The Implications of World Trade Liberalization on Agricultural Trade and Food Security: A case Study of Sudan

Imad E. E. Abdel Karim
University of Khartoum, Sudan
Dieter Kirschke
Humboldt University of Berlin, Germany

Abstract

This paper assesses and quantifies the consequences of world trade liberalization in agriculture on trade and food security of Sudan. Sudan, with the agricultural sector as the main sector of economy, is characterized by its small open economy, and is classified as one of the least developed countries. Thus, Sudan becomes more vulnerable to any changes in international agricultural markets. The liberalization of international agricultural trade has a great influence on Sudan's food security and on the whole economy. An extended form of a multi-market model for Sudan is developed and used for the analysis. The model embodies important characteristics of agriculture in Sudan like substitution effects and stages of production. As agriculture is the main sector of Sudan's economy, the model is extended to explicitly integrate some of the key important macroeconomic linkages, and to establish certain feedback effects between agriculture and the macro-economy. The model simulations reveal that a higher world market price would overall lead to measurable gains in food security and agricultural trade of the country. However, when the effect of a higher cost of production is considered, the positive results are reversed. Furthermore, the results of the model simulations show that the domestic policy environment matters very much with respect to the potential impact of world trade liberalization of agriculture. The paper concludes that Sudan should reorient its national policies towards export promotion in order to benefit from the new emerging trading opportunities in world markets. However, to capture a greater benefit from the new environment in the international markets, Sudan should consider and manage carefully all factors, domestically or internationally - e.g. quality standard, loss of preference, dumping effects - that hinder its economic and trade growth.

Keywords: Agricultural liberalization, Sudan, Multi-Market Model

1. Introduction

Agriculture in Sudan is the main sector of the economy. It contributes a major part of the country's Gross Domestic Product (Table 1) and provides a living for a large group of the population by providing almost all the domestic needs of staple food. Furthermore, it is until recently the main source of foreign exchange for the country. Therefore, any changes in international agricultural markets should have an enormous impact on Sudan's economy.

Table 1 Share of agriculture in Gross Domestic Product and total exports of Sudan, 1990-2001 (percent)

	Share in Gross Domestic Product	Share in total exports
1990	30.3	98.0
1991	28.7	98.0
1992	33.9	97.0
1993	38.1	93.0
1994	40.0	90.0
1995	43.1	87.0
1996	45.0	86.0
1997	47.6	87.0
1998	48.7	89.0
1999	42.5	55.0
2000	46.4	25.2
2001	45.6	19.0

Source: Bank of Sudan Annual Reports, various issues

An important characteristic of Sudan is the openness of its economy, and with low per capita income, Sudan is considered one of the least developed countries. Given these characteristics and the heavy reliance of Sudan on agricultural trade to earn foreign exchange, welfare and national food security of the country becomes increasingly exposed to changes in international agricultural markets. The World Trade Organization (WTO) brings about a new agricultural trade environment and rules, which could have a great impact on Sudan's food security.

A decisive advance achieved by the GATT agreement in 1994 is the inclusion of international agricultural trade into the system of GATT rules (Hamilton/Whalley 1995, cited by Bender 1997). The implementation of the results of the Uruguay Round Agreement on Agriculture (URAA) is supposed to bring about significant increases in trade, investment, income and welfare for developing countries (Safadi et al 1996). This

opened up new prospects for the liberalization of world trade considering the interests of exporting developing countries. If the result of the URAA is a significant extension of access in international agricultural trade, developing countries with agricultural exports will benefit from improved export accessibility and higher export prices. As a result of growing export demand and reductions in export subsidies directed against them, these countries will see their terms of trade improve. However, the terms of trade for underdeveloped countries with agricultural imports will correspondingly deteriorate (Bender, 1997). In other words, the scenario of partial liberalization of the world market in agricultural products promises positive effects in developing countries with significant agricultural exports (e.g. Brazil, Argentina, Thailand) and negative effects in countries (specifically African countries) showing heavy structural import dependencies in the agricultural area.

