0
Others crops	0	15,070	655	4,506
Poultry	3,043	18,223	0	0
Printing and publishing; petroleum and chemicals*	53,454	72,133	165,341	33,885
Business services, rentals, and real estate	54,194	67,075	7,404	1,511
Rice	8,905	2,905	4,917	0
Roots and tubers	9,564	18,804	0	0
Sheep, goats, and lambs for slaughter	3,294	5,930	0	0
Sugarcane	0	4,450	2,223	1,522
Tea	0	51,419	449	50,071
Textile and clothing	20,301	13,975	9,271	4,720
Trade, hotels, transportation and communication	164,495	383,077	53,477	40,092
Vegetables	17,023	32,256	494	8,323
Water	4,099	14,569	0	0
Wheat	316	536	10,067	75

Source: Kenyan SAM.
*The category "printing and publishing, petroleum and chemicals" is an amalgamation of three separate sectors. For the details, see table A.10 below.

Table A.10 Sector Adjustments to the SAM

MILLIONS OF KENYAN SHILLINGS

Commodity	Demand	Production	Imports	Exports
Printing and publishing; petroleum and chemicals	53,454	72,133	165,341	33,885
Printing and publishing	9,988	17,667	10,913	
Petroleum	16,710	32,604	82,227	18,007
Chemicals	26,756	21,862	72,201	15,878

Source: Kenyan SAM.

Global Prices Resulting from the Global Model Introduced as Shock in the Country Model

Table A.11 The Impact of Doha on World Prices

AVERAGE PERCENT CHANGES*

Sector	2010–2012	2013–2015	2016–2020
Agriculture	0.56	0.55	0.68
Processed food	0.31	1.33	0.68
Nonfood industries	–0.09	0.19	–0.06
Services	0.00	0.00	–0.20

Source: Authors' computation using the global model.
* To arrive at these figures we first took the average of each commodity price between 2009 and 2020 for the baseline and the foreign savings closure, then we took the average of each category of prices, and finally we estimated the percentage change between the baseline and the foreign savings closure average of average prices.

Table A.12 The Impact of Doha on the World Prices of Selected Commodities

PERCENT CHANGE*

Commodity	2010–2012	2013–2015	2016–2020
Beef	1.00	2.00	2.20
Meat	0.40	2.67	1.80
Dairy	–0.78	0.65	–0.39
Oils	1.00	1.33	1.80
Barley	0.80	1.67	1.40
Maize	0.80	1.67	1.40
Other grains	0.80	1.67	1.40
Baked goods, sugar, and confectionary	0.00	2.00	0.80
Wheat	0.80	1.00	1.00
Rice	0.00	–1.67	–1.00

Source: Authors' computation using the global model.
* Figures represent the percent change between the baseline and the foreign savings closure of each commodity's average price in each subperiod of time.

The Results for Alternative Closures

Table B.1 The Change in Macroeconomic Indicators

PERCENT CHANGE*

Measure	Baseline**	Foreign Savings	Tax–Direct	Tax–Indirect
Consumption	1,566	2.29	2.77	2.67
Exports	729	3.73	3.30	3.41
Gross domestic product	2,381	0.18	0.20	0.20
Imports	1,063	2.46	2.68	2.77
Investment	570	1.41	1.66	1.64
Terms of trade***		2.54	2.53	2.55

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.
**Baseline figures are 2010–2020 average values in billions of Kenyan shillings.
*** Ratio of export to import prices.

