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Measurement of the effective rate of protection for agricultural commodities in Sudan

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by

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CHAPTER 1. INTRODUCTION

Developing countries are facing many economic problems and are trying to overcome such burdens as low per capita income, low productivity, inflation and internal and external imbalances, to name but a few. Sub-Saharan Africa, in particular, faces serious economic and agricultural problems. The severe drought and famine that hit the area between 1983 and 1985 have forced many of these countries to recognize the need for economic change, especially in the agricultural sector on which most of the Sub-Saharan countries depend.

Agricultural policies, although not the only factors that have contributed to the poor agricultural production in these countries, have had a substantial effect on reducing farmers' incentives to produce. Low producer prices and government intervention in marketing, input allocation, under-investment in agriculture, and inappropriate macroeconomic and trade policies have exacerbated the chronic production problems. This has weakened the countries' ability to cope with negative natural shocks such as drought (Christensen, 1987).

In most countries, there is a general recognition that the situation prevailing in agriculture for the last decade and the economic environment that has existed for the last five or six years must be changed. In 1985, both the Economic Commission for Africa's Joint Economy Report on Africa and the Organization for African Unity (OAU) stressed the importance

of agriculture, the role of mistaken policies in decreasing agricultural output, maintaining inefficient parastatal structures and diminishing incentives for private business. In order to stimulate economic growth, governments need to reform their policies (Christensen, 1987).

The government policies that affect the agricultural sector take two forms: sector-specific policies and macroeconomic policies. These policy instruments are employed by both developed and developing nations according to their respective objectives. The sector-specific policies are policies directed at the agricultural sector. The macroeconomic policies are nonagriculture specific policies that affect the agricultural sector indirectly (Krueger, Schiff and Valdés, 1988). Studies have shown that the effects of macroeconomic policies tend to have larger impacts than sector-specific policies, on the agricultural sectors of most developing countries (Scandizzo and Bruce, 1980).

The government intervention policies have been encouraged by some development theories that regard industrialization as the path to economic growth and development. Interventions are believed to be necessary in order to transfer surplus from the agricultural sector to the industrial sector, erroneously expecting no effect on agricultural production due to the assumed inelasticity of both the long-run and the short-run supply (Scandizzo and Bruce, 1980). Governments also

intervene to protect import-competing firms and incomes of workers. Furthermore, externalities and market failures exist in developing countries and interventions are used to counter these conditions. Export taxes are sources of revenue to the government. Certain groups in developing countries, such as the urban elite put pressure on the government to keep prices low and governments implement certain policies to achieve this goal.

Despite the various reasons given by countries, studies have shown that market interventions have not served their purpose (Scandizzo and Bruce, 1980). Studies by the World Bank in different countries (Argentina, Egypt, Kenya, etc.) have concluded that there is extensive intervention with market forces by governments in developing countries. This has resulted in adverse terms of trade for agriculture, inefficiency and income distribution effects (Scandizzo and Bruce, 1980).

The Sudan is not an exception to this. Despite the importance of agriculture to the Sudanese economy, its contribution has been declining and the Sudan is now faced with chronic economic problems. The poor performance of agriculture is attributed to a number of factors including shortage of modern inputs, problems of transport, credit, marketing and storage and institutional organizational problems. Some agricultural policies have also contributed

substantially to the difficulties faced by the Sudanese economy (Abdel Salam, 1986).

The purpose of this study is to investigate the extent of government interventions on agricultural market forces in the Sudan and the effect of their intervention on producer incentives, production and the prices of major agricultural crops. In order to understand the extent of government interventions and their effect on the agricultural sector, this study will look at the agricultural sector in the Sudan and some of the policies implemented by the government since the early 1970's. It will then attempt to measure the extent of these interventions using the nominal rate of protection and the effective rate of protection. The latter is a measure of the effects of the protective measures, not only on traded outputs, but also on traded inputs.

CHAPTER 2. LITERATURE REVIEW

This chapter is divided into three main sections. The first section reviews the theory of protection with emphasis on the effective rate of protection (ERP). The second section offers some empirical studies of ERP carried out in various developing countries. The last section reviews a study of protection and government intervention in the case of the Sudan.

Introduction

Studies on government interventions in the agricultural sector in developing countries and their effect on the economy, have shown that these policies are, generally speaking, directed toward certain goals. First, in accordance with some development theories, developing countries have attempted to develop the industrial sector at the expense of the agricultural sector through policies of import substitution and protection of import-competing industries. Resources that could have been used economically in the agricultural sector are directed toward industrialization; the assumption being that such a diversion of agricultural surplus does not reduce agricultural output due to the inelasticity of supply of agricultural products. Second, exchange rate controls and import restriction policies have been exercised to maintain overvalued exchange rates. Third, government procurement policies, export taxation and export quotas have

kept agricultural producer prices low. These policies have also been used with the aim of increasing government revenues and stabilizing prices (Krueger, Schiff and Valdés, 1988). Fourth, pressure groups in developing countries have succeeded in forcing the government to keep prices low; a disincentive for producers. This urban bias in policy making has "kept food prices artificially low in order to benefit politically powerful urban population" (Bale, 1985). Fifth, governments have attempted to provide incentives to producers by subsidizing input prices and investing in capital inputs (Krueger, Schiff and Valdés, 1988). Furthermore, it is argued that developing economies are distorted and government intervention is required "to offset externalities and to rectify market failures" existing in these economies (Bale, 1985).

The government policies affecting the agricultural sector can be divided into two: sector-specific policies and macroeconomic policies. Sector-specific policies are directed at the agricultural sector in the form of administered prices, export taxes and subsidies, import tariff and nontariff barriers, input and credit subsidies and the role of the government in the form of state trade and marketing boards. The macroeconomic policies are nonagriculture specific policies such as monetary, fiscal trade and exchange rate policies (Krueger, Schiff and Valdés, 1988).

Studies have shown that these market interventions have at best, not achieved their goals and at worse, led to a decline in economic conditions in developing countries. The macroeconomic policies tend to have larger impacts on the agricultural sector of most developing countries than the sector-specific policies (Scandizzo and Bruce, 1980).

Government agricultural and macroeconomic policies can affect the agricultural sector in two ways. Agricultural activities are either protected or taxed by these policies. Protection of agricultural products provides an incentive for producers to produce; taxation provides a disincentive. One way to measure the extent of government protection or taxation of certain economic activities is through the calculation of the nominal rate of protection and the effective rate of protection which will be discussed in the following section.

The Effective Rate of Protection

In their study of protection, traditional trade theories have concentrated on trade in final goods. Using the nominal tariff theory and the measurement of the nominal rate of protection (NRP), they have considered only the effect of tariffs on final products. The NRP may be defined as the percentage increase in domestic price over the world market price as a result of the application of protective measures (Balassa, 1971). In the traditional model, which assumes a small country case with two traded goods and two primary

factors, a tariff on a good would lead to a rise in the nominal value of the output of the protected good, a rise in the use of the primary factors and a rise in the nominal and real value added (Bhagwati and Srinivasan, 1973).

$$NPR=(P_i^d-P_i^b)/P_i^b$$

where

P_i^d: domestic price of commodity i

P_i^b: border price equivalent of commodity i, measured at the official exchange rate.

Extensions of the model to more than two primary factors and traded goods and the imposition of more than one tariff change the results in some form or another. For example, in a model with more than two traded goods and more than two primary factors, a tariff on one good will result in an increase in output and nominal value of output. These results cannot be affirmed in the case where there is more than one tariff imposed (Bhagwati and Srinivasan, 1983).

However it is important to consider trade in intermediate goods and raw materials since this includes other factors that determine the measure of protection, thus changing the results of the NRP measures in some cases. Tariffs and other intervention measures not only affect output but also inputs. Thus, there has been an increasing focus on the protection resulting from the protective structure on the domestic value

added in various productive activities (Bhagwati and Srinivasan, 1983). The effective rate of protection (ERP) is the measure that takes into consideration the traded inputs.

Definition

Corden (1966) defines the effective rate of protection as "the percentage increase in value added per unit in an economic activity which is made possible by the tariff structure relative to the situation in the absence of tariff but with the same exchange rates."

Bhagwati and Srinivasan (1973) present two basic definitions of the ERP. One definition, the Corden-Anderson-Naya definition defines the ERP as the proportionate increment in value added per unit output over the free trade value added per unit output.

$$ERP = \left(\sum_{i=1}^{n} p_i^d / \sum_{i=1}^{n} p_i^w y_i\right) - 1$$

where

y_i: net output of good i at unit level of activity involving n internationally traded goods

p_i^d: domestic price of good i

p_i^w: world price of good i

This definition considers only the traded goods components of a productive activity. Nontraded inputs and outputs are either considered as part of the value added or they are

assumed to be non-existent.

Another definition is the Corden-Leith definition which considers separable production functions relating output to intermediate and primary factors.

$$Q = G(\theta(F), M)$$

where

Q: output

M: intermediate factors

F: primary factors

G: concave and homogeneous of degree 1 in θ and M

θ: homogeneous of degree 1 and concave in F

The Corden-Leith definition defines the ERP as the proportionate change in the "price of value added" due to protection (Bhagwati and Srinivasan, 1973).

Balassa (1971) defines the ERP as the percentage increase in domestic value added resulting from the imposition of tariffs and other protective measures on the product and its inputs, over the world market value added. This definition, similar to Corden's definition (Corden, 1966), relates the value added in the presence of a tariff structure to the value added in the absence of tariffs. Thus the ERP does not only depend on the tariff on the commodity produced but also on the input coefficients and the tariff on the inputs.

The Theory of the Effective Rate of Protection

Corden (1966) provides the general equilibrium implications of the ERP concept. Certain assumptions are made in the theory of ERP. (1) Physical input-output coefficients are held fixed and (2) the elasticities of demand for exports and supply of imports are assumed to be infinite. (3) Tradable goods are assumed to remain traded after the imposition of tariffs, taxes and subsidies such that the domestic price of each importable is the foreign price plus the tariff. (4) Total expenditure is assumed to be equal to full employment income through appropriate fiscal and monetary policies. (5) There are no discriminatory trade taxes (including tariffs) and subsidies between exporting and importing countries (Corden, 1966). Corden's objective is to determine the effects of a tariff structure on resource allocation.

Corden (1966) takes a simple case of one importable product j and one importable input i (later extended to include exportables).

$$EPR = (\acute{V}_j - V_j) / V_j$$

where

V_j: value added per unit of j in activity j in the absence of tariffs

V_j': value added per unit of j in activity j in the presence of tariffs

with $V_j = p_j\ (1 - a_{ij})$

and $V_j' = p_j\ [(1 + t_j) - a_{ij}\ (1 + t_i)]$

where

p: price of a unit j in the absence of tariffs

a_{ij}: share of i in cost of j in absence of tariffs

t_j: net effect on tariff or export subsidy and any production tax on industry j

t_i: net effect of tariff or export subsidy on input i with any consumption tax on industry j

Thus the ERP for traded goods may be expressed as

$$ERP=(t_j-a_{ij}t_i)/(1-a_{ij})$$

This can be extended to include many importable and exportable outputs and inputs into any product j, with the exclusion of nontraded inputs.

$$ERP=(t_j-\sum_{i=1}^{n} a_{ij}t_j)/(1-\sum_{i=1}^{n} a_{ij})$$

For exportables, an export subsidy is the equivalent of a tariff for importables, i.e., it raises the internal price of a product and an export tax is the equivalent of an import subsidy. The absence of nontraded inputs is still assumed.

Taking into consideration consumption and production taxes and subsidies, in the equation, only net effects of tariffs and export subsidies are considered. This results from

the fact that consumption taxes on finished goods do not affect ERPs. Consumption taxes on inputs have the same effect as tariffs on inputs, i.e., they increase input costs and as a consequence decrease ERPs. Production taxes on goods, on the other hand, like import subsidies or export taxes, reduce ERPs. Production taxes on inputs reduce protection for the input but have no effect on ERP for the industry (Corden, 1966).

The ERPs can be equal to zero or take positive or negative values. Positive ERP indicates that the value added per unit at domestic prices is greater than what prevails in the international market and at a parity rate of exchange. This means that the industry is protected, that is, government policies encourage the expansion of the product through a positive ERP. The opposite is true for the case of a negative ERP. Domestic value added is less than that which prevails in the international market (in a free trade situation) and thus production is discouraged (Bale, 1985). The ordering of the ERPs on a scale shows the direction in which resources are pulled between activities producing traded goods as a result of protective policies. Assuming normal nonzero substitution elasticities in production, this results in the reallocation of resources from lower protection industries to higher protection industries, depending on the rate of factor mobility (Valdés, 1973). This is the production effect of the

protective structure which depends on the scale of ERP and on production substitution elasticities.

The ERP can also be compared to the NRP. An ERP that is larger than the NRP indicates that subsidization of inputs has offset the taxation of the output. When ERP and NRP estimates are approximately equal, this indicates that the prices of nontraded inputs have been rising faster that prices of the traded inputs (Dethier, 1988).

The Net Effective Rate of Protection (NERP)

Since the analysis of the ERP deals with comparisons between domestic and international prices, the question of the appropriate exchange rate to be used arises. With the presence of tariffs, an exchange rate that is lower than that which prevails in a free trade situation, may be required to maintain a balance of payment (BOP) equilibrium. As a result of lower exchange rates, prices of imports are lower and the extent of protection declines. Thus the exchange rate under protection tends to be overvalued. This understates the discrimination against exports and overstates the extent of protection (Balassa, 1971).

Corden (1966) introduces a nontraded good, with the assumption of constant price,into the analysis; in the general case of many nontraded goods, an average price level is assumed to be held constant. Resources would move toward protected industries and away from the nontraded good and away

from taxed industries and toward the traded good. In the case of consumption, demand would move toward the nontraded good from goods with positive nominal rates and the reverse is true for goods with negative nominal rates. This would lead to internal imbalance (excess demand for or supply of nontraded good) and external imbalance (balance of payments surplus or deficit) since we assume aggregate expenditure is maintained at full employment income. An exchange rate adjustment is needed to maintain external and internal balance, assuming significant production-substitution and consumption-substitution relationships among traded and nontraded goods.

A balance of payments (BOP) surplus and excess demand for nontraded goods requires exchange rate appreciation to restore the balance. This provides a negative ERP for traded goods (Corden, 1966).

The net effective rate of protection (NERP) adjusts for overvaluation of exchange rate compared to the free trade situation (Balassa, 1971). The exchange rate adjustment in the calculation of the ERP i.e., NERP, when compared to the ERP will provide a measure of the incentive or disincentive to production contributed by the exchange rate (Bale, 1985). Corden (1966) states that the NERP "indicates the full effects of a protective rate structure on resource allocation" i.e., whether an activity is protected or taxed relative to nontradables. The extent to which the exchange rate is

adjusted depends on the domestic and foreign elasticities of the demand and supply of tradables. The exchange rate adjustment provides the macroeconomic effect of government policies. Thus the ERP adjusted for exchange rate overvaluation will give the total protection. To determine the direction of change in value added, the protection relative to both the nontraded goods and other traded goods is taken into consideration (Corden, 1966).

Nontraded Inputs

The nontraded sector is affected in three ways by the protective structure. Positive protection of traded goods leads to additional demand for nontraded inputs; demand will divert from finished traded goods with positive nominal tariffs or export subsidies to nontraded goods; the protected traded goods industries will attract the primary factors away from the nontraded sector (Corden, 1966).

With the introduction of nontraded inputs into the model, an important question arises as to how to treat these nontraded inputs. When an industry is protected, there is an increased demand for nontraded inputs. Nontraded inputs can be treated in either of two ways. One way is to treat them as any tradable input with zero duties. The second way is to treat them as primary factors or as value added by primary inputs (Bruno, 1972). Treatment of nontraded inputs as tradable inputs arises from defining ERP as the effect of

tariff structure on value added. To obtain value added, all inputs, whether traded or nontraded, should be excluded. Treatment of nontraded inputs as primary factors is explained by the fact that the protection of traded goods represents protection for primary factors and industries producing nontraded inputs used in the production of the traded goods.

According to Corden (1966), nontraded inputs should be treated as primary factors and not as traded inputs. This is based on the fact that nontraded inputs do not have infinite elasticities such that increasing their quantities will lead to higher costs and this violates one of the assumptions of the protective structure. Thus comparing protection of traded goods relative to nontraded goods does not mean the inclusion of all nontraded goods since protection will have led to increase in relative prices. Resources will then move toward the nontraded industry which produces inputs for the protected traded industries (Corden, 1966). Value added per unit would then be defined as value added by primary factors plus value added by nontraded inputs.

Multiple Exchange Rates

The question of multiple exchange rates may also be incorporated into the analysis of protective structure especially when dealing with developing countries. Different exchange rates on imports and exports can be converted into nominal tariffs, import subsidies, export taxes and subsidies.

Thus, if the official rate is higher than the exchange rate applied to imports, this may be regarded as an import subsidy. In order to determine the direction in which resources are moved between traded goods, ERPs are calculated using multiple exchange rates. An equilibrium exchange rate that would achieve the same BOP result as that which prevails under multiple exchange rates must be estimated. The ERPs are then restated in relation to this equilibrium exchange rate. The resulting NERPs will determine the effect of the multiple exchange rates on the movement of resources between the traded and nontraded sector (Corden, 1966).

Thus in calculating the ERP, we must take into account not only protection relative to nontraded goods but also the exchange rate effects of a protective structure. A positive NERP implies that an industry is protected relative to nontraded goods and resources move toward that industry. The reverse is true in the case of negative NERP (Corden, 1966). The total protection is positive protection with the appropriate exchange rate adjustment. The change in value added depends on protection relative to both nontraded goods and other traded goods. Substitution relative to nontradables and to other tradables determines the total protection of an industry.

Extensions to the ERP Model

Corden (1966) extends the model of protective structure to incorporate the treatment of primary factors, labor and capital, as inputs and how to include costs in the measurement of the ERP.

Another extension to the model is the relaxation of some or all of the assumptions stated earlier. The ERP can be measured in the case of input-output coefficients not being fixed or when substitution exists between primary inputs and material inputs. This will tend to overstate the results of ERP measurements (Corden, 1966).

Furthermore, the model can be extended to analyze the effect of foreign tariffs on the allocation of resources in the country under study. Tariffs on tradables of the foreign country have the same effect as an export tax (assuming no terms of trade effects). Foreign input coefficients can also be used to calculate the ERP for a country, preferably for countries with similar production functions and price ratios (Corden, 1966).

The analysis of the extent of intervention and its effect on product prices is extended in some studies by measuring the effect of price changes on production and consumption and by calculating the reallocation of income that results from intervention. By making such calculations it is possible to identify those groups who gain and those groups who lose from

intervention and to measure the extent of gains and losses.

Objectives of the ERP

The objective of the ERP theory is "to seek a concept of protection that, in the presence of tariff structures involving imported intermediate goods, would be able to perform analytically the same role that nominal tariffs perform in the nominal tariff theory i.e., predict the changes in gross output, nominal value of output, primary factor allocation, real and/or nominal value added" (Bhagwati and Srinivasan, 1983).

Thus, using the same approach as the nominal rate of protection, it is necessary to devise a "price" of value added, as an index to rank different activities and to predict changes in quantity of value added (Bhagwati and Srinivasan, 1973).