The URAA involves partial liberalization of international agricultural trade. Furthermore, the URAA also embodies the decision to continue the process of reform and liberalization through further negotiations. This means there is a new regime for international agricultural trade established by the URAA. This new regime underlines three main areas: market access, export competition and domestic support. Market access commitments mainly relate to converting non-tariff import barriers into tariffs and to schedule tariff reduction. In case of export promotion, export subsidies are to be reduced in terms of expenditure and volume. Restriction of domestic support is also attained.

The major effects of international agricultural trade liberalization will be higher prices and an allocation shift in production. A reduction in export subsidies will also raise the prices paid by the importers (Bade, 1998). The developing countries have to open their domestic markets to price signals in the world markets as part of their overall economic policy reforms, market liberalization, and market privatization. Therefore, they are more exposed than before to the effects of price instability in the world market (Islam, 1996). Another effect of the agreement on developing countries will be that they will be affected by a reduction in price support, which will lead to a reduction in food surpluses and stocks in developed countries, and hence, a fall in food aid availability.

Concerns exist about the possible negative impact of the URAA on poor countries. These were recognized by the Ministers at the Marrakech Meeting. They made a Ministerial Decision on "Measures Concerning the Possible Negative Effects of the Reform Program on Least Developed and Net Food-Importing Developing Countries." The intent of the Decision was to deal with issues relating to food security that arise from the implementation of the Agreement, and to make sure that food aid could continue to meet the needs of least developed and net food-importing developing

countries. However, rather than setting quantitative targets, the decision encouraged activities under the Food Aid Convention (Binswanger et al. 2000).

The new international agricultural trade environment is expected to have a great influence on food security and agricultural trade of Sudan. Sudan is not a URAA signatory and even if it were to become a member of the WTO, its domestic policy will not be significantly affected, as long as it belongs to the least developed countries, which are exempted from application of many commitments made by the URAA. Therefore, in this paper we concentrate more on the expected impact of potential policy changes in the international agricultural markets due to the implementation of the URAA.

In this paper, we attempt to analyze and to quantify the likely impacts of the world trade liberalization of agriculture on Sudan's agricultural trade and food security under different policy scenarios. The analysis focuses on the welfare effects of world market price changes, the direct impact of the URAA, taking into account trade and domestic agricultural distortions in Sudan. A multi-market model for Sudan's agriculture is used to address these questions.

In addition to the above-mentioned objectives, which denote the direct impacts of the URAA and domestic policy, the paper analyzes the consequences of indirect impacts of the URAA, particularly the higher cost of production that are expected to arise from the implementation of the Sanitary and Phyto-sanitary Agreement (SPS).

2. Description of the Multi-market Model for Sudan

An extended form of a multi-market model for Sudan is developed for analyzing the implications of the URAA on Sudan's agriculture. Multi-market models have in recent years become one of the most widely used tools for the analysis of policies and shocks that involve the expected implications of the URAA (see e.g. Goldin and Knudsen, 1990; Dixit et al., 1992; Hartmann et al., 1994) or to measure liberalization effects of agricultural trade on both developed and developing countries (Kirschke et al., 1996). The model is a standard static model that assumes perfectly competitive markets, homogeneity of the products and the small country case. The model has been implemented and solved using Excel. The model embodies different important characteristics of the agriculture in Sudan like substitution effects and stages of production in which the linkages between input and output are considered.

The supply and demand system in the model is derived from a reduced form Cobb-Douglas function. The derived demand equation for products used as intermediate inputs is captured by input-output coefficients. In specifying supply and demand

functions for each product, domestic prices for one market help to determine the quantity supplied and demanded not only in that market but also in the other market through cross-market price linkages.

The parameters of the supply and demand equations are calibrated so as to reproduce the base year 1995. To adjust the calibration procedure, an effort has been made to impose some standard microeconomic consistency on the initial sets of supply and demand elasticities, which are obtained from international sources and expert knowledge. This means that certain microeconomic requirements are imposed in order to make the predetermined elasticity sets comply with microeconomic theory. Symmetry and homogeneity conditions are imposed on the supply side; and symmetry, homogeneity and adding-up conditions on the demand side (see Kirschke and Jechlitschka, 2002; von Witzke et al., 2000; Wahl et al., 2000; Weber, 2000).