Table B.2 The Change in the Production of Commodities and Activities by Closure

PERCENT CHANGE*

Commodity or Activity	Baseline**	Foreign Savings	Tax– Direct	Tax– Indirect
Agriculture				
Rice	65	–1.31	–1.31	–1.31
Wheat	10	0	0	0
Maize	1,198	0.39	0.42	0.44
Barley	16	–0.97	–0.97	0
Vegetables	785	0.76	0.76	0.74
Oil seeds and pulses	626	2.1	2.1	2.08
Sugarcane	89	0.09	0.09	0.09
Fruits nuts	434	0.43	0.43	0.41
Other crops	367	0.52	0.46	0.5
Other cereals	2	9.52	9.52	9.52
Tea	1,111	0.85	0.84	0.8
Coffee	266	1.01	0.98	0.98
Cut flowers	451	0.94	0.89	0.87
Cotton	11	–2.17	–2.17	–2.17
Root plant–based fibers	438	0.39	0.49	0.44
Beef	665	0.74	0.83	0.83
Sheep, goats, and lambs	164	0.52	0.56	0.56
Other livestock	112	0.41	0.48	0.48
Poultry	506	0.46	0.52	0.47
Forestry	213	0.36	0.4	0.4
Fishing	117	0.33	0.39	0.39
Processed Food				
Baked flours	566	5.22	5.34	5.88
Beverages and tobacco products	1,019	–1.13	–1.1	–0.35
Dairy products	968	0.45	0.52	0.5
Meat and dairy processing	1,395	10.53	10.5	10.59
Milled grain products	967	–3.6	–3.44	–3.27
Other manufactured food	124	2.04	1.79	2.84
Nonfood Industries				
Mining	164	–10.29	–11.14	–11.33
Footwear and leather	478	–3.01	–3.14	–2.72
Textiles and wearing apparel	402	–2.55	–2.6	–2.41
Nonmetallic products	993	0.35	0.39	0.39
Machinery and equipment, metal production	858	0.78	–0.02	0.33
Other manufactures and wood	1,976	–1.23	–1.39	–1.37
Refined oil, chemicals, and printing	1,924	–4.49	–4.87	–4.39
Services				
Construction	5,139	1.35	1.6	1.58
Electricity	499	0.51	0.63	0.63
Water	407	0.34	0.4	0.4
Business services, rentals, and real estate	1,489	0.81	1.01	0.77
Trade, hotels, transportation, and communication	9,902	–0.38	–0.38	–0.39
Finance	2,538	0.19	0.26	0.22
Health and education	2,538	–0.48	–0.5	–0.6
Administration	1,929	–0.65	–0.74	–0.74
Other services	3,153	0.58	0.71	0.65

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.
**Baseline figures are 2010–2020 average values in billions of Kenyan shillings.

Table B.3 The Change in the Demand, Exports, Imports, and Production of Commodities and Activities

Commodity	Demand		Exports		Imports		Production	
	Base*	Change**	Base*	Change**	Base*	Change**	Base*	Change**
Agriculture								
Rice	63	–1.60	0	—	74	11.61	65	–1.31
Barley	15	–1.01	0	—	0	—	16	–0.97
Coffee	38	0.00	228	1.22	0	—	266	1.01
Cotton	10	–5.19	0	—	0	—	11	–2.17
Crops	274	–0.81	92	4.68	22	–5.48	367	0.52
Cut flowers	3	0.00	448	0.93	0	—	451	0.94
Fruits and nuts	186	0.08	38	6.73	0	—	434	0.43
Maize	946	–0.41	8	81.55	18	–31.38	1,198	0.39
Oil seeds and pulses	270	–2.85	163	18.84	10	–1.47	626	2.10
Tea	92	0.33	1,019	0.88	11	0.70	1,111	0.85
Vegetables	390	–0.32	251	3.12	9	–4.50	785	0.76
Sugarcane	62	–1.35	26	3.24	57	–5.65	89	0.09
Wheat	8	0.00	1	0.00	258	–3.70	10	0.00
Roots plant-based fibers	230	0.50	0	—	0	—	438	0.39
Beef	647	0.77	0	—	0	—	665	0.74
Sheep, goats, and lamb	98	1.96	0	—	0	—	112	0.41
Other livestock	72	0.75	0	—	0	—	164	0.52
Poultry	131	2.23	0	—	0	—	506	0.46
Fishing	110	0.42	0	—	0	—	117	0.33
Forestry	213	0.36	0	—	0	—	213	0.36
Processed food								
Baked goods, sugar	481	2.43	83	18.60	80	–7.78	566	5.22
Milled grain products	835	–4.27	0	—	19	442.91	967	–3.60
Other cereal grains	1	0.00	1	0.00	0	—	2	9.52
Meat, dairy processing	891	–0.61	490	26.46	21	–12.87	1,395	10.53
Dairy products	378	1.71	0	—	0	—	968	0.45
Beverage and tobacco	681	–0.02	336	–3.14	43	26.90	1,019	–1.13
Other processed foods	37	3.31	87	1.50	136	1.02	124	2.04
Nonfood industries								
Mining	9	–5.98	154	–10.51	10	7.46	164	–10.29
Footwear and leather	348	–1.79	128	–5.93	31	1.01	478	–3.01
Textiles and apparel	246	–0.50	154	–5.46	181	3.53	402	–2.55
Non metallic products	882	0.51	109	–0.92	141	0.82	993	0.35
Machinery and equipment	373	0.84	485	0.70	1,945	0.80	858	0.78
Other manufactures	1,332	–0.59	642	–2.46	1,013	1.02	1,976	–1.23
Refined oil and chemicals	1,048	–2.46	875	–6.87	3,003	1.57	1,924	–4.49
Services								
Construction	5,139	1.35	0	—	0	—	5,139	1.35
Electricity	499	0.51	0	—	0	—	499	0.51
Water	407	0.34	0	—	0	—	407	0.34
Business services, rentals, and real estate	1,451	0.86	37	–2.27	148	3.65	1,489	0.81
Trade, hotels, transportation, and communication	8,546	0.28	1,335	–4.14	1,018	4.12	9,902	–0.38
Finance	2,470	0.32	65	–3.44	123	3.12	2,538	0.19
Health and education	2,538	–0.48	0	—	0	—	2,538	–0.48
Administration	1,929	–0.65	0	—	0	—	1,929	–0.65
Other services	3,153	0.58	0	—	0	—	3,153	0.58