ERPs are useful in policy analysis because they can be used to compare the effect of price interventions across commodities and to give an indication of the direction of resource movements not only within the agricultural sector but also between agriculture and other sectors of the economy (Bale, 1985).

Different trade theorists have used alternative ways to define the objective of the ERP. According to Bhagwati and Srinivasan (1973), Corden (1966) is concerned with the prediction of gross output, Bhagwati and Srinivasan (1971)

with predicting gross outputs and primary factor allocations and Bruno (1973) with real value added, gross outputs and primary resources shifts.

Corden (1971) argues that for the ERP approach to be applicable, certain assumptions must be set. If these assumptions are violated, and the model loses its simple nature, it is no longer possible to obtain neat results. Bhagwati and Srinivasan (1973) confirm Corden's conclusion. In their general equilibrium analysis of the ERP, they conclude that, as a drawback of the ERP, the measure of the ERP analogous to the nominal tariff theory does not exist. "The ERP index works over a narrower range of sufficient conditions that the nominal tariff theory". Except when the Corden-Leith definition is considered where the production functions relating output to primary factors and intermediate inputs are separable, the ERP indices are limited in predicting primary factor reallocation and gross output changes.

Some Empirical Studies of NRP and ERP in Developing Countries

Studies have confirmed that there is extensive government intervention with the market forces in developing countries. To determine the extent and the effect of intervention, both the NRP and the ERP have been calculated for a selection of developing countries.

One of the earlier studies was carried out by Balassa (1971) where the structure of protection for seven countries

was estimated. A comparison between the different countries was provided with estimates of average NRP and ERP for export industries, import-competing industries; each of these categories further divided into primary and manufacturing activities. They considered interindustry patterns of protection based on calculations using actual exchange rates and then using exchange rates adjusted for overvaluation compared to the free trade situation. They showed that there were some variations of differences in the ranking of industries by rates of nominal and effective protection among industries but substantial differences in the magnitudes of nominal and effective protection for individual industries.

The protection pattern within the manufacturing sector among all the countries showed that effective rates were generally lowest on primary commodities and highest on consumer goods, with the intermediate goods and machinery placed within that range. Most of these countries exported primary commodities and the negative protection of these primary commodities resulted in the discrimination against exports. In some countries, import substitution was favored over exporting in manufacturing industries.

Valdés (1973) examined the effect of trade policy on the agricultural trade of Chile between 1945 and 1965. Chile moved from a net exporter of agricultural products prior to World War II to a net importer. Valdés' hypothesis was that a

the trade gap that existed in Chile was largely due to the commercial policies implemented especially in regard to exchange rates, price control, export quotas and high prices of some inputs originating in highly protected industries. Valdés used an extension of the theory of effective protection that considers the explicit effects of exchange rates, domestic price controls and import duties. The study measured the rate of protection for several agricultural activities in Chile.

In this study, the effective rates of protection were estimated using a "fixed proportions" production function in which the elasticities of factor substitution were zero. The analysis covered five products: wheat, beef, wool, barley and lamb. The implicit tariff was calculated for each year from 1947 to 1965. The values obtained indicated that production of wheat, beef, wool and lamb were subject to negative effective protection during the entire period. Barley production was the only activity without negative protection and the one subject to the greatest instability. Thus, Valdés concluded that the negative protection of the agricultural sector, due to the type of commercial policies adopted, resulted in the trade balance deficit of the agricultural goods.

The World Bank conducted several studies on various developing countries to investigate the effect of government

policies on agriculture. Scandizzo and Bruce (1980) attempted to research the extent of government intervention in developing countries. The method used included, among other measures, the NRP, the ERP and the domestic resource cost. The six country study confirmed that there was extensive interference by governments in developing countries with market forces and this had resulted in turning the domestic terms of trade against agriculture. It had also led to adverse effects with respect to efficient allocation of economic resources and distribution of income.

Another World Bank study by Bale (1985) studied the differences in agricultural performances among five different countries and attempted "to identify common policy-induced causes of the inhibited development of food systems in developing countries". Again NRP and ERP were used to measure and evaluate the effects of government intervention. The study revealed that there was massive intervention by government in production pricing and distribution of food in all of the countries studied. This had given rise to internal price distortions for domestic products and between domestic and international prices of the same product. These distortions had serious implications on the economy in terms of allocation and efficiency. However, the study showed that the government controlled production, distribution and pricing of food, not as a source of revenue, but as a result of a

distrust in market mechanisms.

A third study by the World Bank on the effect of agricultural pricing policies on the major agricultural crops in Egypt, using NRP and ERP measures, revealed the same results, i.e., that producers of major crops were taxed throughout the period under study (1960 - 1985) by means of direct and indirect price interventions. Comparisons between the levels of nominal and effective taxation of producers did not show any significant difference. The study emphasized the importance of exchange rate and trade policies as an instrument of taxation of agricultural producers and subsidization of consumers. External policies had negative effects on the production of agricultural tradables especially during the first decade of the period under study (Dethier, 1988).

Jansen (1988) calculated the NRP and ERP for the major crops in Zambia for the period 1966 - 1985. Results showed that the net effect of agriculture-specific policies and macroeconomic policies provided a disincentive to production of the major crops. There was an increase in these negative rates over time, and therefore an increase in the disincentives for agricultural producers. The agricultural sector was taxed highly during the post-independence period through price intervention policies on agricultural output and inputs.

In both the studies in Egypt (Dethier, 1988) and Zambia (Jansen, 1988), the value added approach was used due to the

unavailability of data on input-output coefficients.

Krueger, Schiff and Valdés (1988) measured the effects of the sectoral and economywide policies of eighteen developing countries for the period 1975-1984 using direct, indirect and total NRPs. Results showed that the effects of the macro-economic interventions were larger than the direct effects, whether the latter was positive or negative. Direct policies provided protection for food production in about 70% of the countries studied. On average, food imports were subsidized while exports were taxed. The indirect policies had negative effects and in the case of imported food products, they offset the positive protection provided by the direct policies. With indirect interventions, as with direct, exports had been taxed. The overvaluation of the exchange rate lowered the price of tradables relative to nontradables thus reinforcing the taxation of agricultural importables.

A more recent study of the effects of exchange rate and trade policies on agriculture was carried out in Pakistan (Dorosh and Valdés, 1990). The study attempted to quantify the "direct effects" of agricultural policy interventions and the indirect effects of economy-wide trade and macroeconomic policies on the agricultural sector. The macroeconomic policies in the form of exchange rate and trade policies, had a larger impact on the agricultural price incentives. This confirms the findings of Krueger, Schiff and Valdés (1988).

In some cases, it changed the direction of protection provided by the direct agricultural policies. The five major agricultural products were taxed consistently during the 20-year period under study (1960s to early 1980s). As a result, production of these crops suffered. Indirect effects taxed producers and subsidized consumers of most food crops and cotton. These policies resulted in lower overall agricultural growth.

The Structure of Protection in the Sudan

El Badawi (1989) investigated the effect of government intervention in the agricultural sector in the Sudan using the nominal rate of protection (NRP). El Badawi provided calculations for the direct nominal rates of protection (NRPD) which measure the effect of price controls, export taxes or quotas and other factors directly affecting the price of agricultural products. The indirect nominal rate of protection (NRPI) was used to measure "the effect of the disparities between the official exchange rate from its equilibrium and the intertradable effect of trade policy on price" (El Badawi, 1989). El Badawi estimated the extent of government intervention through the NRP for six major agricultural tradables in the Sudan namely cotton, groundnuts, gum arabic, sesame, food grains (a weighted average of sorghum and millet) and livestock (a weighted average of sheep and cattle) from 1970 to 1986.

For the NRP calculations, El Badawi used

$$NRPD = \left(\frac{P_{FI}}{P_{NA}} - \frac{P_{BI}}{P_{NA}}\right) / \frac{P^{*}_{BI}}{P^{*}_{NA}}$$

$$NRPI = \left(\frac{P_{BI}}{P_{NA}}\right) / \left(\frac{P^{*}_{BI}}{P^{*}_{NA}}\right) - 1 = \left(\frac{P^{*}_{NA} E_0}{P_{NA} E^{*}}\right) - 1$$

$$NRPT = NRPD + NRPI = \frac{(P_{FI}/P_{NA})}{(P^{*}_{BI}/P^{*}_{NA})} - 1$$

where

P_{FI}: domestic producer price of a tradable agricultural product (adjusted for transport, storage and other marketing costs)

P_{BI}: border price P_I^* evaluated at the official exchange rate E_0 where $P_{BI} = P_I^* \times E_0$

PNA: nonagricultural sector price index which consists of a tradable share θ with price PNAT and a nontradable share $(1 - \theta)$ with price PNAH where $PNA = \theta PNAT + (1 - \theta) PNAH$

P_{BI}^*: border price evaluated at the equilibrium nominal exchange rate E^* where $P_{BI}^* = P_{BI} \times E^*$

$PNA^* = \theta PNAT^* \times E^* + (1 - \theta) PNAH$ nonagricultural price index where the price index of the tradable part is evaluated at the equilibrium nominal exchange rate E^* and in the absence of trade policy affecting nonagricultural tradables $PNAT^* = PNAT / E_0 (1 + t_{NAT})$

t_{NAT}: rate of taxes on nonagricultural tradables

NRPT: total nominal rate of protection

El Badawi (1989) uses equilibrium real exchange rates in his calculations instead of the nominal exchange rates. Thus the formula P_{BI}^{*}/P_{NA}^{*} is adjusted to

$$\frac{P_{BI}^{*}}{P_{NA}^{*}} = \frac{P_{I}^{*}e^{*}}{P_{NAT}^{*}e^{*} + (1-\theta)P_{X}^{*}}$$

where e^{*} is the real exchange rate and P_{x}^{*} is the foreign price of agricultural exports. The real exchange rate is defined as

$$e^{*} = \frac{E_0 P_{X}^{*}}{P_{NAH}}$$

Table 2.1: Average NRPD, NRPI and NRPT for major agricultural tradables in the Sudan (PPP Equilibrium)

Commodity	NRPD	NRPI	NRPT
Cotton	-18	-64	-82
Groundnuts	-8	-64	-72
Sesame	-2	-64	-66
Gum Arabic	-15	-64	-79
Food Grain	63	-64	-1
Livestock	-15	-64	-79

Source: El Badawi (1989).

Table 2.2: Average NRPD, NRPI and NRPT for major agricultural tradables in the Sudan (Econometric model RER equilibrium)

Commodity	NRPD	NRPI	NRPT
Cotton	-39	-11	-50
Groundnut	-18	-11	-29
Sesame	-4	-11	-15
Gum Arabic	-41	-11	-52
Food Grain	207	-11	196
Livestock	-36	-11	-47

Source: El Badawi (1989).

Tables 2.1 and 2.2 show the results of the calculations of the average NRPD, NRPI and NRPT for the six commodities under study. NRPD estimates indicate the direct intervention i.e., the percentage by which domestic producer prices differ from the prices that would have prevailed under free trade.

El Badawi revealed that all commodities, with the exception of food grains, were taxed through direct government interventions. This subsidization of food grains implied that the government promoted a food self-sufficiency policy. The degree to which all crops were taxed varied; cotton was taxed the most. The traditional sector's non-cereal agricultural commodities were taxed more than those in the modern sector (with the exception of cotton).

Trade and macroeconomic policies have also had a negative effect on the agricultural sector. These policies, although indirect, have had a larger impact on the sector than the

direct policies. The average indirect tax was 64%, about 5.5 times the average direct tax rate on non-cereal agricultural commodities. El Badawi calculated the NRP using both an Equilibrium Real Exchange Rate model and a Purchasing Power Parity model, obtaining comparable results.

CHAPTER 3. THE AGRICULTURAL SECTOR IN THE SUDAN

The agricultural sector in the Sudan is the most important sector in the economy in terms of contribution to the Gross Domestic Product (GDP), foreign exchange earnings and employment. The sector contributes to about 90% of foreign exchange export earnings, 40% of GDP and provides for 50% of total employment (El Badawi, 1987). Despite its substantial contribution to the Sudanese economy, the agricultural sector has the potential for expansion in production and to contribute further in the economy since less than 10% of the cultivatable land (about 207.4 million acres and less than 50% of the available water is being utilized at the present time (D'Silva and El Badawi, 1987).

The agricultural sector is divided into irrigated, mechanized rainfed and traditional subsectors. A broader dichotomy also used is the modern sector (irrigated and mechanized) and the traditional sector. The irrigated subsector is located in the central northern parts of the country while the mechanized and traditional rainfed sectors are widely dispersed (in the eastern, south-central and western regions of the country). There is a variation in the crops produced in each subsector as is clear from Table 3.1. Both the modern and the traditional sectors produce food and cash crops for local consumption and for export (D'Silva, 1985).

Table 3.1: The division of the agricultural sector of the Sudan

Subsector	Area under Production	Activity	Administration
Irrigated	over 4 million acres	cotton groundnuts wheat sorghum sugarcane	government schemes (parastatals)
Mechanized rainfed	over 7 million acres	sorghum sesame	private and public farms
Traditional	over 9 million acres	sorghum millet groundnuts sesame gum arabic other crops livestock	majority of population (small farms)

Source: D'Silva, 1985.

The irrigated subsector is dominated by large government schemes. Cotton and groundnuts are the export crops while sugarcane and wheat are grown in the irrigated subsector as import substitutes. Sorghum (the staple food crop) is grown for local consumption (D'Silva and McKaig, 1986). Livestock are only raised in the traditional sector where the majority of the population live.

Farmers in the irrigated subsector are restricted in their decision-making in terms of land allocation and use of government provided inputs. The producers in the mechanized and traditional rainfed subsectors operate under more

competitive environments. The government also undertakes the marketing of cotton, sugarcane and wheat in the irrigated subsector while crops are sold commercially in the other two subsectors. Prices are determined in the market in both the mechanized rainfed subsector and the traditional subsector but in the irrigated subsector, the prices are government determined (D'Silva, 1985).

Due to the lack of the data (especially in the traditional sector), this study will focus on the irrigated subsector in general and the Gezira Scheme in particular.

The Gezira Irrigation Scheme

The Gezira Irrigation Scheme, a public scheme, is the largest and the oldest agricultural irrigation project in the Sudan and plays a major role in the Sudanese economy. The area under cultivation in the Gezira Scheme is over 2 million feddans, that is, about 10 per cent of the total area cultivated and about 50 per cent of the total irrigated area in the country. This public scheme is made up of the Main Gezira Scheme (1.1 million feddans) and the Managil Extension (1.0 feddans) and each of these is divided into groups and blocks accommodating a total of 102 thousand tenancies. The size of the tenancy ranges from 15 feddans in Managil which has a 3-course rotation to 40 feddans in Gezira Main which practices a 4-course rotation. About 80% of the tenancies lie in the 15-20 feddan range (Magar, 1986).

The strategic importance of the Gezira Scheme stems from the fact that a significant portion of the country's agricultural production and exports originates in the scheme. About 80% of the extra long staple (ELS) cotton and 40% of medium staple (MS) cotton (Sudan's main export crop), over 70% of wheat and over 30% of groundnuts have been produced in the scheme; this has impacted the country's trade and balance of payments via export earnings, savings through import substitution, and the cost of imported inputs (Magar, 1986). The Scheme was initially established as a foreign exchange earner through the production of export crops and for self-sufficiency through the production of food crops.

The Gezira Scheme was previously run on a tripartite partnership (for the production of cotton); the tenants (the cultivators or farmers), the Central Government and the Sudan Gezira Board (SGB). Each partner had certain responsibilities in the production process and each received a fixed share of net profits. The partners shared the expenses related to production, preparation and marketing of cotton. Expenses were deducted from the total returns on cotton and the net distributed between the three partners in the following manner: tenants 47%, the Government 36%, the SGB 10%, reserves 2%, social services 3% and the local government 2% (Basheer, 1982). The rest of the crops were left up to the tenants and they received all the returns from these crops. This was

known as the Joint Account System and it continued until June 1980 when it was replaced by the Individual Account System which took effect from the 1981/82 season.

Under the Joint Account System, the Government was responsible for the provision of water through the maintenance and operation of the dam and canal systems. The Government also had control over the financial aspects of the SGB, particularly with respect to the procurement procedures for foreign and locally supplied goods and services (Magar, 1986).

The SGB provided a range of services, some of which were paid for by the tenants. The Board was responsible for the management and administration of the scheme, for construction, maintenance and water distribution in minor canals, for certain mechanized farm operations, land clearance and leveling, allocation of tenancies, instruction and supervision of tenants, supply of treated cottonseed, provision of fertilizer, pest control, collection, transportation, ginning, baling and storing of cotton lint before sale, extension of credit and the provision of loans, and for social development within the scheme, such as promotion of social development services, financial contribution for applied research (Magar, 1986).

The tenant was responsible for the management of his holding and the cultivation of the crops. Although there was some tenant representation on various government bodies, the

tenants had limited influence in most decision concerning production such as decisions on rotation of crops, irrigation, pricing policies and post harvest operations, especially with respect to cotton. In addition, the tenant had no power to take any kind of action in cases where the government and the SGB fails to carry out their obligations. Thus, this was not an equal partnership as far as the tenants were concerned (Magar, 1986).

The Joint Account System provided no incentive for the tenants to produce efficiently as the fixed percentage sharing of costs resulted in the efficient producer bearing a larger share of the expenses than the inefficient producer. Tenants therefore put more effort in the production of the other crops using input resources specified for cotton. Both the tenants and the SGB also tried to transfer much of their individual expenses to the Joint Account. This increase in the joint expenses,in addition to the increase in the price of imported inputs, resulted in the decline in net revenue for the three partners. The debt of the tenants was also increasing steadily under the Joint Account System due to the late payment for the purchase of cotton (Ibrahim, 1989).

The Individual Account

In the late 1970's, the Gezira Scheme witnessed a decline in the productivity of all the crops in general and in cotton in particular and a dramatic increase in expenses. This

resulted in the migration of many farmers and the abandonment of their land to find other sources of income. There was also a noticeable change in the structure of farmers in the scheme because of the movement of the younger generations to nonagricultural activities (Basheer, 1982). It was believed that the production relations played a major role in this situation as the Joint Account System (for cotton) prevailing at that time did not give the farmer incentive to produce. The Joint Account System was abandoned for cotton and replaced in 1980, by the Individual Account System and land and water charges for each crop.

The responsibilities of the three partners did not change under the new system. However, the tenant now bears all the expenses of the production of cotton and receives all the revenue after deducting individual expenses and the cost of inputs and agricultural loans given to the tenant. In addition, the tenant pays land and water charges (to the Government and the SGB) (See Appendix A, Table A.5) instead of the percentage that the Government obtained from the net revenue from sale of cotton under the Joint Account System. The land and water charges are not only imposed on cotton but on all other crops grown by the tenant. These charges are flat rates paid annually regardless of production and are determined according to the costs of irrigation and management and the amount of utilization (Basheer, 1982).

The Individual Account System allowed the tenant to treat all crops equally and flexibility and freedom in making production decisions and use of inputs which gave the tenant the incentive to increase productivity and to enjoy higher unshared returns. The tenant is also paid for his crop in one installment as opposed to three installments under the Joint Account System. However, the tenant also bears the risk alone. Furthermore, it is argued that a flat rate for land and water charges is not equitable considering the differences in soil and climatic conditions in various parts of the Gezira as well as the fact that the returns from crops differed (Ibrahim, 1989).