Price transmission equations in the model establish links between the domestic price, the producer price (for producers of exportable products and of import-substitute products), the consumer price and the world market price taking into account taxation or subsidization policy.

The model provides welfare analysis about the distributional impact of price or policy shocks. In addition to that, some national food security indicators like the self-sufficiency ratio, per capita consumption and the ratio of total exports to food imports have been incorporated in the model to provide an overview of national food security implication of any policy shock.

Furthermore, as agriculture is the main sector of the economy of Sudan with extensive forward and backward linkages with the rest of the sectors of the economy, the model is extended to explicitly integrate some of the key important macroeconomic linkages, and to establish some feedback effects between agriculture and the macro-economy, particularly the effect of growth in the GDP on per capita income. In fact, the need for addressing agricultural liberalization in a multi-sector or macro-economic framework would require a general equilibrium approach, which takes into consideration the inter-sectoral effects and macroeconomic linkages, but the lack of relevant data and the complexity precludes the application of such an approach in case of Sudan.

The agricultural commodities considered by the model represent the main agricultural export and food import commodities in Sudan.

The final structure of the model is represented by a flowchart in Figure 1. The figure provides a graphical overview of the basic structure of the model. Lines and arrows show the direction of the linkages. At the top of Figure 1 the supply system is

determined through producer prices and the commodities covered. The producer prices are linked to the international market prices and are set to be affected by two factors: the government intervention in the domestic market (taxes or subsidies) and the changes in the world market prices resulting from the implementation of the URAA. On the other hand, the demand system is set to depend on the consumer prices, prices of competing products and per capita income. Government policies and movements in the international market also affect consumer prices. An important advantage of the model is that per capita income is not considered as constant (exogenous variable), but is determined inside the model (endogenous variable). It is determined by dividing the GDP by total population. The differences between supply and demand quantities determine the model net trade. Moreover, the GDP, the balance of trade, the balance of payment and government revenues are incorporated in the model to give an indication of likely impacts on the macro-economy.

Figure 1 Generic structure of the Sudan multi-market model (SMM)
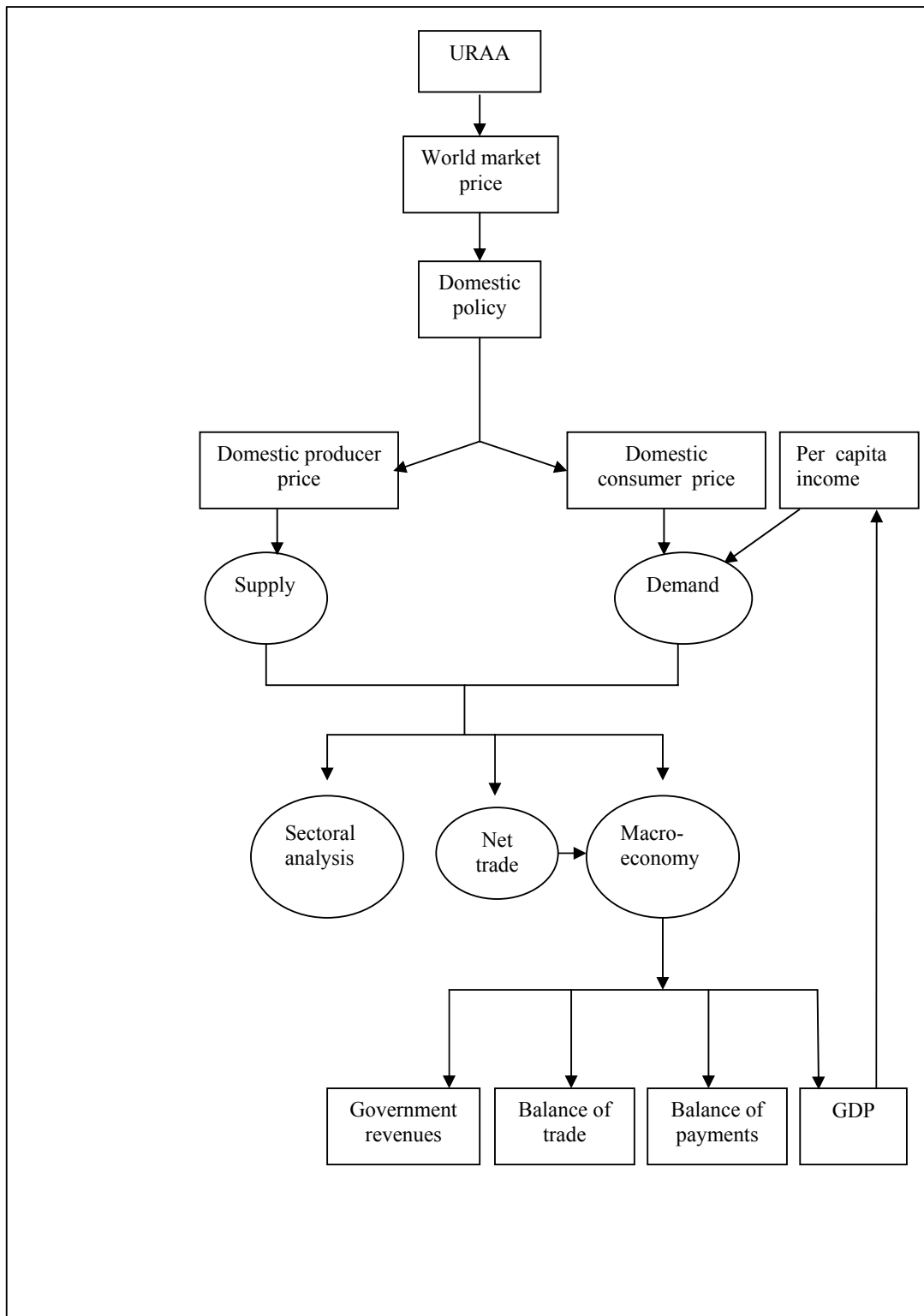
Source: Abdel Karim (2002)