Source: Authors' computation using the country model.
*Baseline figures are 2010–2020 average values in billions of Kenyan shillings.
**Figures represent the percent change between the annual average figure of the Doha scenario for each of the varibales and the average annual figure of the baseline.

Table B.4 Changes in Wage per Worker

PERCENT*

Type of Labor	Baseline 2003**	Foreign Savings	Tax–Direct	Tax–Indirect
Skilled	402,147	–0.17	–0.21	–0.28
Semiskilled	65,045	–0.02	–0.08	–0.12
Unskilled	9,206	–0.17	–0.23	–0.29

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.
**For reference, we repeat here baseline figures for 2003 in Kenyan shillings from table 2.9.

Table B.5 The Change in Household Income per Capita, by Income Decile, Foreign Savings Closure

PERCENT*

Decile	Rural	Urban
1	3.22	—
2	2.66	1.96
3	2.37	2.84
4	2.29	0.97
5	2.21	1.03
6	2.35	2.34
7	2.37	2.50
8	2.13	1.92
9	2.26	2.60
10	2.34	2.52
All	2.23	2.36

Table B.6 The Change in Household Income per Capita, by Income Group

PERCENT CHANGE*

Group	Baseline**	Foreign Savings	Tax–Direct	Tax–Indirect
Rural				
Bottom 40 percent	14.23	2.21	2.57	2.70
Middle 40 percent	30.04	2.16	2.45	2.50
Top 20 percent	26.56	2.40	2.58	2.58
Urban				
Bottom 40 percent	0.24	2.42	1.93	1.93
Middle 40 percent	18.52	2.06	2.50	2.40
Top 20 percent	85.56	1.93	3.03	2.83

Source: Authors' computation using the country model.
* Figures represent the percent change between the annual average figure of the Doha scenario for each of the variables and the average annual figure of the baseline.
**Baseline figures are 2010–2020 averages of the total household income of the corresponding population group.

The Global and Country Models

This appendix describes the global model we use to assess the impact of the Doha Round on world prices and the world demand for goods. It also describes the country model, which is used to shock the Kenyan economy, as represented by the 2003 SAM, with the change in world prices and Kenya's own reduction of tariffs.

Description of the Global Model

This appendix describes the structure of the multiregional and multisectoral MIRAGE model, focusing on a few key assumptions, namely those dealing with products' quality ranges, imperfect competition, foreign direct investment (FDI), and the model's dynamic aspects. (For a full description of MIRAGE, see Bchir and others 2002a.)

The Demand Side

Final consumption is modeled in each region through a representative agent,[1] whose utility function is intratemporal. A fixed share of the regional income is allocated to savings;[2] and the rest is used to purchase final consumption goods. Below this first-tier Cobb-Douglas function, preferences across sectors are represented by a linear expenditure system–constant elasticity of substitution (LES-CES) function. Thus, the model accounts for the evolution of the demand structure of each region as income changes, and it assumes that the elasticity of substitution is constant only among sectoral consumptions that are over and above a minimum level.[3]

The model introduces an additional CES nesting level to the standard Armington-Dixit-Stiglitz CES function (Harrison, Rutherford, and Tarr 1997; Adb-El-Rahman 1991; Greenaway and Torstensson 2000), which takes into

account the nature and intensity of competition. The model thus distinguishes between two quality ranges, defined on a geographical basis; goods produced in a developing economy are assumed to belong to a different quality range than those produced in a developed economy. Thereby, goods from a developing country compete directly with goods from other developing countries, but less directly with goods from developed countries.

