EVALUATION OF THE GOVERNMENT POLICIES ON THE PERFORMANCE OF RAIN-FED SORGHUM IN SUDAN: AN APPLICATION OF THE POLICY ANALYSIS MATRIX

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ABSTRACT

Sudan's economy is predominantly based on agriculture. The importance of agriculture rests on its substantial contribution to GDP, export, employment and production of food and raw material for industries. The rain-fed subsystem plays an important role in the Sudanese economy. It accounts for a substantial share of agricultural GDP and it produces most of the country's requirements of the staple food, i.e. sorghum and millet, and provides a great share of the foreign currency. This study aims to applying one of the most powerful analytical techniques within the area of policy analysis; namely the policy analysis matrix (PAM), to assess the impact of adopted policies on the rain-fed sector. Within this respect three major objectives are pursued: (i) Quantifying the impact of adopted policies on rain-fed cultivation and production performance; (ii) Assessment of adopted policies on inputs use, resource utilization and rain-fed producers' incentives; (iii) The evaluation of the adopted policies. The collection of the data utilized for the analysis in this study took place through various surveys and visits to the sources from which the data was obtained. The result show that the government policy failed to achieve its objectives.

Key Words: *government policies, rain-fed sorghum, Sudan, policy analysis matrix*

Introduction

Sudan's economy is predominantly based on agriculture. The importance of agriculture rests on its substantial contribution to GDP, export, employment and production of food and raw material for industries. The Sudanese agricultural sector comprises three subsystems; the irrigation subsystem, the rain-fed subsystem and the livestock subsystem. The rain-fed agricultural subsystem includes the mechanized and the traditional agriculture. The rain-fed subsystem plays an important role in the Sudanese economy. It accounts for a substantial share of agricultural GDP and it produces most of the country's requirements of the staple food, i.e. sorghum and millet. Moreover, the rain-fed subsystem provides a great share of the country's foreign exchange earnings.

Problem of the study

The rain-fed farming represents the largest sector of the Sudanese agriculture. Sudan's total cultivated area is estimated at an average of over 40 million feddans during the past few years. Rain-fed agriculture constitutes the majority of this total; hence, irrigated agriculture is limited to about 5 mio. feddans in total. In addition, Sudan possesses huge amounts of natural resources. Like fertile soils, varying climate, and adequate rainfall. Accordingly, there is a high potential to improve rain-fed production to contribute significantly to the economy, support sustainable development, food security and income generation in Sudan. However, this potential is not exploited for many reasons, but also due to a lack of scientific policy decision-making support as identifying the most promising policy options. In order to fully exploit the Sudanese potential for expanded agricultural production within the rain fed sector, a comprehensive regional framework for policy decision-making support is required. However, the development of such a framework requires the assessment of the impact of currently adopted agricultural policies and, then, trying to formulate and adopt the most appropriate policy approach that provide adequate intensives to producers, used inputs and employed resources.

Objective of the study

This study aims at applying one the most powerful analytical techniques within the area of policy analysis; namely the policy analysis matrix (PAM), to assess the impact of adopted policies on the rain-fed sector.

Specific Objectives of the study

1. Quantifying the impact of adopted policies on rain-fed cultivation and production performance.
2. Assessment of adopted policies on input use, resource utilization and rain-fed producers' incentives.
3. Application of the policy analysis matrix (PAM) methodology for the evaluation of the adopted policies.

Research Methodology

The collection of the data utilized for the analysis in this study took place through various surveys and visits to the sources from which the data was obtained. Accordingly, the major sources of the utilized data in the various institutions within the study area were visited. In addition, additional specific macro-economic data was obtained from the published reports of the federal ministries and headquarters of specialized authorities.

Theoretical framework

The scope of agricultural policy

Generally speaking, policies are the instruments of action that governments employ to affect changes. In agriculture, there are three principal categories of policies used to bring about the desired changes. The first category comprises the instruments of agricultural price policy. Within this context, there are two main types of instruments that can be used to alter prices of agricultural outputs or inputs. Quotas tariffs, or subsidies on imports and quotas, taxes, or subsidies on exports directly decrease or increase amounts traded internationally and, thus, alter domestic prices. Domestic taxes or subsidies, in contrast, create transfers between the government treasury and domestic producers or consumers and some of them cause divergences between domestic and world prices.