The Individual Account System has proven to be more successful than the Joint Account System. It has led to an increase in productivity, higher efficiency and quality and increased returns for all three parties (the tenant, SGB and the government).

The four main crops that are grown in the Gezira Scheme are cotton, wheat, groundnuts and sorghum, although vegetables are also grown. Appendix A shows production details for the crops grown in the Gezira Scheme. All crops are irrigated with wheat being almost fully mechanized and cotton, groundnuts and sorghum partially mechanized. The SGB is involved in the mechanization process, mainly in the production of cotton. The mechanization of other crops is

taken up by private enterprises (Magar, 1986).

Credit Institutions

Formal Credit

The SGB provides credit to the tenants to finance major production operations such as planting, weeding and harvesting of cotton (D'Silva, 1986). For wheat, the Bank of Sudan provides loans that are administered by the SGB. Before the Individual Account System, expenses incurred in the production of these crops, were deducted from the proceeds of cotton sales. These included land preparation, ridging, purchasing of seeds and fertilizers, transportation and storage, sacks, marketing and cash advances for the payment of agricultural laborers.

The cash advances given to the tenant are usually well below the recommended rates and thus the tenant has to look for other means of financing to supplement the cash advances. Furthermore, these advances are not given to all tenants, nor are they uniform in amount. Because they do not cover the actual costs of cultivation, tenants have used these funds for daily household expenses. In recent years, many tenants have been unable to repay the loans and the government's decision to defer payment has resulted in an accumulation of debt (Magar, 1986).

Informal Credit

The tenant has to rely on his own financial resources for the cultivation of crops besides cotton and wheat. Tenants who do not possess private capital find themselves compelled to use the "sheil" system (mortgage of crops) which involves high real rates of interest (ranging from 60% to 200%). There are several forms of "sheil". The tenant may borrow money and then repay the lender in the form of grain at harvest time or the lender may market the crop for a mark-up. The tenant may also enter into a contract where he promises to deliver a certain amount of the crop to the lender. In this case, if the price of the crop is high, the merchant keeps the surplus and if it is low, he suffers the loss (Ali, 1986a).

It is estimated the 60-90% of tenants practice "sheil" system for sorghum, 45% for wheat and 40% for groundnuts (Magar, 1986). The debts in the informal system seem to be increasing due to the low yields in production and the rising cost of factors of production. The extremely high interest rates have forced tenants even farther into debt. Some tenants have resorted to subleasing all or parts of their land as a way to finance the increasing costs of production especially with crops of a high labor component such as groundnuts and vegetables. The "sheil" system acts as a disincentive to producers as the crop is not enough to cover the amount of the loans.

Another method used to finance production expenses (particularly labor and weeding) is sharecropping, practiced mainly in the case of groundnuts cultivation. About 60% of tenants are involved in sharecropping. After the land is prepared by the tenant, the sharecropper takes over the rest of the farming process from sowing to harvesting (Ali, 1986a). The yield is then divided equally among the tenant and the sharecropper. This system is considered to be better than the "sheil" system in terms of the tenant's ability to have some kind of control over his crop and income. However, both systems result in a substantial reduction in the tenant's income and force him farther into debt. Furthermore, the tenant is not encouraged to improve his crop and yields as the sharing of the proceeds acts as a disincentive (Magar, 1986).

Pricing and Marketing

The Cotton Public Corporation (CPC) is in charge of marketing cotton for export and selling the lint to local textile mills. The CPC, on behalf of the Government, buys all the cotton produced in the Sudan at the gingate at fixed prices. Prices are based on f.o.b. Port Sudan prices minus costs (ginning, transportation, etc.). The grading of seedcotton, ginning, baling and the transportation of lint to Port Sudan is the responsibility of the SGB and the prices paid by the CPC include allowances for the costs incurred by the SGB for the ginning and transportation of cotton lint

(Babiker, 1986). Procurement prices (based on variety and grade) are declared at the beginning of the agricultural season for seedcotton and the tenant is paid according to these prices after deducting cost of ginning, transportation and insurance. If prices of cotton are higher than the declared prices, the increase goes to the tenant later on (Magar, 1986).

The tenant is responsible for the delivery of the seed cotton to the collecting centers of the block. Other crops are sold and collected at the farmgate or taken to the local markets and bartered or sold for cash.

The other crops produced in the Gezira Scheme are the responsibility of the tenant. There are two marketing channels (official and unofficial) for wheat. Through the official channel, wheat is delivered to government authorized mills by the SGB at fixed prices. The Government subsidizes the consumer if the official farmgate prices are higher by paying the difference through the SGB. However, there also exits a free "unofficial" market for wheat where prices are 20-30% higher than the official farmgate price (Babiker, 1986). Although a large portion of the wheat crop ends up in this market, it does not necessarily benefit the tenant because of the "sheil" system (Magar, 1986). The loans for wheat cultivation provided to tenants by SGB are deducted from the proceeds of the wheat delivered to the mills and thus,

tenants are able to avoid repayment of the loans on the portion of the wheat that is sold in the "unofficial" market (Babiker, 1986).

Before 1980, the export of groundnuts, sesame seeds and castor beans was monopolized by the Sudan Oilseed Company which also determined f.o.b. export prices and set annual floor prices for domestic trade. After the abolishment of the Sudan Oilseed Company in 1980, a free export market was established and private merchants were able to sell on the world market. The Sudan Company of Processing of Oilseeds, was established "to compete with private oil mills in the supply of vegetable oils to both local and export markets" (Magar, 1986). The government declares floor prices for groundnuts as a guideline for traders in groundnuts (Babiker, 1986).

Sorghum in the Gezira Scheme is considered to be a subsistence crop, used for household consumption. Any surplus is sold in the local markets (Magar, 1986). Some of the surplus may also be used as payment-in-kind to the laborers hired during the cotton picking season (Babiker, 1986).

Inputs

Among the major inputs imported for the agricultural sector is fuel, 48% of which is used by the irrigated subsector. Gasoline is used for waterpumps, electricity, agricultural machinery and transportation (Ali, 1986b).

Fertilizers, pesticides, insecticides, seeds, jute sacks and machinery are also imported to be used as inputs in the production of crops (D'Silva, 1986). Fertilizers and machinery are provided at subsidized rates to the modern sector which relies heavily on imported inputs. As foreign exchange is scarce, the two subsectors , the irrigated and the mechanized rainfed, have to compete for these inputs. The traditional sector has negligible use of imported inputs.

As mentioned earlier, most of the decisions concerning agricultural operations are made by the SGB, particularly with respect to cropping patterns and agronomic practices. The SGB also carries out operations such as ploughing, pest and disease control, the choice of fertilizer and its mechanical applications for the tenant at his expense. Mechanization is confined to land preparation, carried out by SGB for cotton and by the private sector for the other crops. In recent years, both the mechanization process and the spraying for pest control have been done inefficiently, thus contributing to lower yields (Magar, 1986).

Inputs for cotton production are normally provided by the SGB but inputs for other crops are bought by the tenants from the local markets. Use of fertilizer is restricted to cotton and wheat while use of insecticide is restricted to cotton only (D'Silva, 1986). Treated and tested seeds of extra long Staple cotton and medium staple cotton are distributed to

tenants by SGB. Water is provided to the tenants by SGB at subsidized rates (Ali, 1986b).

Sudan has a poor transportation system in general but the Gezira scheme enjoys relatively better transport providing access to markets. Commercial trucks are used for the transportation of crops to collection centers, mills, etc. Tenants use animal carts for hauling goods shorter distances. The Sudan Railways is used to transport crops and other agricultural commodities to Port Sudan for export (Babiker, 1986).

The Labor Market

Sudanese agricultural labor is characterized by high mobility both to and from the irrigated areas in the North and the mechanized rainfed areas in the East. Migrant workers are mainly from the West of Sudan where lack of water during the dry season (December to June) force labor to look for work in other regions. The peak demand for labor in the irrigated regions (particularly for cotton cultivation) is from January to March and for the mechanized rainfed areas during the months of November and December (Fallon, 1988).

The Gezira Scheme employs a large portion of the seasonal migrant labor. In addition to the tenants and their families, there are workers from the local villages, migrants from Northern Nigeria and Chad living in settlements around the area and seasonal migration workers from outside the area

(mainly from Western Sudan and the Southern Provinces, with some peasants from traditional agriculture in the central and eastern areas as well as some nomadic groups).

Tenants rely heavily upon imported labor for weeding and harvesting of most crops especially cotton (D'Silva, 1986). Migrant labor supply a significant amount of the work done in the Gezira Scheme (about 50% of the total labor force in 1984). Migrants are recruited by both a Central Committee and by representatives of groups of individual workers, in addition to migrant labor who show up at the Scheme during the peak season (floating labor). Transportation to the Gezira Scheme is paid by the recruiter (ILO/UNHCR, 1986).

Migrant labor may start work in the mechanized rainfed farms at the end of the year and then move on to the irrigated areas at the beginning of the next year. There are some laborers, however, who migrate from the West to the East only to the irrigated regions and who have the same employer for years while there are others who work in the Central Provinces during the middle of the year continuing in this manner for years before returning home (Fallon, 1988). Some of the migrant laborers from Western Sudan and Western Africa have settled in camps near the Scheme and these represent a large portion of the seasonal labor (Mohamed, 1986).

Table A.4 in Appendix A gives the picking labor statistics for the Gezira Scheme for the period 1978/79 to

1987/88 divided into family labor, imported labor and floating labor. As is apparent from the table, the total number of available labor is less than the total number of labor required for most years in the Gezira Scheme. This indicates a shortage of labor available, especially during the peak seasons. Poor rainfall and low yields in recent years have resulted in the shift of agricultural labor to other sectors of the economy.

The demand for labor depends on certain factors, including the number of members in the tenant household willing to work, the financial ability of the tenant and the seasonality of agricultural operations. These three factors also determine the labor contract, i.e., the terms on which labor is demanded (ILO/UNHCR, 1986).

The relationship between the tenant and the laborer is not a purely market relationship since factors of kinship, friendship and patronage also enter into the transaction. This affects the amount and form of payment for the labor provided. Laborers in the Scheme are paid both in cash and in kind, usually in the form of sorghum. The wage rate structure is also affected by what is happening in the other agricultural regions. For example, in 1985, a bumper sorghum crop in the mechanized rainfed region resulted in higher wages in that region and thus a shortage of labor for cotton picking in the irrigated subsector (D'Silva, 1986). The government

does not intervene in the mechanism of the private sector labor markets. In 1974, a minimum wage law was imposed but it applied only to permanent workers in the organized sector.

There are certain periods during the year (such as the growth, weeding and harvesting periods) when the tenant requires more labor but suffers problems of liquidity and cash flows. In order to finance cultivation, poor tenants get money by borrowing at high interest rates or by forward selling. Some tenants are forced to supplement their farm incomes by working as laborers on the farms of wealthier tenants.

Government Policies

Agriculture was given priority in the major economic development plans in the Sudan which included the Five Year Plan (1970-1975), extended to 1976/77, the Six Year Plan (1977-1983) and the World Bank Rolling Investment Programs (Abdel Salam, 1986). However, despite the contribution of the traditional sector to foreign exchange earnings and food supplies (50% and 60% in 1984/85 respectively) and the fact that the majority of the population live in this sector, it has been neglected in terms of investment allocations, infrastructure and services. During the Six Year Plan, 80% of the total funds (425 million Sudanese pounds) allocated to the agricultural sector was directed toward the modern sector and only 3% to the traditional sector (D'Silva and El Badawi,

1987).

The irrigated and mechanized subsectors have received about 70% of investment. Public sector investments have been primarily in the irrigated subsector. In the mechanized rainfed subsector, investment has been mainly through private capital especially from the Middle East countries such as Saudi Arabia (El Badawi, 1989). Private capital investment in the agricultural sector has been encouraged by the government (D'Silva, 1985).

Government Policy Instruments

Sector-Specific Policies

Taxes

Agriculture has been viewed as a major source of tax revenue and therefore the agricultural sector has been subject to a number of taxes, both implicit and explicit, on agricultural commodities (D'Silva and El Badawi, 1987). The government extracts about 80% of its revenue from taxes. Export crops are directly taxed via export duties (ad valorem taxes). The development tax (which is basically a manufacturer's sales tax) is an indirect tax imposed on exported commodities. Custom duties (both ad valorem and specific), consumption duties and a defense tax are imposed on imports. There are also other taxes imposed in the form of excise taxes and local taxes (Youngblood et al, 1982).

Cotton, one of the most important cash crops, has been

taxed the most. Implicit export taxes underpriced cotton seed and lint sold to local textile industries and explicit taxes included export duty imposed on f.o.b. prices of cotton. In 1971, a price stabilization levy on all cotton exports was implemented. In addition to these taxes, deductions were made as payment for services rendered such as commission for marketing and preparation charges (Abdel Salam, 1986).

Custom duties were also imposed on inputs such as spare parts and fuel although insecticides and agricultural machinery were exempted. A defense tax, originally a development tax, was levied on all imports with the exception of a few commodities (Abdel Salam, 1986).

Subsidies

The irrigated and mechanized subsectors receive subsidies from the government; the irrigated subsector being subsidized the most. As mentioned earlier, the traditional sector is not subsidized. Subsidies in the mechanized rainfed subsector include subsidized imported inputs through the overvalued exchange rate, low land rent, low fuel prices and cheap credit (with high rates of default) (Abdel Salam, 1986). The government also subsidizes some consumer commodities such as wheat bread, sugar and petroleum products. These items constituted about 60% of the import bill between 1975 and 1980 (D'Silva, 1985). However, the government has made attempts to reduce these subsidies (El Badawi, 1989).

Price Regulations

Price control is an important instrument in the agricultural policy of the Sudan. Government control involves complete regulation of some commodities through public monopolies which fix producer prices such as the Cotton Public Corporation, the Gum Arabic Company and until 1981, the Oil Seed Company. Floor prices are announced by the government for cotton, gum arabic, groundnuts, sesame and sorghum at the start of every season. In the traditional rainfed subsector, auction market prices prevail for sorghum and millet. In the remote traditional regions, there is a monopsony on agricultural products and thus traders are able to dictate the price. Wheat prices in the irrigated subsector are determined on the basis of import parity but the government determines the prices of wheat and wheat bread (Abdel Salam, 1986).

Other Agricultural Policies

The irrigated subsector experiences the most in terms of government interventions. In addition to setting producer and input prices, the government also controls land allocation and imposes fixed cropping patterns (El Badawi, 1989). It provides specific services to the subsector in the form of irrigation water, land preparation and fertilizer. As mentioned before, the irrigated subsector also had a joint account where cotton proceeds, net of costs, were distributed among the three partners - the government, the tenants and the

SGB. This was changed in 1981/1982 and replaced by individual accounts which provided producers with more incentives (D'Silva, 1985). Fertilizers are also restricted by the government to use on cotton and wheat.

Macroeconomic Policies

Sudan's Foreign Trade Policies

The Sudanese government has exercised an extensive system of import restrictions and fixed multiple exchange rates. These control and regulatory measures include high import tariffs, import and export quotas (tight licensing) and banning of certain imports. Table 3.2 gives a detailed summary of government policies concerning exchange rates and trade from 1970 to 1987 (adapted from Hassan, 1989).

Exchange rate policies have had a major effect on producer incentives in the agricultural sector. The government aimed, as in many countries, at industrial substitution. After the expansionary policies of the mid 1970's, financed by deficit financing and external borrowing, the Sudan's economic difficulties increased. The government tried to direct the foreign and payment regime toward increasing government revenues, improving the balance of payment deficit, encouraging remittances from Sudanese nationals working in other countries and export promotion (El Badawi, 1987).

Table 3.2: Exchange rate and foreign trade policies in Sudan

Year	Trade and Payment Regimes
1970/71	Strict import against payment system. All foreign exchange proceeds from exports are to be surrendered to the Bank of Sudan. All transactions at the official rate (OR).
1972	Exchange tax/subsidy (ETS) introduced to all exports except cotton and gum arabic.
July 1973	Premium rate for remittances of Sudanese Nationals working abroad (RR).
Jan. 1974	RR adjusted, nil value system for imports introduced.
May 1975	Gum arabic exports moved to ETS rate (ER_1).
June 1978	1st devaluation, ER_1 adjusted.
Mar. 1979	RR adjusted.
July 1979	ETS extended to cotton (CN-INP).
Sept 1979	2nd devaluation, more liberalized trade (nil-value system abolished), unification of exchange rates (all ETS and RR removed), a parallel rate of LS 0.80 for selected exports and imports.
Sept 1980	All exports and imports except CN-INP and GVIMP at parallel rate.
June 1981	CN-INP moved to parallel market rate (PR).
July 1981	Exchange dealers (ED) licensed and black market legalized.
Nov. 1981	3rd devaluation (OR and PR unified), all trade except 1/4th of non-cotton (NC) exports at PR, the rest at free market rate.
1982	4th devaluation.
Feb. 1983	Commercial banks (CB) licensed to deal at FR, 25% of exports at
Mar. 1983	free market rate (FR).
May 1983	Licenses for ED and CB revoked, then reinstated for CB in May and for ED in June 1983.
Oct. 1984	Exports of NG-NC at FR and 50% of export revenues (100% for sesame) to be transferred to Central Bank.
Feb. 1985	5th devaluation, stringent import licensing and currency control (39 import items banned, licenses of ED revoked), RR to be operated by CB (crawling rate).
1986	CB committee to allocate foreign exchange by priority list. Imports ban list extended to more than 100 items.
1987	6th devaluation, more liberal import system (similar to the nil-value).

OR: official exchange rate; ER_1: exchange tax/subsidy adjusted rate (ETSAR) for non-government imports and non-cotton exports(NG-NC); ER_2: ETSAR for government imports (GVTIMP), which consists of petroleum, wheat, and sugar mainly; ER_3: the cotton exports and imported inputs rate (CN-INP) and RR: the premium rate for Sudanese nationals working abroad (SNWA) remittances. Exchange rates are measured as units of local currency per US dollar (LS/US$).

Source: Hassan, 1989.

Sudan's foreign trade policy can be thought of in terms of three periods - the preliberalization period (before 1978), the liberalization period (1978-1984) and the post liberalization period (1984-1987) (Hassan, 1989). The first period involved full exchange control under fixed exchange rates. A strict import system was maintained and multiple exchange rates were used to promote exports, encourage private transfers and provide protection to domestic industries.

After the economic situation worsened in 1979, the International Monetary Fund (IMF) encouraged the Sudan to embark on a trade liberalization policy and to remove all exchange controls. During this period, all import systems were abolished and the Sudanese pound was devalued four times. Two exchange rates, the official rate and the parallel rate, were established. In 1980, all non-cotton exports (and later cotton) and non-government imports were evaluated at the parallel rate. The black market for foreign exchange was legalized and exports and imports were gradually moved to the free market rate. These policies were implemented with the objective of aligning domestic prices with border prices, providing incentives for producers of exportables, reducing demand for imports and unifying the exchange rates (El Badawi, 1989).

These liberalization policies failed dramatically due to other economic distortions and the government returned to the

previous policy of imposing controls and restrictions on imports and exchange rates. Certain import items were banned in 1985 and the export of sorghum, which was already subject to import quotas, was banned during the drought period of 1985-1986. Higher import tariffs were imposed and imports declined in 1985 and 1986. Only what the government considered priority commodities were imported (USAID, 1985). In early 1987, Sudan devalued the exchange rate for some export crops by nearly 35% but left other exchange rates unchanged. The exchange rate was devalued to improve the competitiveness of the Sudan's agricultural export and to increase the cost of imported goods.