Total demand is made up of final consumption, intermediate consumption, and capital goods. Sectoral demand of these three compounds follows the same pattern as final consumption. The regional representative agent includes the government. The representative therefore both pays and earns taxes, and no public budget constraint has to be explicitly taken into account; instead, this constraint is implicit to meeting the representative agent's budget constraint. Unless otherwise indicated, this implicitly assumes that any decrease in tax revenues (for example, as a consequence of a trade liberalization) is compensated for by a nondistortive replacement tax.

The Supply Side

Production makes use of five factors: capital, skilled labor, unskilled labor, land, and natural resources. Factor endowments are assumed to be fully employed, and their growth rates are exogenous (zero for land and natural resources, based on UN demographic forecasts for labor), except for capital. Yet, even though savings rates are exogenous, total incomes vary, and the regional and sectoral allocation of savings depends on capital returns, as is explained below.

Installed capital and natural resources are sector-specific, so that their rates of return may vary across sectors and regions. The three remaining factors are perfectly mobile across sectors,[4] but immobile across countries, with the exception of the capital stock, which is partially mobile through FDI.[5]

In a standard fashion, the model assumes perfect complementarity between value added and intermediate consumption. The sectoral composition of the intermediate consumption aggregate stems from a CES function, with the same elasticity as in the corresponding CES-LES for final consumption. For each sector of origin, the nesting is exactly the same as for final consumption, meaning that the sector bundle has the same structure for final and intermediate consumption. Value added is a CES function of land, natural resources, unskilled labor, and a CES bundle of capital and skilled labor. This structure is intended to take into account skill-capital relative complementarity. The elasticity of substitution within the capital and skilled labor bundle is assumed to be lower (0.6) than the elasticity between this bundle and all other factors (1.1).[6]

The model assumes perfectly competitive markets with constant returns to scale in some sectors (for example, agriculture and transportation), but it

assumes imperfect competition, horizontal differentiation of product, and economies of scale in others, in line with Krugman's (1979) theoretical model and Smith and Venables's (1988) applied partial equilibrium model (see also Norman 1990; Harrison, Rutherford, and Tarr 1997).[7] Each firm produces its own and unique variety. The marginal production cost is constant at given factor prices, and production involves a fixed cost each year, expressed as a fixed quantity of output. Within each sector for each region, firms are assumed to be symmetrical. They compete in a Cournot-Nash way; that is, they suppose that their decisions of production do not affect the volume of production of their competitors. Moreover, they rule out the possibility that their production decision may affect the global level of demand through a revenue effect (so-called Ford effects). However, firms take into account their market power, which is the influence they may exert on the sectoral or intra-sectoral price index (given the above-defined demand structure).[8]

Capital, Investment, and Macroeconomic Closure

Whatever its origin, a unit of capital invested in a given region is a bundle, obtained using the same CES nesting as for intermediate consumption. However, the distribution coefficients of the CES functions are different, according to the data. As for intermediate consumption, no factor service is required.

Installed capital is assumed to be immobile. This implies that capital stock adjustment is gradual, the sectoral allocation of investment can be suboptimal (the corresponding loss can be understood as an adjustment cost for the economy), and the rate of return to capital may vary across sectors.[9] Investment is thus the only adjustment device for capital stock. At variance with GTAP (see Hertel 1997), in the model, investment sharing across sectors and countries depends on the rate of return to capital. It is noteworthy that this rate of return already incorporates the influence of many FDI determinants identified in the empirical literature (for example, for a recent survey, Chakrabarti 2001), such as market size, growth rate, and market potential.

Two types of FDI are examined. The first corresponds to the purchase of foreign firms by investors (brownfield investment); the second is the building of new firms (greenfield investment). Both have the same objective, but their consequences regarding the short-run dynamics of the model are not exactly the same; purchasing an existing firm has no effect on the number of firms, contrary to creating a new firm. Based on long-term statistics on FDI, one-third of total FDI is assumed to be in greenfields.