The second category is represented by macroeconomic policies, which comprise the central government decisions to tax and spend (fiscal policies), to expand the supply of money (monetary policies), to influence the foreign exchange rate (exchange rate policies) and to intervene in the markets where the prices of primary factors (wages, interest and land rental rates) are determined. Although these policy decisions are not typically taken principally because of their impact on the agricultural sector, they have a very important impact on agricultural systems. Macro policies can affect both output and input prices in agriculture. Sometimes the macro policy effect, however unintended, might be more than offset the desired incentives of agricultural price policy. In addition to price and macro policies, governments influence their agricultural sector through public investment policy. Government budgetary resources can be invested in agriculture to increase productivity and reduce costs. The most common ways of doing this include investments in agricultural research to develop new technologies with higher yields or lower costs, in infrastructure (roads, irrigation, ports and marketing facilities), in specific agricultural projects to increase production and demonstrate new technologies and in education and training to upgrade the human capital in the sector.

Governments are assumed to have broad objectives that they are trying to further through interventions in the agricultural sector. The three most common objectives are efficiency (the allocation of resources to effect maximal national output and income), equity (the distribution of agricultural incomes to preferred groups or regions) and food security (the short run stability of food prices at affordable levels to consumers, adequacy of food supplies and the long run guarantee of adequate human nutrition). Typically, however, the promotion of objective conflicts with one or both of the others. In this situation, policy makers need to tradeoff the gains in one area against the losses in the others. For example, losses in efficiency, if not too large, might be tolerated if the actions were believed to result in significant improvements in income distribution or food security. Therefore, decision between competing objectives is the essence of policy analysis. The need to make these often difficult decisions arises because of constraints in the economic system. Within the agricultural system, there are three categories of constraints that limit the realization of the sector's potential. The ability of a country's agricultural system to produce commodities is limited by supply constraints such as the availability of domestic resources (land, water, labor, and capital), the existence of technologies (for farming and processing) and the relative costs of all inputs. The value of the produced commodities is in part established by domestic demand constraints like the levels of growth rates of the populations and income, changes in taste preferences and the relative prices of agricultural commodities. Both domestic supply and demand constraints are moderated by the world prices of agricultural outputs and inputs that enter international trade. Because these world prices (the third constraint) determine the domestic prices of internationally tradable commodities when no policies intervene, all agricultural price policies increase, decrease or stabilize domestic prices relative to the underlying world prices. The responsiveness of producers and consumers to these price policies depends on the underlying demand supply constraints, which in turn condition producer and consumer behavior and, thus, the shape and position of supply and demand schedules. For each agricultural system, therefore, the three categories of constraints can be depicted by drawing a supply curve, a demand curve and the relevant world price line for the outputs (the import price for goods that are partly imported or the fob export price for commodities some of which is exported).

Policy analysis

Policy analysis consists of evaluating policy instruments by quantifying the constraints and estimating the likely impacts of policy on objective. Analysts can, thus, identify tradeoffs between objectives and attempt to measure their magnitudes. Policy makers can then better exercise their value judgments about what is desirable policy. By placing different weights on the importance of objectives, policy makers can justify almost any government action. The main services that economic analysis can provide to policy makers are to distinguish whether a policy is likely to improve the efficient operation of the economy and, thus, assist faster growth of national income, measure the expected magnitude of the efficiency gains or losses and quantify the direction and extent of the policy's likely effects on the equity and food security objectives. Even when the none-efficiency effects are difficult to measure, economic analysis can provide a reasonable estimate of any short- and long-run efficiency costs likely to be associated with promotion of none-efficiency objectives.

Methods of policy analysis

Traditionally, economic analysis of agricultural policy has relied heavily on the estimation of supply curves for various inputs and outputs. In principal, these estimates should provide an accurate assessment of market behavior and responses. However, in practice, sufficient historical data of reliable quality are only rarely available to permit an analyst to assess fully the impacts of a complete set of government policies on the behavior of a particular agricultural system. Even when private marginal costs curves can be developed for output responses, input demands and the impact of various interventions on production costs are necessarily overlooked. The resulting policy analysis remains incomplete and often incomprehensible to policy makers.