3. The Scenarios

With the aid of the modeling approach, the following policy scenarios are formulated to address the specific objectives of the paper, mainly to analyze the impact of world market price changes and higher cost of production on Sudan's food security and their consequences for production, consumption, prices and welfare of the country.

The different scenarios developed are contrasted principally to the baseline scenario. The following scenarios are investigated:

a. Baseline scenario (B):

The baseline scenario replicates production, consumption and policy conditions prevailed in the base period. B is used as a point of reference for the subsequent simulated scenarios.

b. World market price changes scenario (W):

This scenario depicts the expected direct impact of world trade liberalization, which is represented by world market price changes, on Sudan's agriculture and food security under current policy conditions in the base period.

c. Higher cost scenario (C):

The scenario combines the expected direct and indirect impact of world trade liberalization on Sudan's agricultural trade and food security. The combined impact of agricultural world market price changes (direct impact) and higher cost of production (indirect impact) are simulated in C under current policy conditions in the base period. The higher cost of production is simulated by a supply shift of 5 percent.

d. National policy scenario (P):

In this scenario, scenarios W & C are simulated under the assumption of free trade.

4. Selected Results

The simulation results of the world market price changes scenario without domestic policy reform indicate that the increase of world agricultural prices would overall lead to measurable gains in Sudan's agricultural trade and slight improvement in national food security. The exports of main agricultural commodities will increase (Figure 2) due to the expansion in domestic production leading to a positive growth rate in national income, recovering of the country's balance of trade and to an increase in government revenues. The imports of food products slightly decrease in terms of quantity as the domestic production of import substitutes increases. However, the higher world market prices increase the food import bill of the country. The national food security, a major concern for Sudan, slightly improves in terms of food self-sufficiency, the ability to import food and the per capita consumption of the main food products, namely cereals, livestock products and sugar, due to the increase in the income and in the foreign exchange earnings (Figure 3). Furthermore, a relatively modest net welfare gain is expected for agricultural producers and the economy of Sudan as a result of the world market price increases (Table 2).