CHAPTER 4. MEASUREMENT OF PROTECTION

The Nominal Rate of Protection (NRP) and the Effective Rate of Protection (ERP) are used to measure the effects of government intervention, both sector-specific and economywide, on the three major crops grown in the Gezira Scheme, namely cotton and groundnuts (export commodities) and wheat (importable). The protection rates are based on data on the farmgate prices of these agricultural products, border price equivalents (adjusted at the farmgate) evaluated at the official exchange rate and at the equilibrium nominal exchange rate and the nonagricultural price index. Value added for these crops is also required in the calculation of the ERP. The estimation of value added uses cost of production data which includes prices and costs of tradable inputs measured at domestic prices, at border prices evaluated at the official exchange rate and at border prices evaluated at the equilibrium nominal exchange rate. The period under study is 1980 to 1988.

The methods used for calculation of NRP and ERP and the estimation of the border prices, the nonagricultural price index, the equilibrium nominal exchange rate and the value added for these agricultural products closely follow the procedure used by Dethier (1988).

The units of measurement for some of the time series data used in this study differs from what has been used in the

Dethier study, especially data obtained from the Gezira Current Statistical Bulletin (1989) and the Bank of Sudan Annual Reports. The measurement units of some of the data has, therefore, been converted to fit the study and the methods of conversion will be explained in detail in the relevant sections. Table 4.1 presents the measures and the equivalents used.

Table 4.1: Measures and equivalents

Item	Type of Measure	Equivalent
One Feddan	Area of Land	4200 square meters 1.0379 acres 0.42 hectares
One Kilogram	Weight	2.2258 pounds
One Metric Ton	Weight	1000 kilograms 2204.5 pounds
One Kantar (Seedcotton)	Weight	315 pounds 143 kilograms
One Kantar (Lint Cotton)	Weight	110 pounds 50 kilograms
One Bale (Seedcotton)	Weight	420 pounds 191 kilogram

Sources: Gezira Statistical Bulletin 1978/79-1987/88, SGB, 1989.
Moe and Haddad, Export Development Study-Sudan, World Bank, 1983.

Data and Calculations

Farmgate Prices

Farmgate prices of cotton, groundnuts and wheat are obtained from the Gezira Current Statistics for 1978/79-1987/88 (Sudan Gezira Board, 1989) and represent prices received by farmers for the unprocessed (raw) cotton. The farmgate price of groundnuts and wheat are expressed in Sudanese pounds (LS) per ton and are taken directly from the Gezira Current Statistics bulletin (Sudan Gezira Board, 1989).

Table 4.2 presents the farmgate prices received for groundnuts and wheat by farmers in the Gezira Scheme for the period 1979/80 to 1987/88.

Table 4.2: Farmgate prices for groundnuts and wheat (LS/ton)

Year	Farmgate Prices of Groundnuts (LS/ton)	Farmgate Prices of Wheat (LS/ton)
1979/80	78.0	118.5
1980/81	262.0	160.0
1981/82	180.0	230.0
1982/83	330.0	280.0
1983/84	420.0	360.0
1984/85	588.0	700.0[1]
1985/86	1120.0	700.0
1986/87	1232.0	770.0
1987/88	1400.0	1001.0

1 No wheat production in the Gezira Scheme in 1984/85. Farmgate price for wheat for 1984/85 was obtained from Abdelrahman, 1990.

Source: Sudan Gezira Board (1989).

Note: The fiscal year 1979/80 is taken to be calendar year 1980, 1980/81 to be 1981 and so on.

Farmgate prices of cotton are for seedcotton (unginned, raw cotton). Price data for cotton is given by grade and by variety. The two varieties grown in the Gezira Scheme are extra long staple cotton (ELS) and medium staple cotton (MS) and a different price is quoted for each variety every year. Prices also vary according to grade. The Gezira extra long staple variety has 9 grades and the medium staple variety has 5 or 6 grades (varies for some years). The price of the fifth grade has been used as an "average" price for ELS cotton and the price of the third grade has been used as an "average" price in the case of MS cotton. These prices are roughly the unweighted averages of all the grades for each variety.

Table 4.3 shows cotton prices according to grade and variety for the period 1980/81 to 1987/88. No price is quoted for 1979/80 by the Gezira Scheme; the 1980 farmgate price for cotton that will be used in the calculations below is taken from El Badawi (1989).

As is apparent from Table 4.3, prices for cotton are expressed in LS/kantar and these have been converted to LS/ton by dividing by 0.143 (1 kantar= 0.143 metric tons).

A weighted average price is then calculated for cotton using ELS and MS cotton prices; the weights being the share of each variety on total cotton production for each year. Thus, the weighted average price is the weighted sum of prices for the two varieties of cotton.

Table 4.3: Farmgate prices for cotton (LS/kantar)

Season	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88
Grade (ELS Cotton)								
1	78.5	102	104	127	155	235	273	338
2	76.5	98	100	122	150	230	268	328
3	74.5	94	96	117	145	225	263	318
4	72.5	90	92	112	140	220	258	308
5	70.5	86	88	107	135	215	248	293
6	67.5	81	83	102	130	210	238	278
7	64.5	76	78	97	125	205	228	263
8	61.5	71	73	92	120	200	218	248
9	58.5	66	68	87	115	193	208	233
Grade (MS Cotton)								
1	54.5	70	72	90	114	210	228	263
2	52.5	68	70	86	110	205	223	253
3	50.5	66	68	82	106	200	218	243
4	48.5	64	66	79	102	195	213	233
5		62	64	74	98	190	203	219
6						185	193	203

Source: Sudan Gezira Board (1989).

Table 4.4 shows the share of ELS and MS cotton in the production of cotton in the Gezira Scheme for the period under study.

Table 4.5 shows the weighted average farmgate price of seedcotton expressed in LS/ton. First the average (grade) price of ELS and MS cotton, expressed in LS/kantar, is converted to LS/ton and then a weighted average (variety) price is calculated in LS/ton using the weights from Table 4.4.

Table 4.4: Percentage share of ELS and MS cotton in total production (1979/80-1987/88)

Year	Production in Kantar		Total Production in Kantar	Percentage Share in Total Production	
	ELS	MS		ELS	MS
1979/80	446,588.0	94,302.0	540,890.0	82.6%	17.4%
1980/81	426,925.0	74,277.0	501,202.0	85.2%	14.8%
1981/82	379,889.0	55,425.0	435,314.0	87.3%	12.7%
1982/83	375,359.5	108,955.5	484,315.0	77.5%	22.5%
1983/84	346,609.0	151,120.0	497,729.0	69.6%	30.4%
1984/85	345,297.5	119,494.5	464,792.0	74.3%	25.7%
1985/86	376,139.3	24,419.0	400,558.3	93.9%	6.1%
1986/87	328,435.0	86,639.0	415,074.0	79.1%	20.9%
1987/88	237,992.0	145,045.0	383,037.0	62.1%	37.9%

Percentage Share of variety in total production = Production of variety divided by the total production.
Source: Sudan Gezira Board (1989).

Table 4.5: Weighted average farmgate prices of seedcotton

Year	Farmgate Price of Cotton (LS/Kantar)		Farmgate Price of Cotton (LS/Ton)		Price of Seed Cotton Weighted Average (LS/Ton)
	ELS	MS	ELS	MS	
1979/80	N/A[1]	N/A[1]	-	-	441.650[1]
1980/81	70.5	50.5	492.318	352.654	471.648
1981/82	86.0	66.0	600.559	460.894	582.822
1982/83	88.0	68.0	614.525	474.860	583.100
1983/84	107.0	82.0	747.207	572.626	694.134
1984/85	135.0	106.0	942.737	740.223	890.691
1985/86	215.0	200.0	1501.397	1396.648	1495.007
1986/87	248.0	218.0	1731.844	1522.346	1688.059
1987/88	293.0	243.0	2046.089	1696.927	1913.757

1 N/A: not available. Figure obtained from El Badawi 1989.
-Farmgate price (LS/Ton) = farmgate price (LS/Kantar) /0.143.
-Weighted average price = % share in total production of ELS x farmgate price of ELS (LS/Ton) + % share in total production of MS x farmgate price of MS (LS/Ton).
Source: Sudan Gezira Board, 1989.

It is important to note that the farmgate prices of cotton, groundnuts and wheat in the Gezira Scheme do not reflect the prices of these crops across the country. Prices vary across regions and across the three sectors of agriculture, viz, the irrigated, mechanized and traditional sectors. However, the Gezira Scheme is the major producer of cotton in the Sudan (80% of ELS and 40% of MS cotton) as well as producing significant amounts of wheat (70%) and groundnuts (30%).

Border Price Equivalents

Border price equivalents are estimates of prices that prevail in the absence of government pricing policy. The world prices of the abovementioned commodities expressed in domestic currency are adjusted at the farmgate by taking into account transportation, handling, processing and other costs so as to "bring them to a comparable basis with domestic prices" (Dethier, 1988). In calculating border prices, the basic assumption is that technological coefficients are constant and are not affected by changes in the relative price of traded to nontraded inputs (Dethier, 1988).

Border prices of cotton, groundnuts and wheat adjusted at the farmgate are calculated. Border prices of cottonseed and fertilizer are required in the calculation of the border price of cotton and the estimation of value added at border prices also requires the border price equivalent of fertilizer.

Border prices are evaluated at the official exchange rate (E_0) and at the equilibrium nominal exchange rate (E^*). There are different exchange rates for different agricultural tradables and the border price for each crop is evaluated at the respective exchange rate.

Table 4.6 presents the exchange rates that apply to cotton, groundnuts and wheat respectively. The method by which the equilibrium exchange rate (E^*) is derived is presented in a later section. Exchange rates for cotton and groundnuts have been obtained from El Badawi (1989). For wheat, the official exchange rate used is also from El Badawi (1989).

Table 4.6: Exchange rates for cotton, groundnuts and wheat (LS/US$)

Year	E_c	E_g	E_0
1979/80	0.50	0.68	0.50
1980/81	0.90	0.90	0.55
1981/82	1.30	1.30	0.96
1982/83	1.40	1.40	1.30
1983/84	1.30	2.10	1.30
1984/85	2.50	2.50	2.50
1985/86	3.25	2.93	2.50
1986/87	3.25	4.10	2.86
1987/88	4.50	4.50	4.50

E_c: exchange rate for cotton; E_g: exchange rate for groundnuts; E_0: official exchange rate (used for wheat).
Source: El Badawi (1989).

World Prices

World prices of cotton and groundnuts (export crops) and cottonseed are f.o.b. prices from which costs (transportation, marketing, processing, etc.) are subtracted to get the border price equivalent at the farmgate. World prices of wheat (importable) and fertilizer (imported input) are c.i.f. prices to which costs are added to obtain the border price equivalent at the farmgate.

World prices of cotton, groundnuts and wheat have been estimated by dividing the total value of exports, in f.o.b. valuation, of each crop by the total volume exported (for cotton and groundnuts) and by the total volume imported (for wheat) for each year. Total value and quantities have been obtained from the Bank of Sudan Annual Report (various issues). Total values are expressed in Sudanese pounds (LS) and total quantities of groundnuts exported and of wheat imported are expressed in tons, thus giving prices in LS/ton. However, the volume of cotton exported is expressed in bales and has been converted into tons by multiplying the number of bales by 0.191 (1 bale=191 kilograms and 1 ton=1000 kilograms). Values and volume of cotton exported are also divided into long staple cotton and other cotton (includes medium staple and short staple cotton). To get the world price expressed in LS/ton, total value of cotton (long staple + others) is divided by the total volume of cotton exported.

Table 4.7 shows total values and quantities for groundnuts and wheat and world prices expressed in LS/ton for the period 1980-1988.

Table 4.8 shows values and quantities (in bales) for long staple and other cottons and the price of cotton after conversion from bales to tons for the same period.

Table 4.7: World prices of groundnuts and wheat (LS/ton)

Year	Groundnuts			Wheat		
	Quantity (Ton)	Value (LS000)	Price (LS/Ton)	Quantity (Ton)	Value (LS000)	Price (LS/Ton)
1980	22093.0	5924.0	268.139	156081.0	18447.0	118.189
1981	94347.0	66457.0	704.389	229890.0	26876.0	116.908
1982	88900.0	33191.0	373.352	149138.0	22332.0	149.741
1983	18037.0	16511.0	915.396	198268.0	52162.0	263.088
1984	22453.0	26773.0	1192.402	140922.0	38249.0	271.420
1985	13260.0	23149.0	1745.777	193115.0	78600.0	411.270
1986	1090.0	2466.0	2262.385	116509.0	52022.0	446.506
1987	7283.0	10056.0	1380.750	217660.0	199500.0	916.567
1988	69080.0	86538.0	1252.721	234619.0	224886.0	958.516

Price=Value in LS'000s / quantity in tons.
Source: Bank of Sudan Annual Report (various issues).

To get the world prices of cotton, groundnuts and wheat in U.S dollars (US$), the world price in domestic currency for each crop is divided by its respective exchange rate (shown in Table 4.6). The world price of cottonseed is also obtained by dividing the value of cottonseed by the total quantity exported. The data has been obtained from the FAO Trade Yearbook (various issues) and is in f.o.b. valuation.

Table 4.8: World prices of cotton (LS/ton)

Year	Total Quantity in Bales	Total Value LS'000s	Total Quantity in Tons	Price LS/Ton
1980	617092	115441	117855.615	979.512
1981	343320	68657	65569.137	1047.093
1982	468064	121130	89393.430	1355.021
1983	1128541	395969	215534.950	1837.145
1984	967122	405000	184706.264	2192.671
1985	529314	374260	101091.291	3702.198
1986	936907	366721	178935.638	2049.458
1987	938788	455195	179308.508	2538.614
1988	816197	978435	155881.780	6276.776

Quantity in Tons = Quantity in Bales x 0.191.
Price(LS/Ton) = Total Value in LS'000s/Total Quantity in Tons.
Source: Bank of Sudan Annual Reports (various issues).

Value of cottonseed (FAO estimates) is in US dollars (US$) and the quantities exported (FAO unofficial figures) are in tons. Prices have been converted from foreign currency to domestic currency by using the official exchange rate (E_0).

Table 4.9 shows the values and quantities of cottonseed and the price of cottonseed both in US$/ton and is in LS/ton for the period 1980-1988. No figures were available for value and quantity exported of cottonseed for 1981. 1980 figures were used.

C.i.f. prices of fertilizer, in domestic currency, was obtained from the Sudan Gezira Board (SGB) office in Wad-Medani, Sudan for the period 1984/85 to 1987/88. The prices of fertilizer for the period 1979/80 to 1983/84 were estimated by using the percentage change in field prices (i.e prices

paid by the farmers) from year to year. It is important to note that the SGB did not import any fertilizer in 1987/88 and therefore the domestic price was used for that year. World price of fertilizer in domestic currency has been converted to foreign currency (US$) by using the official exchange rate (E_0).

Table 4.10 presents field prices of fertilizer in LS/ton and c.i.f. prices in LS/ton and US$/ton for the period 1979/80 to 1987/88.

Table 4.9: World prices of cottonseed (LS/ton)

Year	Quantity (Ton)	Value (000$)	Price ($/Ton)	Eo	Price (LS/Ton)
1980	1558	216	138.64	0.50	69.32
1981	1558[1]	216[1]	138.64	0.55	76.25
1982	3000	420	140.00	0.96	134.40
1983	9000	1450	161.11	1.30	269.44
1984	8000	1450	181.25	1.30	235.63
1985	5900	890	150.85	2.50	377.13
1986	4000	650	162.50	2.50	406.25
1987	6000	850	141.67	2.86	405.18
1988	7000	1100	157.14	4.50	707.13

1 1980 figures.
Price ($/Ton) = Value in $'000 / Quantity in Tons.
Price (LS/Ton) = Price in $/Ton x Official Exchange Rate (Eo).
Source: FAO Trade Yearbook (various issues).

Table 4.10: World prices of fertilizer

Year	Field Price (LS/Ton)	C.I.F. (LS/Ton)	E_0	C.I.F. ($/Ton)
1979/80	160.00	104.78[1]	0.50	209.56
1980/81	193.00	126.39[1]	0.55	229.80
1981/82	344.00	225.27[1]	0.96	234.66
1982/83	350.00	229.20[1]	1.30	176.31
1983/84	334.00	218.72[1]	1.30	168.25
1984/85	330.00	216.10	2.50	86.44
1985/86	1020.00	612.34	2.50	244.94
1986/87	611.60	379.30	2.86	132.62
1987/88	648.20	648.20[2]	4.50	144.04

1 Calculated as percentage change of field price.
2 1987/88 field price.
E_0: Official exchange rate reported from El Badawi (1988).
Source: Sudan Gezira Board, 1989.

Adjustment of Border Prices to Farmgate

Border Prices Evaluated at the Official Exchange Rate

Data on transportation, handling, processing, marketing and other costs has been taken from a World Bank report on export development on the Sudan (Moe and Haddad, 1983). The report presents price structures for export of both long staple cotton and medium staple cotton (lint), groundnuts and cottonseed and price structure for wheat and fertilizer imports for 1982. It includes a detailed breakdown of costs for each commodity (in LS/ton) from world price to farmgate price (see Appendix B for details). Figures for the years preceding and proceeding 1982 have been estimated by using the CPI (cost of living price index) with 1980 base year. CPI

figures (1980-1988) have been obtained from Hassan (1989) (see Appendix D, Table D.7).

To obtain the border price equivalents for groundnuts and cottonseeds (exports), costs are subtracted from their world prices expressed in domestic currency. Costs are added to the world price of wheat (importable) and fertilizer (import) to get the border price evaluated at the farmgate. This gives border prices at farmgate evaluated at the official exchange rate for each crop respectively.

In the case of cotton, farmgate prices refer to raw cotton while world prices refer to cotton lint. This makes it necessary to adjust the world price accordingly. The ginning process of raw cotton produces cotton lint, cottonseed, waste and scarto (linters). To obtain border price equivalents of cotton, we need to convert world prices of cotton lint to world prices of the raw cotton equivalent of lint.

Table 4.11: Breakdown of seedcotton

Components	ELS	Percent of 315 lb	MS (Shambat)	Percent of 315 lb	MS (Akala)	Percent of 315 lb
Lint	107 lb	34.00%	94 lb	29.8%	117 lb	37.2%
Seed	200 lb	63.50%	210 lb	66.7%	190 lb	60.3%
Scarto	4 lb	1.25%	4 lb	1.3%	-	-
Waste	4 lb	1.25%	7 lb	2.2%	8 lb	2.5%
Total	315 lb	100.00%	315 lb	100.0%	315 lb	100.0%

lb: pounds.

The breakdown of raw cotton into lint, seed, waste and scarto depends on the variety of cotton. Table 4.11 shows the breakdown of 315 pounds (1 kantar) of raw cotton into its four components according to variety.