The Dynamic Setup

Adapting to a trade policy shock is neither immediate nor costless. Dynamics are thus useful, in order to be able to study the corresponding adjustment period, which encompasses the short- and medium-run effects.

In addition, a number of effects are dynamic, in the sense that they are intrinsically linked to an accumulation or evolution process. Such effects are difficult to take into account in a static framework (for example, see Baldwin, 1989, 1992; Baldwin and Forslid 1999; World Bank 2001; and Fontagne and Guerin 1997). The model does not link a technological externality to trade, and the savings rate is assumed to be constant over time in each region. Note, however, that capital accumulation is still influenced by income changes, which are proportionately transmitted to savings, and by the net balance of inflows and outflows of FDI.

The model's dynamic is exclusively of a sequential nature; thus, the equilibrium is solved successively for each period. The time span can be freely chosen. Except for capital, the growth rate of production factors is set exogenously. The model does not consider any technical progress in the base case.

In each period, mobile factors adjust instantaneously (subject to the constraint of uniqueness of their unit cost in the economy), while capital stock only adjusts through investment. The model does not include any explicit adjustment cost. However, the sticky adjustment of capital stock and of the number of firms (that is, of varieties) implies that the value of these sectoral variables is not necessarily optimal, and this may induce implicit adjustment costs.

The Country Model

The model used here is based directly on the prototype developed by the Trade, Finance, and Economic Development Division of the United Nations Economic Commission for Africa (Bchir, Chemingui, and Ben Hammouda 2007) for the analysis of African economies. It has been constructed and calibrated using information contained in Kenya's SAM for 2003. It considers twenty representative Kenyan households distinguished by their income levels (deciles) and areas of residency (urban versus rural). The SAM also accounts for forty-three economic sectors and their corresponding commodities, twenty-eight of which relate to agriculture or food industries and six to other manufacturing industries. The model features two types of capital: physical capital and land. Three types of labor are taken into account, distinguished by their levels of qualification. Finally, the model does not make a distinction among trading partners for Kenya; it considers all international trade flows as taking place with the rest of the world.

The model is dynamic and is solved recursively for the period 2003–2020. The current version of the model distinguishes between two modes of production: agricultural production and nonagricultural production. The economy consists of several agricultural sectors and nonagricultural sectors. The following subsections describe its structure:

The Production Block

In each period, within each sector, and for each mode of production, the production function is a Leontief function that combines value added and total intermediate consumption. Agricultural value added is generated by the use of land, capital, and workers. The value-added function is a nested CES function that combines capital and land in the first stage in order to form the composite factor that is combined with the aggregate labor to generate value added. This particular assumption allows the highest level of substitutability between land and capital. Nonagricultural value added has aggregate labor and capital as production factors in a nested two-stage CES function, which takes into account the highest substitution between composite labor and capital in the first stage and among the three types of labor in the second stage.

Public policies are not neutral (Barro 1997; Fan and Rao 2003). Productive activities benefit from externalities coming from public investment in education, transportation and telecommunication, and infrastructure.

To determine intermediate consumption, the model assumes that the various modes of production follow the same shape of total intermediate consumption. The global demand for intermediate consumption in each sector is a CES function of various intermediate consumption goods from various sectors of the economy. If a given good used as intermediate consumption is an agricultural good, firms have the choice between a good that is locally produced and an imported good. This choice is described by a CES function. The imported intermediate consumption good can be reached from partner regions. The model assumes that the intermediate consumption of nonagricultural products is determined by an equation in which nonagricultural demand is a choice between local components and imported components, according to the Armington hypothesis.

Labor Markets

The labor market structure and wages definition assume segmented markets (Agénor, Izquierdo, and Fofack 2003). The model follows Beghin and others (1996) in considering the labor market as a competitive market but with imperfect labor mobility. For each labor category and for each period, the number of workers available in the economy corresponds to its level in the previous year, to which we add the new entrant workers who arrive on the labor market. The wage by category grows every year, depending on the inflation rate and the unemployment rate. For a given salary level, the number of workers by skill engaged by various sectors is the sum of all the labor demands that emanate from the sectors. The rest of the workers remain unemployed.

The Household's Demand

The consumption demand of households follows the same structure as intermediate consumption. First, households make the choice between the consumption of various products. The welfare function adopted in the DIVA model is an LES-CES one. At the second stage, they will make an Armington bargain between local and imported products.