Figure 2 Trade effects for agricultural commodities in the world market price changes scenario (W), absolute change relative to the base period
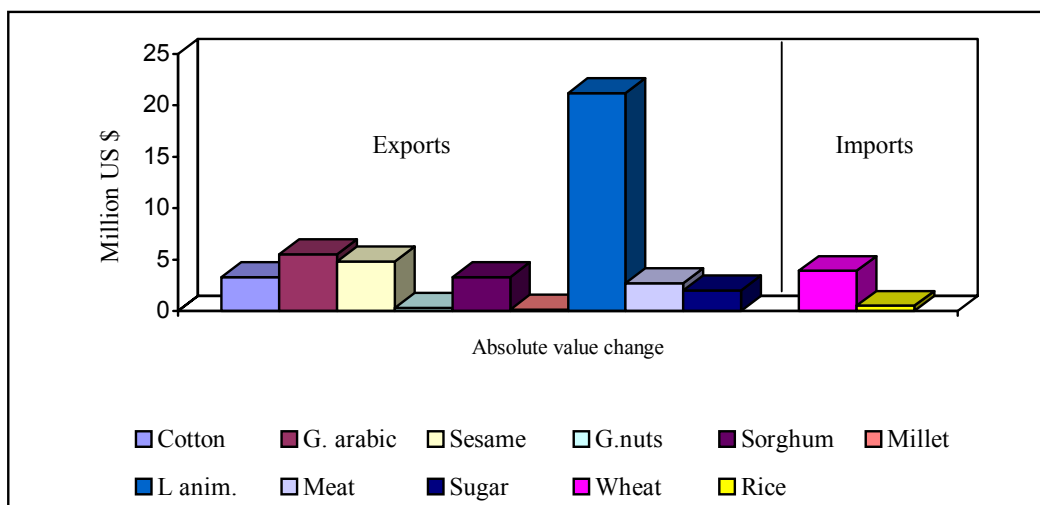
Source: Abdel Karim (2002)

Figure 3 **National food security implications for Sudan in the world market price changes and higher cost scenarios (W & C), percentage change relative to the base period**
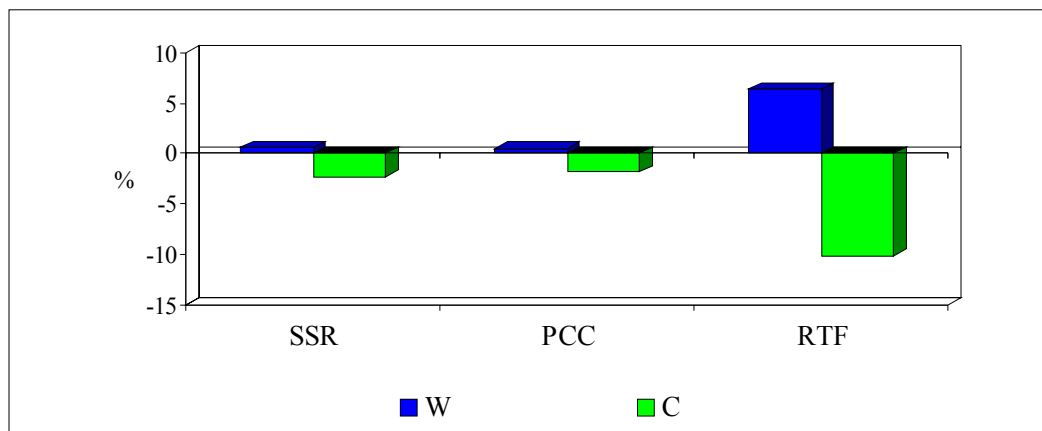
Note: ASSR is the aggregate self-sufficiency ratio, APCC is the aggregate per capita consumption (1000 kg/head) and RTF is the ratio of total exports to food imports
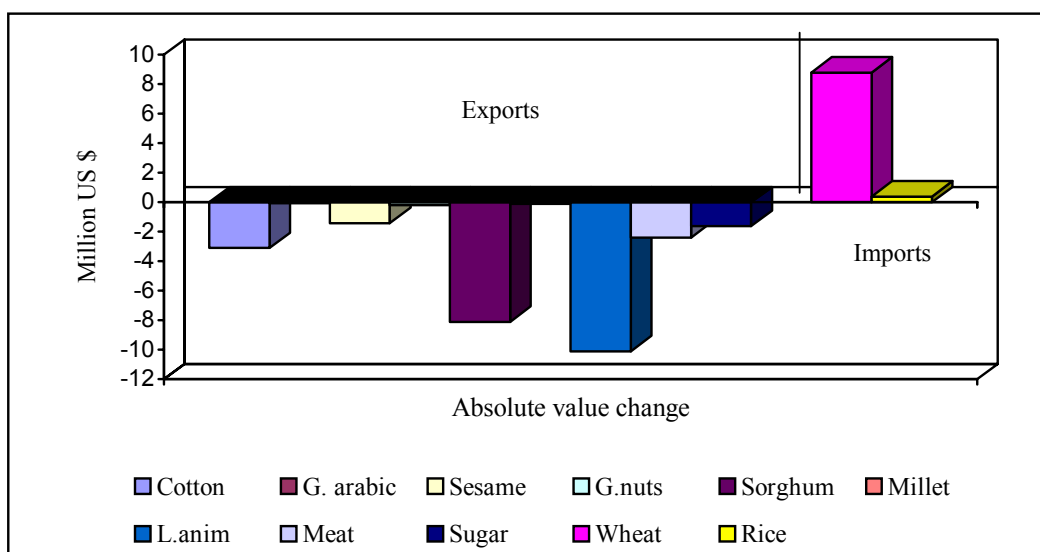Source: Abdel Karim (2002)