Since long staple cotton makes up between 65% and 95% of the total production of cotton in the Gezira Scheme (see Table 4.4) and more than 50% of the total volume of cotton exports (see Table D.5 in Appendix D), the breakdown of long staple cotton has been used. This means that cottonseed constitutes 63.5% of 1 kantar of seedcotton while lint constitutes 34% and waste and scarto 2.5%. Due to the lack of data on prices of scarto and waste, they have not been included in the calculation of the price of raw cotton equivalent of lint. However, since scarto and waste make up only 2.5% of the composition of raw cotton and their prices are usually low, their exclusion is not expected to bias the results.

The cost of transportation, ginnery and other costs (in LS/ton) is subtracted from the export price (LS/ton) of lint cotton to get the border price equivalent of lint. To get the border price equivalent of raw cotton at the farmgate, 34% of the border price equivalent of lint is added to 63.5% of the border price equivalent of cottonseed. The border price equivalent of cotton obtained is the price evaluated at the official exchange rate for cotton. As noted previously, the border price equivalent of cottonseed is evaluated at the

official exchange rate (E_0) while the border price equivalent of cotton at domestic currency is evaluated at the exchange rate that applies to cotton (E_c). The same holds true for groundnuts and wheat, i.e., border prices are evaluated at the exchange rate for groundnuts (E_g) and for wheat (E_0) respectively.

Border Price Equivalent Evaluated at the Equilibrium Exchange Rate

To obtain the border price equivalent evaluated at the equilibrium nominal exchange rate (E^*), costs are added or subtracted (depending upon whether they are imports or exports) from world prices evaluated at E^*. The method by which E^* is estimated is explained in a later section.

World prices of cotton, groundnuts and wheat are converted to domestic currency evaluated at E^* by multiplying the world price by the ratio of E^* to the official exchange rate that applies to each crop respectively. For cottonseed, fertilizer and wheat, prices are multiplied by E^*/E_0 (E_0 being the official exchange rate) to convert them to domestic currency evaluated at E^* (see Table 4.1).

World prices in domestic currency evaluated at E^* are then converted to border price equivalents in LS evaluated at E^* by subtracting costs (for each respective product) in the case of cotton, groundnuts and cottonseed and by adding costs in the case of wheat and fertilizer. For cotton, 34% of the

border price equivalent of lint evaluated at E^* is added to 63.5% of the border price equivalent of cottonseed evaluated at E^* to obtain the border price equivalent of cotton in domestic currency evaluated at E^*.

Border price equivalents for cotton, groundnuts, wheat, cottonseed and fertilizer in domestic currency evaluated at the official exchange rate (for each commodity respectively) and evaluated at the equilibrium exchange rate are presented (in LS/ton) in Table 4.12 for cotton, groundnuts and wheat and in Table 4.13 for cottonseed and fertilizer for the period 1980-1988.

Table 4.12: Border price equivalents for cotton, groundnuts and wheat

Year	Border Price @ E_0			Border Price @ E^*		
	Cotton	Groundnuts	Wheat	Cotton	Groundnuts	Wheat
1980	240.666	138.230	163.640	346.241	122.457	161.821
1981	249.040	416.962	169.606	187.967	268.258	174.764
1982	342.045	185.702	216.710	292.479	134.007	231.390
1983	480.810	524.204	392.774	578.796	628.820	354.603
1984	553.608	682.443	388.342	746.405	387.182	346.251
1985	956.796	998.355	579.995	1286.404	1382.425	596.665
1986	467.854	1295.691	659.428	554.772	1565.941	646.218
1987	529.880	666.406	1224.216	810.301	612.523	1495.568
1988	1515.204	467.710	1363.407	2416.430	904.770	2318.769

Table 4.13: Border price equivalents for cottonseed and fertilizer

Year	Border Price @ E_0		Border Price @ E*	
	cottonseed	fertilizer	cottonseed	fertilizer
1980	33.06680	132.9910	52.47640	162.3294
1981	33.40808	161.1195	55.59048	197.8875
1982	72.17600	272.5335	94.57600	310.0785
1983	120.69390	288.0600	162.58250	333.9000
1984	127.61370	291.6290	178.36370	338.7379
1985	211.78870	318.1120	294.75620	365.6540
1986	210.37450	760.0240	337.12450	951.0740
1987	182.93700	543.4850	335.94080	686.7171
1988	357.49870	893.5750	604.20850	1119.7240

Nonagricultural Price Index (PNA)

The calculation of the nominal rate of protection (NRP) and the effective rate of protection (ERP) is also based on data on the nonagricultural price index (PNA). The nonagricultural price index is used to measure relative prices. PNA index is based on CPI data and is made up of indices of prices for the tradable (PNA(T)) and nontradable (PNA(NT)) components of the nonagricultural sector.

$$PNA = a\ PNA(T) + (1-a)\ PNA(NT)$$

where

PNA: the nonagricultural price index

PNA(T): the nonagricultural price index for tradables

PNA(NT): the nonagricultural price index for nontradables

a: the share of tradables in the nonagricultural sector

A calculated PNA index has been borrowed from El Badawi

(1989). The data has been rebased with 1980 base year (by dividing all years by 1980 prices) as is shown in Table 4.14. The quantity weights used by El Badawi (1989) for the tradable and nontradable sectors are 30% (a) and 70% (1-a) respectively.

Table 4.14: Calculation of PNA

Year	PNA	PNA(T)	PNA(NT)	PNA	PNA(T)	PNA(NT)
	(base year 1970)			(base year 1980)		
1980	430.25	387.90	448.40	100.00	100.00	100.00
1981	532.63	479.50	555.40	123.79	123.61	123.86
1982	685.00	622.00	712.00	159.26	160.35	158.79
1983	879.80	813.30	908.30	204.70	209.67	202.56
1984	1144.56	1036.90	1190.70	266.07	267.31	265.54
1985	1671.81	1486.80	1751.10	388.35	383.30	390.52
1986	2054.34	1861.70	2136.90	477.58	479.94	476.56
1987	2654.74	2454.40	2740.60	617.66	632.74	611.20
1988	3466.69	3214.90	3574.60	806.67	828.80	797.19

Source: El Badawi (1989).

PNA is also measured at the equilibrium nominal exchange rate (E^*), in the absence of trade intervention, to adjust for exchange rate overvaluation and distortions due to trade policies. This corrected nonagricultural price index (PNA^*) is computed by adjusting the tradable component of PNA as follows

$$PNA^* = a\ E^*/E_0\ PNA(T)/(1+t_m) + (1-a)\ PNAT(NT)$$

where

E^*: equilibrium nominal exchange rate

E_0: official exchange rate

t_m: equivalent import tariff

a: 0.3

Time series data on the official exchange rate is obtained from El Badawi (1989). Calculations for the equilibrium nominal exchange rate (E^*) is presented in the next section. The equivalent import tariff (t_m) is also borrowed from El Badawi (1987) where it was used as a proxy for tax on imports. Table 4.15 presents PNA^*, the nonagricultural price index, corrected for exchange rate overvaluation and distortions resulting from trade policies.

Table 4.15: Calculation of PNA^*

Year	E_0	E^*	E^*/E_0	t_m	$1+t_m$	PNA(T)	PNA(NT)	PNA^*
1980	0.50	0.64	1.28	0.38	1.38	100.00	100.00	97.83
1981	0.55	0.71	1.29	0.41	1.41	123.61	123.86	120.66
1982	0.96	1.12	1.17	0.22	1.22	160.35	158.79	157.15
1983	1.30	1.56	1.20	0.22	1.22	209.67	202.56	203.66
1984	1.30	1.58	1.22	0.48	1.48	267.31	265.54	251.74
1985	2.50	3.05	1.22	0.54	1.54	383.29	390.52	364.46
1986	2.50	3.28	1.31	0.37	1.37	479.94	476.56	471.06
1987	2.86	3.94	1.38	0.36	1.36	632.74	611.20	620.12
1988	4.50	6.07	1.35	0.36	1.36	828.80	797.19	804.64

$PNA^* = [0.3x(E^*/E_0)(PNA(T)/1+t_m)]+0.7xPNA(NT)$.
Source: El Badawi (1987) and El Badawi (1989).

Estimation of the Nominal Equilibrium Exchange Rate

The equilibrium nominal exchange rate (E^*) is "used as a benchmark value against which to measure the extent of the overvaluation of the currency" (Dethier, 1988). It is

expressed in Sudanese Pounds per U.S. Dollar (LS/US$). The methodology used to compute the equilibrium exchange rate is based on the elasticities approach. E^* may be defined as "the rate that would prevail for a sustainable level of current account deficit and if there was free trade, i.e., if tariffs and other trade taxes were removed" (Dethier, 1988). This is a long run equilibrium concept.

The formula used to compute E* is that used by Dethier (1988) in his study of the agricultural pricing policies in Egypt.

$$E^* = \left(\frac{dQ_0 + dQ_1}{e_s \times Q_s + e_d \times Q_d} + 1 \right) E_0$$

where

E^*: equilibrium nominal exchange rate

Q_d: demand for foreign exchange

Q_s: supply of foreign exchange

dQ_0: $(Q_d - Q_s)$ the current account deficit for a particular year in units of foreign exchange

e_s: elasticity of supply of foreign exchange

e_d: elasticity of demand for foreign exchange

E_0: official exchange rate

$$dQ_1 = \left(\frac{t_m}{1+t_m}\right) Q_d \times e_d - \left(\frac{t_x}{1-t_x}\right) Q_s \times e_s$$

where

t_m: implicit tariff equivalent

t_x: implicit export tax

Due to the lack of data, the elasticity of supply of foreign exchange is assumed to be one and the elasticity of demand for foreign exchange is assumed to be equal to two. This has been used by Dethier (1988) and suggested by Krueger, Schiff and Valdés (1988).

To obtain the equilibrium nominal exchange rate, the official exchange rate is corrected for imbalance in the external account and then for trade policies. This gives E^* with external balance and no trade distortions.

The demand for foreign exchange Q_d is derived from demand for imports (imports + invisible debits) and the supply of foreign exchange Q_s is derived from the demand for exports (exports + invisible credits). Data for the calculation of Q_d and Q_s and the deficit of the current account of the balance of payments is obtained from the Current Account Balance of Goods and Services for 1980-1988 for the Sudan from the IMF International Financial Statistics (expressed in US$ millions) and from the Bank of Sudan Annual Report (see Appendix D, Table D.6).

Table 4.16: Calculation of the equilibrium nominal exchange rate E^*

Year	Q_d	Q_s	dQ_0	dQ_1	t_m	t_x	E_0	E^*
1980	1687.8	1239.6	448.2	806.9	0.38	0.09	0.50	0.636
1981	2402.3	1584.9	817.4	1095.2	0.41	0.16	0.55	0.715
1982	1351.4	1023.8	327.6	277.7	0.22	0.17	0.96	1.116
1983	1344.5	1055.1	289.4	463.4	0.22	0.02	1.30	1.561
1984	1113.0	1064.1	48.9	666.0	0.48	0.05	1.30	1.582
1985	1071.2	1079.1	-7.9	717.9	0.54	0.03	2.50	3.051
1986	956.4	644.9	311.5	482.7	0.37	0.05	2.50	3.276
1987	1086.5	590.9	495.6	544.1	0.36	0.05	2.86	3.936
1988	1360.7	814.9	545.8	686.4	0.36	0.04	4.50	6.068

$dQ_1 = [(t_m/1+t_m)Q_d \times 2] - [(t_x/1-t_x)Q_s \times 1]$
$E^* = \{[(dQ_0 + dQ_1)/(e_s \times Q_s + e_d \times Q_d)] + 1\}E_0$
Source: El Badawi (1987) and the IMF International Financial Statistics.

Table 4.16 shows the calculation of the equilibrium nominal exchange rate E^* for the period 1980-1988.

Estimation of Value Added

Value Added at Domestic Prices

Value added at domestic prices (VA^d) is defined as the farmgate price minus the value of tradable inputs. Cost of production data and farmgate prices of agricultural products are needed to estimate the value added for cotton, groundnuts and wheat at domestic prices.

VA^d = farmgate price - cost of tradable inputs

Cost of Production Data at Domestic Prices

Official data on the cost of production was obtained from the Gezira Current Statistics for 1978/79-1987/88 (Sudan

Gezira Board, 1989) prepared by the Sudan Gezira Board Planning and Social Economics Research Unit. This bulletin contains time series data on production, yields, areas grown, quantities of inputs used, cost of production, returns and prices of both agricultural inputs and outputs. The agricultural products covered in this bulletin are cotton, groundnuts, wheat and sorghum. This study focused only on cotton, groundnuts and wheat as sorghum is grown mainly for private consumption.

Cost of production data is expressed in Sudanese Pounds per feddan (LS/feddan). Cost data for each crop includes cost of tradable inputs (seeds, fertilizers, herbicides, insecticides, machinery, etc.) and of nontradable inputs (labor, services and other costs incurred by the farmer). The data is broken down into different farming activities (land preparation, agricultural operations, harvest and post harvest operations, materials used and services, transport, land and water charges and other costs).

The data has been converted from LS/feddan to LS/ton using total area harvested and total production of each crop to obtain a measure of value added in LS/ton. Since the calculation of value added requires only the cost of traded inputs, the cost of traded inputs has been converted from LS/feddan to LS/ton. Cost of machinery is obtained by adding up the cost of activities using machinery. Appendix C, Tables

C.1, C.2 and C.3 give a breakdown of costs of traded inputs for cotton, groundnuts and wheat for the period 1976/77 to 1987/88.

In order to convert from LS/feddan to LS/ton, production (expressed in tons) is divided by the area (expressed in feddans) to obtain a yield for each crop expressed in tons/feddan. The relevant cost data in LS/feddan is then divided by the yield to get the cost in LS/ton. In the case of cotton, production is expressed in kantars. To obtain production in tons, production in kantars is multiplied by 0.143 (1 kantar = 0.143 tons).

Appendix A shows areas grown (in feddans), volume of production (in tons converted from kantars for cotton) and yields in tons per feddan for cotton, groundnuts and wheat for the period 1979/80-1987/88.

In addition to the costs of production data in LS/feddan converted to LS/ton, Appendix C (Tables C.1, C.2 and C.3) also shows the value added at domestic prices in LS/ton obtained by subtracting cost of tradable inputs from the farmgate price of cotton, groundnuts and wheat respectively.

Table 4.17 shows the value added at domestic prices in Sudanese pounds per ton for cotton, groundnuts and wheat.

Table 4.17: Value added at domestic prices (LS/ton) for cotton, groundnuts and wheat

Year	Value Added for Cotton			Value Added for Groundnuts	Value Added for Wheat
	LS	MS	Average		
1980	364.41	224.75	343.74	64.71	47.75
1981	279.44	139.78	258.77	247.47	-13.68
1982	366.59	226.92	348.00	142.59	50.51
1983	385.34	245.67	353.91	295.49	148.30
1984	422.96	248.38	369.89	380.70	139.03
1985	635.24	432.73	583.22	531.55	479.03
1986	557.40	452.65	551.04	1015.14	267.62
1987	1092.33	882.84	1048.55	1128.47	451.81
1988	1218.52	869.35	1086.18	1254.52	638.84

Value Added at Border Prices

To calculate the total effective rate of protection, the value added with border prices of agricultural products and costs of tradable inputs evaluated at border prices is required. Border prices are converted to the domestic currency at the official exchange rate for each respective crop and at the equilibrium nominal exchange rate (E^*) as seen in the earlier sections.

Value Added at border prices (VA^b) evaluated at the official exchange rate for each crop may be defined as:

VA^b = border prices of the agricultural commodity evaluated at

E_a - cost of tradable inputs in border prices evaluated at E_0

where

VA^b: value added at border prices

E_a: the exchange rate that applies to each agricultural commodity (E_c for cotton, E_g for groundnuts and E_0 for wheat)

E_0: the official exchange rate

As mentioned before, an important assumption is that the purchase of traded inputs at border prices does not change the technological coefficients. This means that "there is no substitution between labor and mechanized operations and between organic and chemical fertilizers" (Dethier, 1988).

Cost of Production Data at Border Prices

In order to estimate the value added at border prices for each crop, border prices of traded inputs have been computed as follows:

1. Border prices for machinery, insecticides, herbicides and seeds are assumed to be equal to domestic prices. In the case of machinery, due to the unavailability of price data on machinery, costs of mechanized activities have been used.

Border prices for seeds have been estimated but in order to calculate costs per feddan or costs per ton for each agricultural product, quantities used per feddan in the production of each crop was needed. No such information was available.

Prices of herbicides and insecticides were available by kind, in addition to quantities used per feddan for each crop.

However, due to the detailed breakdown of the prices of these inputs by type, it was extremely difficult to calculate the costs per feddan using the data given.

2. Data was available to calculate the costs per feddan for fertilizer for cotton and wheat at border prices for the period under study; groundnuts do not use fertilizer. The border price equivalent for fertilizer evaluated at the official exchange rate (E_0) and at the equilibrium nominal exchange rate (E^*) was explained in an earlier section.

Cost of fertilizer per feddan for cotton and wheat at border prices was calculated by multiplying the c.i.f price of fertilizer by the quantity of fertilizer used (in tons) and then dividing by the area (in feddans) over which fertilizer was applied for each crop. To obtain costs per ton at border prices evaluated at the official exchange rate, costs per feddan were divided by the yield (ton/feddan) for cotton and wheat respectively. Appendix C, Tables C.4 and C.5, shows the cost of fertilizer for cotton and wheat respectively in LS/ton using border price of fertilizer evaluated at the official exchange rate for the period 1980-1988.

Value added at border prices evaluated at the official exchange rate is obtained by subtracting the cost of tradable inputs at border prices evaluated at Eo from the border price equivalent of each crop evaluated at the exchange rate that

applies to that crop.

Tables 4.18 shows value added at border prices evaluated at the official exchange rate for cotton, groundnuts and wheat respectively for 1980 to 1988. As mentioned above, only the cost of fertilizer has been adjusted using its border price evaluated at E_0. Costs of the other tradable inputs remain at their domestic prices.

Table 4.18: Value added for cotton, groundnuts and wheat at border prices (LS/ton) evaluated at their respective exchange rates

Year	Value Added for Cotton at E_c	Value Added for Groundnuts at E_g	Value Added for Wheat at E_0
1980	110.1354	124.9426	98.4911
1981	48.0663	402.4334	6.3236
1982	127.5150	148.2973	61.4082
1983	262.1971	489.6915	270.8936
1984	234.3557	643.1431	198.3629
1985	647.6187	941.9040	579.9953
1986	-412.3100	1190.8290	259.9261
1987	-81.9508	562.8735	909.8653
1988	642.8428	322.2351	954.6188

Value Added(LS/Ton) = Border price - Total Cost of Tradable Inputs.

Value added at border prices evaluated at the equilibrium nominal exchange rate E^* is calculated as follows:
Border prices of crops converted to domestic currency at E^* and border prices of traded inputs (namely fertilizer) valued at E^* are used to estimate the value added at border prices

evaluated at E^*. Cost of traded inputs (with the exception of fertilizer) have been obtained by multiplying the relevant data by E^*/E_0.

The border prices expressed in domestic currency evaluated at E^* for cotton, groundnuts and wheat are estimated in the second section. The cost of traded inputs multiplied by E^*/E_0 are obtained for cotton, groundnuts and wheat respectively.

Value Added at border prices evaluated at E^* = border price equivalent of the crop evaluated at E^* - cost of traded inputs at border prices evaluated at E^*.

Table 4.19 show the value added at border prices evaluated at E^* for cotton, groundnuts and wheat for the period 1980-1988.