The Government's Demand

The government has two types of spending: current spending and investment expenditures. The public demand for final goods follows the same structure as households' consumer structure. The government's demand for final products is deducted from a decision on cost minimization under the hypothesis of a CES objective function. As for households, in the second-level, the government decides on the origin of the products.

International Trade

The model links to a global model that can generate demand and world price vectors. These vectors from the global model are then plugged into the country model. This way, the exports and the world prices are considered exogenous. The total imports of a given good from a given region are defined as the sum of the demand for imported goods of the different agents of the economy: households, the government, intermediate consumption, and capital good. Given that the demand vector had almost no effect on Sub-Saharan African countries, we implemented the model with only the world price vector.

Investment

Within every sector, the model considers two types of investments: public investment and private investment. The first is exogenous and depends on government choices and priorities. The second is endogenous and depends on the profitability of the sector and the level of public investment. Private investment is determined by these variables: the level of initial capital, net return on capital, domestic interest rate, inflation rate, and ratio of public investments to GDP (see Agénor, Izquierdo, and Fofack 2003). Public investment is exogenous. Its value is added to private investment to obtain the total sectoral investment. The demand for capital goods follows from the investment decisions of firms. The shape of a CES function results from producer bargaining between various capital goods. For capital goods equipment, producers choose between those that are locally produced and those that are imported.

Prices

To determine production prices, the model assumes perfect competition, or the zero profit condition, for all sectors and production modes. The value-added prices are determined as a function of the volume and the process of the factors used by each sector. The link between production prices and market prices is dealt with when considering indirect taxes. The tax rate varies according to the sector and the production mode. Intermediate consumption, capital goods, and public consumption are not subject to direct taxation. Thus their market prices are equal to their production prices. Tariff rates are differentiated by product and type of use (final consumption, intermediate consumption, capital goods, or public consumption). For public consumption, the model assumes that no tax is applied. Thus, the prices of locally produced goods are equal to their production prices, and the prices of imported products are equal to their free-on-board prices. Finally, the hypothesis of the small country retained in the DIVA model implies that world prices are exogenous.

Goods and Services Market Equilibrium

In the nonagricultural market, total demand is made up of final consumption, intermediate consumption, and capital goods and external demand. Total domestic production is made up of local production and exports.

Revenues

Households' revenue has three main sources: labor income, the distributed part of firms' profits, and remittances. Households save part of their revenue and allocate the rest to consumption.

The Public Sector

The model treats the public deficit question by separately modeling public spending and government income. The government has two types of expenditures: investments and current expenditures. Government revenue is defined as the sum of indirect taxes (tariffs and consumption taxes) and direct taxes (taxes on firms' profits and on household income). The public deficit is then defined as the difference between total revenues and total expenditures. This deficit is financed by credits from private banks, from the central bank, and from abroad.

Notes

1. This assumption can be relaxed to study the impact of a decision on poverty (see, for instance, Hertel and others 2001), but it requires detailed survey data, which are available only on a country basis.

2. This simplifying assumption does not allow us to consider the indirect impact of liberalization on savings, through a variation of the return rate of capital, which can significantly alter the effects of opening in a dynamic framework; see Baldwin (1992).

3. The minimum consumption is supposed to be one-third of the initial consumption in developed countries, and two-thirds in developing countries.

4. Factor market rigidity, particularly labor market rigidity, can affect the impact of the liberalization process (McKibbin 1999).

5. These assumptions can be relaxed for some specific studies, for instance, the use of MIRAGE to study the EU enlargement (Bchir and Maurel 2002) allows for migrations of the labor force.

6. According to many studies (for extensive surveys, see Cahuc and Zylberberg 1996), the elasticity of substitution between skilled labor and capital and unskilled labor is close to unity. However, using a CES function preserves the possibility for sensitivity analyses. Otherwise, the true value of substitution elasticities depends on the aggregation level.

7. The transportation sector plays a specific role: It covers both regular transport activities, which are demanded and can be traded like any other service, and international transport of commodities. The latter is a Cobb-Douglas bundle of regional supplies, and it accounts for the difference between the free-on-board and cost-insurance-freight values of traded goods. The same bundle is used for any route. It is employed in fixed proportions with the volume of each good shipped along each route.

8. This means that firms adopt pricing-to-market. They fix different prices for each market. Pricing policy can depend on the consumption destination (households or firms), but this is not the case for MIRAGE.

9. Note, however, that there is no technological difference between capital generations.

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