Table 2 **Welfare effects in the world market price changes scenario (W), absolute change relative to the base period**

Market	Producer surplus	Consumer surplus	Government budget	Welfare
	Absolute change (m US $)	Absolute change (m US $)	Absolute change (m US $)	Absolute change (m US $)
Cotton	1.7	0.3	0.9	2.9
Gum arabic	4.5	-3.0	2.6	4.1
Sesame	5.9	-1.0	1.4	6.3
G. nuts	12.8	0.8	6.2	19.9
Sorghum	12.1	8.2	5.2	25.6
Millet	4.8	5.4	0.2	10.5
Live animal	133.1	40.1	46.3	219.5
Meat	204.5	-26.1	122.3	300.3
Sugar	14.5	7.0	-0.6	20.9
Wheat	15.3	2.5	0.4	18.3
Rice	0.04	0.1	0.07	0.2
Aggregate welfare change	409.6	34.7	185.1	629.5
Relative to the GDP (%)				5.7

Source: Abdel Karim (2002)

The simulated results of the higher cost scenario (C) indicate that the overall benefit accrued to Sudan from the higher world market prices would be significantly eroded in all terms due to a higher cost of production. At one hand, the exports of agricultural commodities are greatly deteriorated due to the supply shock arising from the higher cost of production (Figure 4). On the other hand, the imports of food products increase as the domestic supply decreases. Therefore, the country's balance of trade registers a declining trend. The improvement in the national food security is totally changed to deterioration. Consequently, the higher cost scenario is expected to result in a welfare loss for Sudan. As a conclusion, the poor quality standard in Sudan, due to external or internal factors, would be considered as the main factor constraining Sudan's exports.

Figure 4 Trade effects for agricultural commodities in the higher cost scenario (C), absolute change relative to the base period
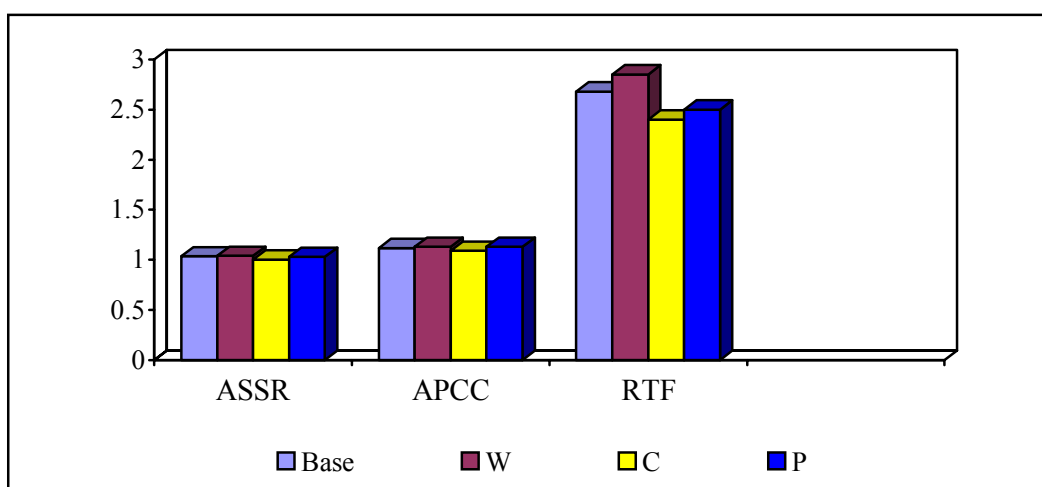