Table 4.19: Value added for cotton, groundnuts and wheat at border prices (LS/Ton) evaluated at E^*

Year	Value Added for Cotton at E^*	Value Added for Groundnuts at E^*	Value Added for Wheat at E^*
1980	181.2698	105.4493	79.6766
1981	-68.2201	249.5023	-32.1124
1982	43.7287	90.3682	51.9069
1983	318.6206	587.4051	209.9225
1984	361.2966	339.4169	117.3759
1985	913.1400	1313.5540	596.6646
1986	-590.1610	1428.3620	130.9158
1987	-23.3611	469.8945	1072.8090
1988	1255.6060	708.5404	1778.0600

The cost of traded inputs , with the exclusion of fertilizer, have been converted from costs at domestic prices to costs at border prices evaluated at E^* by multiplying costs by the ratio E^*/E_0 for cotton, groundnuts and wheat respectively. In the case of fertilizer, cost of fertilizer for cotton and wheat, in LS/ton, was calculated by using the border price equivalent of fertilizer evaluated at E^*.

Tables C.6 and C.7 (Appendix C) show the cost in LS/ton of fertilizer used in the production of cotton and wheat respectively at border price of fertilizer at E^* for the period 1980-1988. The procedure used to obtain cost of fertilizer is the same as the one used for the cost of fertilizer at E_0.

Estimation of Rates of Protection

Nominal Rate of Protection (NRP)

NRP measures the magnitude of the impact of direct and indirect policies on agricultural prices.

Direct Nominal Rate of Protection (NRPD)

NRPD measures the direct effect of price policy (price controls, export taxes, quotas, etc.) on relative prices. It can be defined as the proportional difference between the relative domestic price and the relative border price of agricultural commodities (Krueger, Schiff and Valdés, 1988).

$$NPRD = \frac{P_d/PNA - P_b/PNA}{P_b/PNA} = \frac{P_d - P_b}{P_b}$$

where

P_d: the domestic producer (farmgate) price of the tradable agricultural product

P_d/PNA: the relative price at the actual intervention level

P_b: the border price equivalent of the crop measured at the official exchange rate (and adjusted for transportation, storage and other costs)

PNA: the nonagricultural price index

As noted earlier, in the measurement of the border prices (P_b) of the agricultural products under study, the "official" exchange rate used differs from one crop to the other. P_b is deflated by the PNA.

Indirect Nominal Rate of Protection (NRPI)

NRPI measures the effect of exchange rate overvaluation and trade policy which are indirect forms of intervention that alter relative prices (Dethier, 1988).

$$NRPI = \frac{P_d/PNA - (E^*/E_a)\,P_d/PNA^*}{(E^*/E_a)\,P_d/PNA^*} = \frac{1/PNA - (E^*/E_a)/PNA^*}{(E^*/E_a)/PNA^*}$$

where

$$PNA^* = a\,(E^*/E_0)\,\frac{PNA(T)}{1+t_m} + (1-a)\,PNA(NT)$$

and

a: share of tradables in the nonagricultural price index (0.3)

t_m: equivalent tariff rate on nonagricultural tradables

E^*: equilibrium nominal exchange rate

PNA(T): index of prices of nonagricultural tradables

PNA(NT): index of prices of nonagricultural nontradables

E_a: the exchange rate that applies to each crop (E_c, E_g and E_0 for cotton, groundnuts and wheat respectively)

Thus the relative price in the absence of indirect interventions becomes $(E^*/E_0)(PA/PNA^*)$ i.e., "to correct for indirect intervention, relative border prices should be evaluated at the equilibrium nominal exchange rate and deflated by a nonagricultural price index PNA^* to correct prices of tradables for exchange rate overvaluation and trade policy distortions" (Dethier, 1988).

As is apparent from the above equation, NRPI i.e., the incidence of indirect interventions, is the same for all crops and depends on (E^*/E_0) (level of exchange rate overvaluation) and on t_m, the impact of trade policies in PNA(T).

Total Nominal Rate of Protection (NRPT)

$$NRPT=\frac{P_d/PNA-(E^*/E_a)\,P_b/PNA^*}{(E^*/E_a)\,P_b/PNA^*}$$

where

E_a: the exchange rate that applies to each crop (E_c, E_g, E_0 for cotton, groundnuts and wheat respectively)

Since NRPT is not equal to the sum of NRPD and NRPI, the

direct nominal rate of protection (NRPD) has been adjusted as follows:

$$NRPd=NRPT-NRPI=\frac{P_d/PNA-P_b/PNA^*}{(E^*/E_a)\,P_b/PNA^*}$$

where NRPd is the adjusted NRPD which "measures the impact (P_d/PNA - P_b/PNA) of the direct policies as a percent of P_d^*/PNA^*, the relative price which would prevail in the absence of all interventions and with $E = E^*$ (Krueger, Schiff and Valdés, 1988).

Tables 4.20, 4.21 and 4.22 present NRPD, NRPI and NRPT for cotton, groundnuts and wheat respectively for the period 1980-1988. The formulas used are presented below. The exchange rate E_a corresponds to E_c, E_g and E_0 for cotton, groundnuts and wheat respectively.

$$NRPD=\frac{Farmgateprice-BorderpriceatE_a}{borderpriceatE_a}$$

$$NRPd=\frac{Farmgateprice/PNA-BorderpriceatE_a/PNA^*}{(E^*/E_a)\,BorderpriceatE_a/PNA^*}$$

$$NRPI=\frac{1/PNA-(E^*/E_a)/PNA^*}{(E^*/E_a)\,PNA^*}$$

$$NRPT=\frac{Farmgateprice/PNA-(E^*/E_a)\,BorderpriceatE_a/PNA^*}{(E^*/E_a)\,BorderpriceatE_a/PNA^*}$$

Table 4.20: NRP estimates for cotton

Year	NRPD	NRPd	NRPI	NRPT
1980	0.959769	0.716536	-0.23573	0.497786
1981	0.893873	1.072336	0.23553	1.339943
1982	0.703926	0.790941	0.14539	0.951655
1983	0.212744	0.185441	-0.10708	0.082878
1984	0.253829	0.153255	-0.22155	-0.023950
1985	-0.069070	-0.103560	-0.23075	-0.283890
1986	2.195526	2.132246	-0.02266	2.123101
1987	2.185737	1.813422	-0.17184	1.638295
1988	0.263037	0.192645	-0.26051	-0.066000

Table 4.21: NRP estimates for groundnuts

Year	NRPD	NRPd	NRPI	NRPT
1980	-0.43572	-0.47598	0.03940	-0.41348
1981	-0.37164	-0.49125	0.23553	-0.22364
1982	-0.03070	-0.05049	0.14538	0.11022
1983	-0.37047	-0.33532	-0.10708	-0.43788
1984	-0.38456	-0.55520	0.25749	-0.22609
1985	-0.41103	-0.36661	-0.23075	-0.54694
1986	-0.13559	-0.13166	-0.11889	-0.23836
1987	0.84872	0.89085	0.04475	0.93146
1988	1.99331	1.47215	-0.26051	1.21350

Table 4.22: NRP estimates for wheat

Year	NRPD	NRPd	NRPI	NRPT
1980	-0.27584	-0.29614	-0.00645	-0.28052
1981	-0.05663	-0.07710	-0.06648	-0.11935
1982	0.06133	0.04309	-0.10131	-0.04619
1983	-0.28712	-0.30002	0.02685	-0.26797
1984	-0.07298	-0.14550	0.11977	0.03804
1985	0.20700	0.12743	-0.0.984	0.08809
1986	0.06152	0.04848	0.01643	0.07896
1987	-0.37102	-0.28434	-0.22535	-0.51276
1988	-0.26580	-0.13400	-0.50043	-0.63322

The NRPD estimates for cotton, groundnuts and wheat measure the deviation of the producer domestic price from the border price equivalent evaluated at the farmgate. NRPD estimates for cotton are positive for the period under study, except for 1985. This indicates positive protection of cotton i.e., that producers of cotton receive a higher price in the presence of direct government interventions than they would have in the absence of these interventions. The extent of protection ranges from 25% in 1984 to 220% in 1986. In 1985, the NRPD for cotton is negative and implies that the cotton is taxed by about 7%. The adjusted direct NRP for cotton gives the same picture of positive protection for cotton (except for 1985) i.e., that cotton receives a subsidy.

NRPD estimates for groundnuts are negative for most years except for 1987 and 1988 where they are positive. This implies that groundnuts is taxed, with the tax ranging between 3% and 44%. The positive NRPD estimates for groundnuts in 1987 and 1988 imply that groundnuts received a subsidy during these two years.

The NRPD estimates for wheat are also negative for most years (except for 1982, 1985 and 1986). This implies wheat has been taxed during this period. Taxation ranged between 6% in 1981 and 37% in 1987. The years where NRPD for wheat are positive imply that wheat was protected during these years.

The NRPI estimates for cotton are negative for most years

with the exception of the years 1981 and 1982. The NRPI estimates capture the effects of indirect government policies such as exchange rate and trade policies on producer prices. The negative estimates imply that cotton, an agricultural export, is taxed via indirect interventions. This taxation ranges from 2% in 1986 to 26% in 1988. The NRPI estimates for groundnuts are surprising. There are years when the estimates are positive i.e., indirect government policies had positive effects on the prices of groundnuts. The NRPI estimates for wheat are negative for most years.

The NRPT estimates give the effect of both direct and indirect interventions. This is positive for cotton for all years except 1984, 1985 and 1988. This implies that the direct government interventions offset the negative effect of the indirect government policies. The NRPT estimates for groundnuts and wheat are negative for most years which implies that the overall effect of both the direct and indirect government policies have resulted in the taxation of groundnuts and wheat.

Given that the government taxes agricultural commodities heavily, in particular cotton, these are surprising results. The main source of the problem may be the fact that the prices in the Gezira Scheme are government determined. Due to lack of information, the procedure by which the prices are determined by the government is not available. Prices do not

represent opportunity cost and do not convey market information. Thus, the NRP calculations are not able to capture the level of protection or taxation. In addition to this, world prices were obtained by dividing the total value of exports by the total quantity exported. However, due to lack of information, it is not clear at what stage these values are reported by the Bank of Sudan and thus whether these prices represent f.o.b prices for these commodities.

Effective Rate of Protection (ERP)

ERP captures the combined effects of government interventions on the prices of crops and agricultural inputs. ERP is a measure of protection afforded to an activity not a commodity.

ERP is the ratio of value added at domestic prices to value added at world prices expressed as a percentage of value added at world prices (Dethier, 1988).

Direct Effective Rate of Protection (ERPD)

$$ERPD=\frac{VA_d/PNA-VA_b/PNA}{VA_b/PNA}=\frac{VA_d-VA_b}{VA_b}$$

where

VA_d: the value added of agricultural product at domestic prices of tradable outputs and inputs

VA_b: the value added of agricultural products at border prices of tradable outputs and inputs evaluated at Eo

PNA: the nonagricultural price index

Indirect Effective Rate of Protection (ERPI)

Indirect effective rate of protection ERPI = ERPT - ERPD

It is important to note that, in the study of Egypt by Dethier (1988), in the equation for ERPD and ERPT, the value added for each crop was divided by an index of value added in nonagriculture (VANA) in order to obtain an effective protection rate in relative terms. The indices of value added in nonagricultural sectors are based on the implicit Gross Domestic Product (GDP) deflator data (i.e., the ratio of sectoral GDP at current prices to GDP at constant prices) (Dethier, 1988). However, due to the lack of adequate data, PNA and PNA* have been used in place of VANA and VANA* following the example of Zambia (Jansen, 1988). A rough estimate of VANA and VANA* showed that the use of PNA does not alter the results significantly.

$$VANA^{*}=a(E^{*}/E_{0})\frac{VANA(T)}{1+t_{m}}+(1-a)\,VANA(NT)$$

where

VANA*: the corrected nonagricultural value added index

VANA(T): tradable component of nonagricultural value added index

VANA(NT): the nontradable component of nonagricultural value added index

Total Effective Rate of Protection (ERPT)

In the case of total intervention

$$ERPT = \frac{VA_d/PNA - (E^*/E_a)\,VA_b/PNA^*}{(E^*/E_a)\,VA_b/PNA^*}$$

where

ERPT: the total effective rate of protection

VA_d: the value added of agricultural products at domestic prices of tradable outputs and inputs

VA_b: the value added of agricultural products at border prices evaluated at official exchange rates for each crop

PNA: the nonagricultural price index

PNA^*: the corrected nonagricultural price index

E^*: the equilibrium nominal exchange rate

E_a: the official exchange rate that applies to each crop (E_c, E_g, E_0 for cotton, groundnuts and wheat respectively)

The data used to calculate NRP and ERP (direct, indirect and total) has been explained in previous sections. Table 4.23 shows ERPD and ERPT for cotton, groundnuts and wheat respectively for the period 1980 to 1988.

The ERP estimates for the three agricultural commodities under study follow the same direction as the NRP estimates. The ERPD estimates for cotton are positive for all years except for 1985, 1986 and 1987. This implies that cotton was

protected during this period with protection ranging from 10% to 438%. The ERPD estimates for groundnuts indicate that groundnuts have been taxed for most years except for the last two years. As in the NRPD estimates for groundnuts, the last two years show large positive values which imply subsidization of groundnuts in 1987 and 1988. The ERPD estimates of wheat show taxation of this commodity during the entire period of study. The level of taxation varied from 7% to 316%.

Table 4.23: ERP estimates for cotton, groundnuts and wheat

Year	Cotton		Groundnuts		Wheat	
	ERPD	ERPT	ERPD	ERPT	ERPD	ERPT
1980	2.121	1.385	-0.482	-0.462	-0.515	-0.518
1981	4.384	5.652	-0.385	-0.240	-3.163	-3.019
1982	1.736	2.134	-0.038	0.101	-0.177	-0.261
1983	0.350	0.205	-0.397	-0.461	-0.453	-0.438
1984	0.578	0.229	-0.408	-0.256	-0.299	-0.215
1985	-0.099	-0.307	-0.436	-0.566	-0.174	-0.255
1986	-2.336	-2.306	-0.148	-0.249	-0.068	-0.053
1987	-13.795	-11.596	1.005	1.095	-0.503	-0.615
1988	0.690	0.249	2.893	1.879	-0.331	-0.666

The ERPT estimates of cotton show positive protection while the ERPT estimates for groundnuts and wheat show negative protection i.e., taxation of these two commodities. As with the NRP estimates, the problem lies in the fact that the prices of these agricultural commodities are fixed and therefore do not represent opportunity cost. Furthermore, the inability of tenants in the Gezira Scheme make production

decisions in terms of choosing inputs and minimizing costs due to the control imposed by the SGB and the government has also affected the calculations of ERP.

Due the unavailability of f.o.b. prices for Sudan and the unanticipated results obtained especially in the case of cotton, the nominal and effective rates of protection for cotton were also calculated using prices for U.S. Middeling M-1-3/32 inch cotton c.i.f. Northern Europe obtained from the Cotton Outlook and Situation Report. Transportation and freight costs were deducted from the c.i.f. prices for cotton to get f.o.b. prices at Port Sudan. Table 4.24 shows the c.i.f. Northern Europe price for U.S. cotton expressed in cents per pound and the f.o.b. price of cotton expressed in LS/ton.

Table 4.24. Price per pound of U.S. Middeling M-1-3/32" c.i.f. Northern Europe and f.o.b. cotton price Port Sudan

Year	c.i.f. price cent/lb[1]	ci.f. price $/ton	f.o.b price Port Sudan $/ton	LS/ton
1980	93.63	2065.27	1838.09	919.05
1981	83.53	1841.50	1638.94	1475.04
1982	72.57	1599.88	1423.89	1851.06
1983	84.08	1853.63	1649.73	2309.62
1984	80.91	1783.80	1587.58	2063.85
1985	59.91	1320.79	1175.50	2938.77
1986	47.91	1056.30	940.11	3055.34
1987	74.78	1648.56	1467.22	4768.47
1988	63.86	1407.91	1253.04	5638.69

1 Source: Cotton Situation and Outlook Report

Table 4.25. NRP and ERP estimates for cotton using Northern Europe c.i.f. price for U.S. cotton

Year	NRPD	NRPd	NRPI	NRPT	ERPD	ERPT
1980	1.101	0.824	-0.236	0.605	2.657	1.795
1981	0.298	0.337	0.236	0.604	0.595	0.970
1982	0.228	0.246	0.145	0.407	0.342	0.537
1983	-0.039	-0.040	-0.107	-0.142	-0.089	-0.186
1984	0.337	0.218	-0.222	0.041	0.850	0.440
1985	0.183	0.090	-0.231	-0.090	0.314	0.011
1986	1.030	0.994	-0.023	0.984	-4.830	-4.743
1987	0.501	0.418	-0.172	0.243	1.044	0.692
1988	0.423	0.311	-0.261	0.052	1.299	0.700

Table 4.25 gives the NRP and ERP estimates for cotton using the Northern Europe c.i.f. price for U.S. cotton. The estimates do not change much with the prices used. The NRPD and NRPd estimates still indicate that cotton is protected. The NRPI indicate that the indirect intervention in the form of exchange rate overvaluation and trade policy result in the taxation of cotton (except for 1981 and 1982). The NRPT indicates the protection of cotton for most of the period under study. The same conclusions are obtained from the ERPD and ERPT estimates of cotton. As discussed earlier, the prices of cotton fixed by the government do not reflect opportunity cost and the control of input and land allocation by the government parastatals has greatly affected the results obtained from the calculation of the rates of protection of not only cotton but also of groundnuts and wheat.

CHAPTER 5. DISCUSSION AND CONCLUSION

Discussion

Introduction

The Sudan has experienced severe economic problems including increasing negative trade balances and external debt service obligations. Since over 90% of the Sudan's export earnings comes from agriculture, economic recovery has always been linked to agricultural recovery and improved export performance. In addition to providing most of the food supply, the agricultural sector is also a source of raw materials for the nonagricultural industries in the country (D'Silva and El Badawi, 1987). Thus, the agricultural sector is an important contributor, not only to foreign exchange earnings but also to food security. For these reasons, it is considered the driving force behind the country's economic prosperity (Ibrahim, 1989). Government intervention policies have been considered to be extremely hindering to the growth of agriculture in particular and to the economic growth of the country as a whole. Thus the study of the effect of the country's agricultural and economic policies is crucial.

Analysis of Some Government Policies

The agricultural sector has thus been exposed to several restricting policies as is apparent from the government policies indicated in Chapter 3. The imposition of taxes in the form of export, import, development and local taxes have

affected the agricultural sector severely. These taxes have had a significant effect on producers' revenues and incentives. As a result of these taxes and low productivity, the competitiveness of Sudan's agricultural products in the world market is low (Abdel Salam, 1986).

As we have seen, the modern sector receives the most in terms of subsidies while the traditional sector is virtually neglected. This seems to indicate that the beneficiaries of these subsidies are the powerful interest groups in the country. Policies, aimed at keeping prices of food low for the urban sector, put poor farmers in the traditional sector at a disadvantage. The traditional sector consists of the majority of the farming population and also, has the highest potential for contributing to the country's economy. However, lack of investments in this sector has resulted in low production and hence, lower incomes for the traditional cultivators.

Trade restrictions have resulted in smuggling and the emergence of black markets for exchange rates (Abdel Salam, 1986). Price regulation policies and the setting of floor prices have caused adverse effects on producers. Announced floor prices do not change to reflect changes in international prices and these prices are set too low to be effective.

The existence of multiple exchange rates also poses a problem. Although the government adopted a policy of a series

of devaluations, it still maintained different exchange rates, namely, exchange rates for agricultural inputs, cotton and gum arabic, other exports and remittances for Sudanese nationals working abroad (El Badawi, 1989). These exchange rates result in different incentives not only for crop producers but also across subsectors. The existence of black market exchange rates that are much higher than the official exchange rates indicates that the exchange rates are overvalued.

Fixed cropping patterns imposed in the irrigated subsector have inhibited producers from making decisions. Fixed resource allocations are not influenced by prices. These act as disincentives to producers. Furthermore, devaluations result in output price incentives to producers but also in increased costs of imported inputs. The producers in the Gezira Scheme have no power to respond to these price signals by changing the intensity of input use or by reallocating crops. This has resulted in inefficient allocation of resources in the Scheme. Studies done on Sudan have concluded that in order to improve producer incentives, certain policy changes have to take place, especially in terms of exchange rate flexibility and the extent of government involvement in the production process. It is argued that the irrigated subsector parastatals are a liability to the government's treasury rather than a source of income (D'Silva, 1985).

Thus despite the substantial contribution of the agricultural sector to the GDP and foreign exchange earnings, its share is declining (D'Silva, 1985 and El Badawi, 1987). El Badawi argued that "the biased relative structure of incentives in the economy" is the main cause behind this phenomenon. It has also been argued that overvalued exchange rates, inflationary internal balances and protectionism distorted the structure of incentives in the Sudan in favor of home goods and import-competing sectors and against exportables (El Badawi, 1987). To finance the expanding fiscal deficit, the government relied on agriculture as a major tax base. Direct intervention in agriculture which included the underpricing of exports, forced procurement, and restrictive foreign trade and payment regime, has resulted in weakening the backbone of the Sudanese economy. In addition to the adverse policies, shortages in inputs, inefficiency and bureaucracy, high costs in marketing, distribution, transportation and storage have contributed to the failing of the agricultural sector. The absence of marketing and credit system in the traditional sector has resulted in the low prices facing producers in that sector.

Policy reforms, initiated in 1979, included exchange rate changes, increases in producer prices of cotton, groundnuts, sesame and gum arabic, reduction of subsidies on bread, sugar and petroleum products and change in production relations in

the irrigated sector. It is thus evident that the Sudanese government recognizes the need for changes in its policies concerning agriculture and the economy in general. Sudan's policy makers face the tax of increasing agricultural production, achieving food self-sufficiency, increasing exports, decreasing debt servicing and increasing government revenues. Among these changes are unification of exchange rates, institutional changes in the irrigated subsector, reducing operating cost and budgetary subsidies for agricultural parastatals and encouraging private sector involvement in the agricultural sector.

Results

Estimates of the direct nominal rate of protection (NRPD) for cotton are positive for all years except for 1985. This implies that cotton has been protected during this period. These results are somewhat surprising. Both El Badawi (1989) and Dethier (1988) have calculated negative NRPD for cotton. This unexpected result may be due to a number of reasons. The main and most important reason may be that the prices of cotton are government determined and it is not evident how these prices are determined. A second reason may be due to the fact that the study concentrated only on the Gezira Scheme, a government operated project where policies directed specifically toward the scheme may be favorable especially in the case of cotton, the major crop. However, the Gezira

Scheme does produce a large proportion of the cotton crop and it is evident that any policy directed toward cotton would have an effect on cotton production as a whole. The third reason is the extremely poor and unreliable data that has been used. Estimates are not accurate due to the manipulation that had to be performed on the data. For example, the cost data used is the cost structure for one year deflated using CPI to obtain costs for the remaining years.

Direct nominal rate of protection estimates for groundnuts and wheat are negative for most years except for 1987 and 1988 for groundnuts and 1982, 1985 and 1986 for wheat. The results however show a general trend of taxation in the case of these two commodities. This result is consistent with El Badawi's results for groundnuts (El Badawi 1989). Negative NRP estimates imply that the producers of these commodities receive a lower domestic price than what would have prevailed in the absence of interventions.

The indirect nominal rates of protection (NRPI) for the crops under study are negative for most years (except for groundnuts) thus indicating that the economy-wide policies have taxed these agricultural commodities. The total nominal rates of protection indicate the total effect of intervention and these are positive for cotton and negative for groundnuts and wheat for most of the years under study.

The effective rates of protection for all three crops

seem to move in the same direction as the NRP results. According to both the direct and total estimates (ERPD and ERPT respectively) cotton has been protected and groundnuts and wheat have been taxed for the period 1980 - 1988.

The NRP and ERP estimates seem to imply the same result i.e., direct policies have protected cotton and taxed groundnuts and wheat while the macroeconomic policies have taxed cotton, groundnuts and wheat. However, as mentioned earlier, the calculation of the NRP and ERP estimates is affected by the fact that government determined prices do not convey demand and production information and that prices do not influence the resource allocations and cropping patterns in the Gezira Scheme since they are fixed by the government. A more appropriate method of calculating the rates of protection for these commodities is to use shadow prices which reflect opportunity cost.

Conclusions and Recommendations

Aside from the unexpected and unreliable result in terms of cotton, it is safe to deduce that agricultural commodities are being taxed both directly and indirectly in the Sudan. Although inappropriate agricultural and macroeconomic policies have contributed to this factor, there are other issues to consider.

Developmental efforts have been concentrated in the irrigated and rainfed mechanized subsectors (the modern

sector). The lack of development programs in the rainfed traditional sector have hindered the development of this sector which as seen above is a crucial part of the Sudanese economy. According to D'Silva (1985), the rainfed sector has a very high potential for growth. Appropriate government policies, in terms of investments and availability of inputs should be directed to traditional agriculture so as to increase revenue and productivity in that sector. It is now evident that concentration of investment in the modern sector has not reaped the desired results and has been at the expense of the potentially productive traditional sector. The heavy reliance on imported goods by the modern sector has taken its toll on the Sudanese economy.

The government should also aim at increasing producer incentives by letting producer prices move with exchange rate adjustments and adjusting prices toward border price equivalents as well as increasing the efficiency in the management of government operated agricultural schemes and including producers in the decision process. D'Silva and McKaig (1986) also suggest changes in the cropping patterns by reducing the areas allocated to cotton production and increasing the areas for wheat and/or sorghum production. This does not only increase food production and thus reduce food imports but also provides savings in terms of water requirements. This increase in water availability could mean

increased food production in the other schemes (D'Silva and McKaig, 1986). This still implies planned production rather than free market. Although restrictive government policies have hindered productivity in the agricultural schemes, reduction of the areas allocated to cotton production would serve as a better policy if the government continues to exercise control.

The weather conditions and the political instability cannot be ignored as contributing factors to the country's growing problems. However, it is the inadequate government policies that are the main culprit. In order to induce positive change, the government should implement exchange rate, trade and pricing policies that will improve the incentive structure of producers. Although development programs should continue to focus on agriculture as the main engine of growth, especially with respect to exports, it is questionable whether concentration on only cotton as the major export crop is wise. Sudan has suffered from lower cotton production and has had problems with marketing the crop internationally (D'Silva and McKaig, 1986). Sudan has a comparative advantage in many of the agricultural commodities it produces with rainfed crops offering the highest potential (Moe and Haddad, 1983). It is therefore a better strategy to promote a number of agricultural commodities for export instead of relying on one major foreign exchange earner.

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APPENDIX A. GEZIRA SCHEME STATISTICS

Table A.1. Production of cotton, groundnuts, wheat and sorghum

Season	ELS Cotton[1]	MS Cotton[1]	Groundnuts[2]	Wheat[2]	Sorghum[2]
78/79	1,169,791	460,524	189,383	123,758	146,917
79/80	1,094,169	345,182	132,556	170,579	163,647
80/81	914,497	242,490	83,750	75,997	69,191
81/82	1,539,286	151,056	97,771	87,483	89,414
82/83	1,629,807	645,977	60,755	92,969	125,167
83/84	1,480,536	972,972	91,529	103,100	216,167
84/85	1,516,637	910,365	108,558	0[3]	147,024
85/86	1,286,477	132,685	55,882	97,387	318,315
86/87	1,554,272	493,904	91,083	95,908	179,202
87/88	921,721	830,384	95,897	119,568	141,287

1. Production in kantars.
2. Production in metric tons.
3. No wheat production in Gezira during the 1984/85 season.
Source: Sudan Gezira Board, 1989.

Table A.2. Areas under production for cotton, groundnuts, wheat and sorghum (in feddans)

Season	ELS Cotton	MS Cotton	Groundnuts	Wheat	Sorghum
78/79	409,127	88,897	217,182	493,436	344,068
79/80	446,588	94,302	228,545	362,502	327,294
80/81	426,925	74,277	170,919	366,737	300,832
81/82	379,889	55,425	264,245	267,863	343,899
82/83	375,360	108,256	148,182	155,760	320,940
83/84	346,609	151,120	136,611	265,865	410,791
84/85	345,298	119,495	212,859	0[1]	420,068
85/86	376,139	24,419	102,535	242,498	578,754
86/87	328,435	86,639	151,050	179,869	448,005
87/88	237,992	145,045	158,728	252,314	394,457

1. No wheat production in Gezira during the 1984/85 season.
Source: Sudan Gezira Board, 1989.

Table A.3. Yields of cotton, groundnuts, wheat and sorghum

Season	ELS Cotton[1]	MS Cotton[1]	Groundnuts[2]	Wheat[2]	Sorghum[2]
78/79	2.859	5.180	0.872	0.251	0.427
79/80	2.450	3.660	0.580	0.471	0.500
80/81	5.333	3.265	0.490	0.207	0.230
81/82	4.052	2.725	0.370	0.327	0.260
82/83	4.342	5.929	0.410	0.597	0.390
83/84	4.271	6.438	0.670	0.388	0.526
84/85	4.392	7.618	0.510	0.000[3]	0.350
85/86	3.420	5.434	0.545	0.402	0.550
86/87	4.732	5.701	0.603	0.533	0.400
87/88	3.873	5.725	0.604	0.474	0.358

1. Yields in kantar/feddan.
2. Yields in ton/feddan.
3. No wheat production in Gezira during the 1984/85 season.
Source: Sudan Gezira Board, 1989.

Table A.4. Picking labor statistics

Season	Tenants & Their Families	Local Labor	Imported Labor	Floating Labor	Total Available	Total Required
78/79	132,703	69,116	252,877	7,877	462,573	460,296
79/80	138,316	75,829	217,138	5,460	436,743	460,596
80/81	131,627	77,473	186,018	5,161	400,279	410,513
81/82	124,978	77,399	161,761	3,518	367,656	394,202
82/83	145,719	86,380	203,659	3,209	438,967	466,185
83/84	141,940	90,850	231,933	5,697	470,420	493,054
84/85	141,505	94,078	214,862	13,640	464,085	470,830
85/86	132,421	87,584	173,024	11,505	404,534	405,790
86/87	127,284	99,326	163,358	8,495	398,463	406,953
87/88	124,399	89,874	144,526	7,517	366,316	383,015

Source: Sudan Gezira Board, 1989.

Table A.5. Land and water charges (LS/feddan)

Season	Cotton	Wheat	Groundnuts	Sorghum	Vegetables
81/82	28.50	18.00	14.00	7.00	25.00
82/83	28.50	18.00	14.00	7.00	25.00
83/84	38.00	23.00	19.00	19.00	33.25
84/85	50.00	31.00	25.00	25.00	44.00
85/86	65.00	40.00	32.00	32.00	57.00
86/87	80.00	49.00	40.00	40.00	70.00
87/88	101.00	60.00	50.00	50.00	96.00

Source: Sudan Gezira Board, 1989.

Table A.6. Total cost and gross revenues (LS/feddan)

Season	Cotton		Groundnut		Wheat	
	Cost	Revenue	Cost	Revenue	Cost	Revenue
78/79	64.727	170.730	26.000	52.000	22.000	21.000
79/80	80.972	139.600	38.000	90.000	65.000	51.000
80/81	107.864	156.000	46.910	139.220	40.800	44.255
81/82	233.886	385.800	73.770	75.030	93.413	67.100
82/83	293.948	401.760	90.513	159.020	124.278	194.000
83/84	426.200	548.800	135.114	350.410	140.804	150.800
84/85	443.620	701.720	132.830	270.720	0.000[1]	0.000[1]
85/86	777.590	777.580	200.960	615.760	273.210	303.340
86/87	834.930	1210.630	262.660	592.770	275.780	409.710
87/88	1035.850	1403.860	379.480	669.460	320.909	518.370

1. No wheat production in the Gezira during the 1984/85 season.

Source: Sudan Gezira Board, 1989.

APPENDIX B. PRICE STRUCTURES

Table B.1. Price structure for export of long staple cotton lint in 1982 constant prices

International: US$/MT	1982 Financial	1982 Economic
Price c.i.f North Europe[1]	1675	1675
International Freight	176	176
Price f.o.b. Port Sudan	1499	1499
Port Sudan: LS/MT		
Price f.o.b. Port Sudan	1350	1350
Development tax (5% of f.o.b.)	68	-
Export company commission (1% of f.o.b.)	14	8
Shipping expenses (LS 0.50/Kantar)	11	7
Quay dues (0.5% of f.o.b.)	7	4
Price ex-store, Port Sudan	1250	1331
CPC commission (2% of ex-store)	25	15
Insurance and claims (1.25% of ex-store)	16	14
Equalization fund (2% of ex-store)	25	-
Price stabilization fund (0.5% of ex-store)	6	-
CPC unforeseen expenses (2% of ex-store)	25	15
Selling price, Port Sudan	1153	1287
Bank interest (9% per annum for 12 months)	104	90
Price to parastatal	1049	1197
Transport and handling	39	33
Ex-ginnery price	1010	1164
Ex-Ginning: LS/MT		
Return from lint (34%)	343	396
Return from seed (61%)	131	106
Collection Center to Ex-Ginnery:		
Ginning, baling and storage	40	25
Transport and handling	6	4
Farmgate to Collection Center:		
Transport	3	2
Farmgate price (LS/MT)	425	471
(LS/Kantar)	61	67

1. 1982 price based on market quotation (May 1982) for GSB, April 8, 1982.

Source: World Bank Export Development Study, 1983.

Table B.2. Price structure for export of medium staple cotton lint in 1982 constant prices

International: US$/MT	1982 Financial	1982 Economic
Price c.i.f. North Europe[1]	1668	1688
Price f.o.b. Port Sudan	1335	1335
Port Sudan: LS/MT		
Price f.o.b. Port Sudan	1202	1202
Development tax (5% of f.o.b.)	60	-
Export company commission (1% of f.o.b.)	12	7
Shipping expenses (LS 0.50/Kantar)	12	7
Quay dues (0.5% of f.o.b.)	6	4
Price ex-store, Port Sudan	1112	1184
CPC commission (2% of ex-store)	22	13
Insurance and claims (1.25% of ex-store)	14	8
Equalization fund (2% of ex-store)	22	-
Price Stabilization fund (0.5% of ex-store)	6	-
CPC unforeseen expenses (2% of ex-store)	22	13
Selling price, Port Sudan	1026	1150
Bank interest (9% per annum for 12 months)	92	55
Price to parastatal	934	1095
Transport and handling	39	33
Ex-ginnery price	895	1062
Ex-Ginning: LS/MT		
Return from lint (38%)	340	404
Return from seed (58%)	82	64
Collection Center to Ex-Ginnery		
Ginning, baling and storage	48	29
Transport and handling	6	4
Farmgate to Collection Center:		
Transport	3	2
Farmgate price (LS/MT)	365	433
(LS/Kantar)	52	62

1. 1982 price based on market quotation (May 1982) for Mexican, Middeling 35 (1-3/32").

Source: World Bank Export Development Study, 1983.

Table B.3. Price structure for export of groundnut in 1982 constant prices

International: US/Ton	1982 Financial	1982 Economic
Price c.i.f. Europe (shelled)	410	410
Price f.o.b. Port Sudan[1]	513	513
Port Sudan: LS/Ton		
Price f.o.b. Port Sudan	461	461
Company profit (5% of f.o.b.)	23	14
Impurities (2% of f.o.b.)	9	5
Agent commission (1% of f.o.b.)	5	3
Delay charges (1% of f.o.b.)	5	3
Insurance (0.01% of f.o.b.)	-	-
Free fatty acid content (1% of f.o.b.)	5	3
Oil deficit (1% of f.o.b.)	5	3
Price at dock	409	430
Stabilization fee	1	-
Port Sudan expenses	14	8
Storage (LS 0.6 for 4 months)	3	2
Price at company store	391	420
Bank interest (11% per annum for 4 months)	14	8
Local dealer price, Port Sudan	377	412
Auction Market to Port Sudan: LS/Ton		
Local dealer profit (5%)	19	11
Loading/off-loading	3	2
Transport	25	25
Price at local dealer store	330	374
Bank interest (14% per annum for 4 months)	15	9
Local tax (LS 0.5/Kantar)[2]	11	-
Decortication	9	5
Sacks	9	5
Local tax paid by dealer (15%)[3]	43	-
Auction market price	243	355
Auction market price, in shell (LS/Ton)[4]	158	231
Auction market price, in shell (LS/Kantar)	7.2	10.5
Farmgate prices as % of border prices	53	77

1. 25% historical price differential over international reference price.
2. 1 kantar = 100 lb = 45 kg; 22 kantars in one metric ton.
3. To Central Government.
4. 65% recovery rate.

Source: World Bank Export Development Study, 1983.

Table B.4. Price structure for wheat import, 1982

International: US$/Ton	Financial	Economic
Price f.o.b. NA	166	166
International Freight	40	40
Price c.i.f. Port Sudan	206	206
Port Sudan: LS/Ton		
Price c.i.f. Port Sudan	185	185
Defense tax (10% of c.i.f.)	19	-
Port handling	8	5
Bagging and storage	4	2
Commission (2% of c.i.f.)	4	2
Price ex-store Port Sudan	220	194
Port Sudan to Mill:		
Transportation	30	60
Sacks	4	2
Price at mill[1]	254	256
Local transport	3	3
Farmgate price (LS/Ton)	257	259
(LS/Sack)	23	23

1. Official price paid to farmers: LS 230/ton.
Source: World Bank Export Development Study, 1983.

Table B.5. Price structure for export of cotton seed, 1982

	Financial	Economic
International: US$/MT		
Cotton oil, c.i.f. Rotterdam[1]	610	
Cotton pellet, c.i.f. Denmark[1]	187	
Seed value of oil : 610 x .16 =	98	
Seed value of cake: 187 x .78 =	146	
Crushing margin (5%)	12	
Seed price, c.i.f. North Europe	256	
International freight[2]	44	
Price f.o.b. Port Sudan	212	
Port Sudan: LS/MT		
Price f.o.b. Port Sudan	191	191
Export tax (15% of f.o.b.)	29	-
Development tax (5% of f.o.b.)	10	-
Port Sudan costs	5	3
Bank charges (1% of f.o.b.)	2	1
Selling price, Port Sudan	145	187
Ginnery to Port: LS/MT		
Transport and handling	15	9
Sacks	9	5
Ex-ginnery price[3]	121	173

1. Market Quotations, May 1982.
2. Same as for groundnuts.
3. White cotton seed valued at 2/3 of this price.

Source: World Bank Export Development Study, 1983.