Source: Abdel Karim (2002)

In the domestic policy reform scenario (P), where free trade is considered, the model simulations show that the domestic policy environment matters very much with respect to the potential impact of world market price changes on Sudan's food security and agricultural trade. The gains from agricultural liberalization are most significant. Free trade leads to a significant increase in production, trade, national income, and improvement in national food security and the welfare of the country. The domestic policy reform improves food security of Sudan in terms of per capita consumption of cereals, livestock products and sugar due to the increase in the income and foreign exchange earnings, but worsens it in terms of an increased food import bill as indicated by the lower ratio of total exports to food imports in case of full policy reform (Figure

5). Thus, the overall impact of domestic policy reforms on national food security remains ambiguous, unless the government has other foreign exchange resources to cover the extra food imports or receives food aid. Furthermore, the domestic policy reforms direct the production activities toward commodities that enjoy comparative advantage, as in the case of cotton, and therefore, enhance efficiency of the country in allocating its scarce resources. The only negative impact from domestic policy reforms is expected for the government revenues, which could be compensated from other undistorted taxation sources.

Figure 5   National food security implications for Sudan in the free trade scenario (WP), percentage change relative to the base period.

Note: ASSR is the aggregate self-sufficiency ratio, APCC is the aggregate per capita consumption (1000 kg/head) and RTF is the ratio of total exports to food imports
Source: Abdel Karim (2002)

Within a domestic policy of national food self-sufficiency, where the implication of higher world market price is simulated under the assumption of national food self-sufficiency, especially in cereals, the simulated results show that in order to achieve food self-sufficiency in cereals, their supply must increase and their demand must decrease after raising the domestic price. This has a diverse food security effect and a high welfare loss. The policy has a greater effect on the comparative advantage and the efficiency of the country in allocating its scarce resources. Therefore, the net results of the self-sufficiency policy in cereals could be considered detrimental not only to the competitiveness of agricultural trade of Sudan, but also to its national food security which is the major concern of the policy.

5. Conclusion

Based on the model results, the following conclusions are derived. Sudan should recognize trade as an engine of growth and reorient its national policies towards export promotion in order to benefit from the new emerging trading opportunities in world markets. A reduction in the taxation of the agricultural sector, both direct and indirect, would be a step in the right direction. Sudan should care very much about any intervention by the state - in form of controls, taxes, subsidies, selective protection - which would distort prices and make the resulting allocation of resources inefficient, and thus hindering economic growth. Sudan should direct its food security policy towards production activities that lead to an efficient allocation of resources. With regard to political viability it is obvious that the partial liberalization scenario seems to be a more realistic option in the near future. However, to capture a greater benefit from the new environment in the international markets, Sudan should consider and manage carefully all factors, domestically or internationally - e.g. quality standard, loss of preference, dumping effects - that hinder its economic and trade growth. Sudan should adopt policies that not only emphasize on an efficient allocation of resources and export promotion by motivating producers of export commodities, but also lead to a better quality standard satisfying the requirements of the SPS, diversifying export commodities and opening new markets abroad. The long term solution for Sudan to respond to the demand for its products in the world markets lies in building up trust and confidence of importers in the quality and safety of their food supply systems. This requires the improvement of national food control systems and food quality and safety programs of industries. Such efforts will greatly help to increase the relatively small share of Sudan in international food trade.

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