Table B.6. Price structure for urea import (fertilizer), 1982

International: US$/Ton	Financial	Economic
Price f.o.b. N.W. Europe, bagged[1]	160	160
International Freight	45	45
Price c.i.f. Port Sudan	205	205
Port Sudan: LS/Ton		
Price c.i.f. Port Sudan	185	185
Import duty (5% of c.i.f.)	9	-
Port handling	6	4
Port Sudan to Farmgate:		
Transportation	30	60
On-site price	230	249
Price per sack (LS/50 Kg)	10	12

Source: World Bank Export Development Study, 1983.

APPENDIX C. COST OF PRODUCTION DATA

Table C.1. Cotton: Cost of production data and value added at domestic prices

Season	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88
Farmgate Prices[4]									
Long Staple (LS) Cotton									
LS/Kantar	70.50[1]	70.50	86.00	88.00	107.00	135.00	215.00	248.00	293.00
LS/Ton	492.32	492.32	600.56	614.53	747.21	942.74	1501.40	1731.84	2046.09
Medium Staple (MS) Cotton									
LS/Kantar	50.50[1]	50.50	66.00	68.00	82.00	106.00	200.00	218.00	243.00
LS/Ton	352.65	352.65	460.89	474.86	572.63	740.22	1396.65	1522.35	1696.93
Weighted Average									
LS/Kantar	67.54	67.54	83.46	83.50	99.40	127.55	214.09	241.73	274.05
LS/Ton	471.65	471.65	582.82	583.10	694.13	890.71	1495.04	1688.06	1913.76
Tradable Inputs[4] (LS/Feddan)									
Seeds	2.09	3.98	4.63	3.67	6.01	6.87	9.58	12.65	15.57
LS/Ton	5.49	12.04	8.33	5.45	8.51	9.19	18.88	17.90	23.76
Fertilizer	12.53	21.07	40.34	42.70	41.61	40.42	114.75	76.61	79.33
LS/Ton	32.87	63.74	72.55	63.45	58.95	54.06	226.17	108.42	121.11
Herbicides	0.00	0.00	6.15	13.00	26.21	28.60	38.25	37.82	54.02
LS/Ton	0.00	0.00	11.06	19.33	37.13	38.25	75.39	53.52	82.47
Insect.[2]	27.52	33.63	60.75	69.51	112.85	101.29	259.00	248.71	281.94
LS/Ton	72.22	101.75	109.25	103.30	159.87	135.46	510.49	351.97	430.43
Empty Sacks	1.32	2.55	5.26	7.57	14.59	22.26	14.64	21.11	28.81
LS/Ton	3.45	7.72	9.46	11.26	20.66	29.77	28.86	29.87	43.99
Machinery	5.29	9.13	12.97	17.77	27.61	30.49	42.72	54.99	82.42
LS/Ton	13.88	27.62	23.32	26.41	39.12	40.78	84.20	77.22	125.82
Total	48.74	70.37	130.10	154.22	228.88	229.93	478.94	451.89	542.09
LS/Ton	127.90	212.87	233.97	229.19	324.24	307.50	944.00	639.51	827.57
Value Added for Cotton[3]									
LS Cotton	364.41	279.44	366.59	385.34	422.96	635.24	557.40	1092.33	1218.52
MS Cotton	224.75	139.78	226.92	245.67	248.38	432.73	452.65	882.84	869.35
Average	343.74	258.77	348.85	353.91	369.89	583.22	551.04	1048.55	1086.18

1. 1980/81 farmgate price.
2. Insecticide and Application.
3. Computed: Value Added = Farmgate price - Cost of tradable inputs.
   Cost in LS/ton = (Cost in LS/feddan)/yield.
4. Source: Sudan Gezira Board, 1989.

Table C.2. Groundnuts: Cost of production data and value added at domestic prices

Season	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88
Farmgate Prices[3]									
LS/Ton	78.00	262.00	180.00	330.00	420.00	588.00	1120.00	1232.00	1400.00
Tradable Inputs[3] (LS/Feddan)									
Seeds	3.59	2.84	7.59	7.42	14.71	16.19	21.00	29.62	43.14
LS/Ton	6.19	5.80	20.51	18.10	21.96	31.75	38.53	49.12	71.41
Herbicides	0.00	0.00	0.00	0.00	2.46	0.00	0.00	0.00	0.00
LS/Ton	0.00	0.00	0.00	0.00	3.67	0.00	0.00	0.00	0.00
Decort.[1]	0.00	0.27	0.00	0.28	0.00	0.00	0.00	0.00	0.00
LS/Ton	0.00	0.55	0.00	0.69	0.00	0.00	0.00	0.00	0.00
Sacks	2.74	2.62	3.69	2.65	2.65	5.20	30.79	25.80	31.27
LS/Ton	4.72	5.34	9.97	6.46	3.96	10.20	56.49	42.79	51.76
Machinery	1.38	1.39	2.56	3.80	6.51	7.40	5.36	7.01	13.48
LS/Ton	2.39	2.84	6.92	9.26	9.72	14.51	9.83	11.63	22.31
Total									
LS/Ton	13.29	14.53	37.41	34.51	39.30	56.45	104.86	103.53	145.48
Value Added for Groundnuts[2]									
LS/Ton	64.71	247.47	142.59	295.49	380.70	531.55	1015.14	1128.47	1254.52

1. Decortication.
2. Computed: Valued Added = Farmgate price - Cost of tradable inputs.
   Cost in LS/ton = (Cost in LS/feddan)/yield.
3. Source: Sudan Gezira Board, 1989.

Table C.3. Wheat: Cost of production data and value added at domestic prices

Season	79/80	80/81	81/82	82/83	83/84	84/85[1]	85/86	86/87	87/88
Farmgate Price[3]									
LS/Ton	118.50	160.00	230.00	280.00	360.00	700.00	700.00	770.00	1001.00
Tradable Inputs[3] (LS/Feddan)									
Fertilizer	12.50	15.07	27.13	28.87	26.59	26.59	81.98	50.18	30.84
LS/Ton	26.56	72.70	83.07	48.37	68.57	68.57	204.13	94.11	65.08
Seeds	6.89	8.47	13.00	19.99	22.65	22.65	33.50	54.58	57.75
LS/Ton	14.64	40.85	39.80	33.49	58.40	58.40	83.42	102.36	121.85
Sacks	3.44	1.79	2.46	5.72	5.36	5.36	12.06	11.20	12.83
LS/Ton	7.31	8.63	7.53	9.58	13.82	13.82	30.03	21.00	27.08
Insect.	1.57	1.39	2.36	6.38	9.93	9.93	19.01	11.52	13.97
LS/Ton	3.33	6.71	7.23	10.68	25.60	25.60	47.34	21.60	29.48
Seed Dress.	0.00	0.00	0.27	0.20	0.20	0.20	0.00	0.00	0.00
LS/Ton	0.00	0.00	0.83	0.33	0.52	0.52	0.00	0.00	0.00
Machinery	8.90	9.28	13.40	17.46	20.96	20.96	37.28	42.18	56.23
LS/Ton	18.91	44.80	41.03	29.25	54.06	54.06	92.83	79.11	118.66
Total									
LS/Ton	70.75	173.68	179.49	131.70	220.97	220.97	457.74	318.19	362.16
Value Added for Wheat[2]									
LS/Ton	47.75	-13.68	50.51	148.30	139.03	139.03	242.26	451.81	638.84

1. No Wheat Production during 1984/85 period. Farmgate price obtained from Abdelrahman (1990); input data from 1983/84.
2. Computed: Value Added = Farmgate price - Cost of tradable inputs.
   Cost in LS/ton = (Cost in LS/feddan)/yield.
3. Source: Sudan Gezira Board, 1989.

Table C.4. Cost of fertilizer in border prices evaluated at the official exchange rate (E_0) for cotton

Year	Border Price at E_0	Quantity in Tons[1]	Area in Feddans[1]	Cost/Feddan	Ton/Feddan[1]	Cost (LS/Ton)
1980	132.9910	55006	540890	13.52456	0.381	35.49755
1981	161.1195	53379	501202	17.15954	0.331	51.84152
1982	272.5335	47165	435314	29.52820	0.556	53.10828
1983	288.0600	59829	484315	35.58498	0.673	52.87516
1984	291.6290	65019	497729	38.09588	0.706	53.96017
1985	318.1120	60914	464792	41.69063	0.748	55.73614
1986	760.0240	43378	400558	82.30598	0.507	162.33920
1987	543.4850	43595	415074	57.08193	0.707	80.73824
1988	893.5750	46579	383037	108.66260	0.655	165.89720

Cost/feddan = (Border price of fertilizerxquantity)/area.
Cost/ton = (Cost/feddan)/(Ton/feddan).
1. Source: Sudan Gezira Board, 1989.

Table C.5. Cost of fertilizer in border prices evaluated at the official exchange rate (E_0) for wheat

Year	Border Price at E_0	Quantity in Tons[2]	Area in Feddans[2]	Cost/Feddan	Ton/Feddan[2]	Cost (LS/Ton)
1980	132.9910	26919	362504	9.87571	0.471	20.96753
1981	161.1195	29354	366737	12.89616	0.207	62.30032
1982	272.5335	18925	267863	19.25497	0.327	58.88372
1983	288.0600	12443	155760	23.01188	0.597	38.54586
1984	291.6290	13291	265824	14.58123	0.388	37.58049
1985	318.1120	-[1]	-	-	-	-
1986	760.0240	18713	242498	58.64926	0.402	145.89360
1987	543.4850	15924	179867	48.11585	0.533	90.27365
1988	893.5750	14952	252313	52.95301	0.474	111.71520

Cost/feddan = (Border price of fertilizerxquantity)/area.
Cost/ton = (Cost/feddan)/(Ton/feddan).
1. No wheat production in Gezira during the 1985 period.
2. Source: Sudan Gezira Board, 1989.

Table C.6. Cost of fertilizer in border prices evaluated at the equilibrium exchange rate (E^*) for cotton

Year	Border Price at E^*	Quantity in Tons[1]	Area in Feddans[1]	Cost/Feddan	Ton/Feddan[1]	Cost (LS/Ton)
1980	162.3294	55006	540890	16.50814	0.381	43.32846
1981	197.8875	53379	501202	21.07540	0.331	63.67192
1982	310.0785	47165	435314	33.59609	0.556	60.42463
1983	333.9000	59829	484315	41.24774	0.673	61.28937
1984	338.7379	65019	497729	44.24978	0.706	62.67674
1985	365.6540	60914	464792	47.92132	0.748	64.06594
1986	951.0740	43378	400558	102.99550	0.507	203.14700
1987	686.7171	43595	415074	72.12552	0.707	102.01630
1988	1119.7240	46579	383037	136.16340	0.655	207.88300

Cost/feddan = (Border price of fertilizerxquantity)/area
Cost/ton = (Cost/feddan)/(Ton/feddan)
1. Source: Sudan Gezira Board, 1989.

Table C.7. Cost of fertilizer in border prices evaluated at the equilibrium exchange rate (E^*) for wheat

Year	Border Price at E^*	Quantity in Tons[2]	Area in Feddans[2]	Cost/Feddan	Ton/Feddan[2]	Cost (LS/Ton)
1980	162.3294	26919	362504	12.05433	0.471	25.59307
1981	197.8875	29354	366737	15.83911	0.207	76.51746
1982	310.0785	18925	267863	21.90760	0.327	66.99572
1983	333.9000	12443	155760	26.67384	0.597	44.67980
1984	338.7379	13291	265824	16.93664	0.388	43.65113
1985	365.6540	-[1]	-	-	-	-
1986	951.0740	18713	242498	73.39214	0.402	182.56750
1987	686.7171	15924	179867	60.79649	0.533	114.06470
1988	1119.7240	14952	252313	66.35454	0.474	139.98840

Cost/feddan = (Border price of fertilizerxquantity)/area.
Cost/ton = (Cost/feddan)/(Ton/feddan).
1. No wheat production in Gezira during the 1985 period.
2. Source: Sudan Gezira Board, 1989.

APPENDIX D. STATISTICS ON SUDAN

Table D.1. Shares of major export commodities in total value of exports

Year	Cotton	Ground-nuts	Sesame	Gum Arabic	Food Grains	Live-stock	Other[1]
1970	0.61	0.05	0.06	0.09	0.02	0.06	0.11
1971	0.61	0.08	0.07	0.07	0.03	0.07	0.07
1972	0.59	0.08	0.07	0.07	0.03	0.08	0.08
1973	0.55	0.09	0.07	0.05	0.02	0.07	0.15
1974	0.39	0.19	0.13	0.10	0.03	0.05	0.11
1975	0.55	0.21	0.06	0.06	0.01	0.02	0.09
1976	0.44	0.17	0.10	0.06	0.03	0.04	0.12
1977	0.54	0.15	0.10	0.06	0.02	0.05	0.08
1978	0.61	0.05	0.05	0.08	0.02	0.06	0.13
1979	0.55	0.02	0.07	0.07	0.12	0.06	0.11
1980	0.27	0.02	0.07	0.07	0.15	0.10	0.32
1981	0.21	0.01	0.11	0.11	0.17	0.14	0.25
1982	0.25	0.07	0.08	0.08	0.23	0.13	0.16
1983	0.49	0.02	0.09	0.09	0.09	0.10	0.12
1984	0.50	0.03	0.12	0.08	0.01	0.12	0.15
1985	0.44	0.03	0.12	0.08	0.00	0.19	0.15
1986	0.44	0.00	0.07	0.17	0.02	0.09	0.21
1987	0.30	0.01	0.09	0.18	0.17	0.03	0.23
1988	0.43	0.04	0.12	0.12	0.05	0.06	0.19

1. Other Agricultural Tradables.
Source: El Badawi, 1989.

Table D.2. Export earnings by major agricultural commodity (value in millions of U.S. dollars)

Year	Cotton	Sorghum	Ground-nuts	Sesame	Live-stock	Gum Arabic
1978/79	320.70	8.70	25.50	27.80	30.00	40.00
1979/80	333.40	68.70	13.20	40.60	35.60	43.90
1980/81	182.00	71.40	55.60	32.20	43.70	32.60
1981/82	69.40	64.40	48.10	41.70	48.90	43.60
1982/83	581.10	87.40	38.10	51.30	128.60	47.50
1983/84	333.20	31.10	44.60	45.00	133.30	61.90
1984/85	245.10	0.00	15.00	43.40	197.30	41.60
1985/86	136.00	0.50	6.70	35.10	237.70	27.30

Source: D'Silva and El Badawi, 1987.

Table D.3. Export earnings by subsector (US$ millions)

Year	Traditional Subsector	Mechanized Subsector	Irrigated Subsector
1978/79	100.00	23.00	332.00
1979/80	98.00	70.00	358.00
1980/81	85.00	72.00	212.00
1981/82	129.00	94.00	93.00
1982/83	215.00	117.00	599.00
1983/84	244.00	60.00	353.00
1984/85	261.00	30.00	255.00
1985/86	279.00	20.00	156.00

Source: D'Silva and El Badawi, 1987.

Table D.4. Estimates of Gross Domestic Product at factor cost, current prices[1]

Year	Agr.[2]	Comm.[3]	M&M[4]	T&C[5]	C[6]	E&W[7]	G.S[8]	O.S[9]	GDP[10]
1980	1420	798	327	431	181	45	364	506	4072
1981	1770	1091	379	487	216	92	514	423	4972
1982	2396	927	369	683	378	76	545	862	6236
1983	2945	1274	541	930	599	126	726	1190	8331
1984	3692	1519	688	1137	661	175	955	1587	10417
1985	4014	1957	985	1495	824	284	1374	1967	12899
1986	7432	2910	1529	2130	1077	435	2389	2786	20688
1987	10607	4420	2227	3217	1522	613	3144	4188	29936
1988	12150	5457	2920	4000	2085	810	4395	5595	37410

1. Rounded off to the nearest decimal.
2. Agriculture, 3. Commerce, 4. Manufacturing and Mining,
5. Transport and Communication, 6. Construction,
7. Electricity and Water, 8. Government Services,
9. Other Services, 10. Gross Domestic Product.
Source: Bank of Sudan Annual Reports, various issues.

Table D.5. Estimates of Gross Domestic Product at factor cost, constant 1980 prices[1]

Year	Agr.[2]	Comm.[3]	M&M[4]	T&C[5]	C[6]	E&W[7]	G.S.[8]	O.S.[9]	GDP[10]
1980	1420	798	327	431	181	45	364	506	4072
1981	1450	893	310	399	177	75	421	348	4072
1982	1629	630	251	464	257	52	371	586	4239
1983	1505	651	277	475	306	65	371	609	4259
1984	1468	603	273	452	262	69	379	630	4137
1985	1123	547	275	418	231	80	384	550	3608
1986	1464	573	301	420	212	86	471	549	4076
1987	1493	622	314	453	214	86	443	590	4215
1988	1316	591	316	433	226	88	476	606	4051

1. Rounded off to the nearest decimal.
2. Agriculture, 3. Commerce, 4. Manufacturing and Mining,
5. Transport and Communication, 6. Construction,
7. Electricity and Water, 8. Government Services,
9. Other Services, 10. Gross Domestic Product.
Source: Bank of Sudan Annual Reports, various issues.

Table D.6. Percentage of long staple cotton in the total value of cotton exports

Year	Long Staple Cotton		Other Cotton		Total Value	Percentage Value of Long Staple Cotton
	Value (LS)	Quantity (Bales)	Value (LS)	Quantity (Bales)		
1980	77894	354729	37547	262363	115441	67.48
1981	46758	199218	21899	144102	68649	68.11
1982	78845	278349	42285	189715	121130	65.09
1983	238177	620904	157792	507637	395969	60.15
1984	294100	501470	155900	465652	450000	65.36
1985	257756	224100	116504	255214	374260	68.87
1986	168049	249144	198672	687763	366721	45.82
1987	230171	377425	225024	561363	455195	50.57
1988	496728	335977	481707	480220	978435	50.77

Table D.7. Current Account of Goods and Services (US$/Millions)

Year	Imports	Invisible Debits	Q_d	Exports	Invisible Credits	Q_s
1980	1238.8	449.0	1687.8	689.4	550.2	1239.6
1981	1795.1	607.2	2402.3	792.7	792.9	1584.9
1982	824.7	526.7	1351.4	400.9	622.9	1023.8
1983	772.8	571.7	1344.5	514.2	540.9	1055.1
1984	653.8	459.2	1113.0	519.0	545.1	1064.1
1985	617.3	453.9	1071.2	444.2	634.9	1079.1
1986	683.6	272.8	956.4	326.8	318.1	644.9
1987	763.5	323.0	1086.5	265.0	325.9	590.9
1988	1019.4	341.3	1360.7	427.0	387.9	814.9

Q_d = Imports+Invisible Debits
Q_s = Exports+Invisible Credits
Source: IMF Financial Statistics, International Monetary Fund.

Table D.8. Consumer Price Index (CPI)

Year	CPI (base year 1980)
1980	100.00
1981	123.67
1982	156.71
1983	206.33
1984	269.77
1985	397.03
1986	509.60
1987	632.15
1988	927.05

Source: Hassan, 1989.