Based on the above, agricultural policy research ought to use a more simplified, pragmatic and disaggregated analytical framework. Ideally, the framework should yield results that are simultaneously comprehensible to policy makers and yet retain theoretical consistency. Accordingly, this study employs the framework of the policy analysis matrix (PAM). Based on an assessment of average costs rather than marginal costs, the PAM method contains numerous theoretical assumptions and simplifications and thorough understanding of these limitations is essential for useful application of the method. However, in most situations, the advantages of the method outweigh its shortcomings.

The Policy Analysis Matrix (PAM)

The PAM is an accounting matrix developed by Pearson and Monke in 1987. It is designed to reflect both the efficiency of the existing situation and to demonstrate the effects of different policies and market failure. In practice, the method fits both as a way of empirical analysis for measuring agricultural price policy effects and as a logical framework for thinking about such policies. The first step in constructing a PAM is to select the commodity system to be analyzed. Each matrix normally relates to a whole commodity system (production, processing and marketing). However, because of data limitation and time constraints, the cases analyzed in this study deal only with the first stage (the farm production) of the selected commodity systems.

The PAM is based on two accounting identities, the first one defines profitability as the difference between total (or per unit) sales revenue and costs of production and the other shows the effects of divergence due to distorting policies and market failures. Revenues and costs are calculated using both actual market prices (private prices) and efficiency prices (social prices) to yield social net benefits. The differences between the private and social prices reflect the divergence of actual distorted prices from efficiency prices. These differences are referred to as transfers. The structure of the PAM is shown in table 1. In constructing the PAM, costs are subdivided and entered separately as costs of tradable and costs of non-tradable inputs. The latter inputs are also called domestic resources or factors. In the PAM, profitability is measured horizontally. Each column entry is thus a component of the profit identity (FAO, 1996).

Table: Policy Analysis Matrix

	Revenue	Total Cost		Profit
		Tradable inputs	Domestic factors	
Private prices	A	B	C	D
Social prices	E	F	G	H
Transfers	I	J	K	L

Source: FAO, Agricultural price policy, Rome, 1996

A Total revenue in private prices (market prevailing prices; it is also called financial prices).
B Costs of tradable inputs in private prices.
C Costs of domestic factors in private prices.
D Private profit.
E Total revenues in social prices (prices which are adjusted to government interventions).
G Costs of tradable inputs in social prices.
H Social profits.
* * Private or financial profits (D) D = A - B - C
* * Social profits (H) H = E - F - G
* * Output transfers (I) I = A - E
* * Input transfers (J) J = B - F
* * Factor transfers (K) K = C - G
* * Net transfers (L) L = D - H = I - J – K

Private profits

Private profits are defined in the first row as D = A - B - C. The letter A is used to define the private revenues (the revenues at current market prices) obtained by multiplying quantities of outputs by their respective private prices. Costs are broken down into two components: Costs of tradable inputs (inputs which are traded in the world markets) such as fertilizers, pesticides and seeds and costs of domestic factors (land, labor and financing), which are also called non-tradable inputs because there is no international markets for these inputs. The value of tradable and non-tradable inputs are recorded at the prevailing market prices (private prices) in the first row and are denoted by the letters B and C, respectively. The private prices incorporate the underlying economic costs and valuations as modified by the policies and market failures that create transfers in the system.

Social profits

Social profits are the differences between the value of outputs (revenues) and costs of inputs all taken at social prices. Social profits are measured in the second row in the PAM. Appropriate valuations of tradable outputs (denoted by E) and tradable inputs (denoted by F) are given by world (border parity) prices. On this basis the social value of additional domestic output is thus the foreign exchange saved by reducing imports or earned by increasing exports. The appropriate world price to use is the CIF import price for importable. The FOB export price is used for exportable. In both cases further adjustment is needed to allow for internal transport and handling costs. These border-parity prices represent the effective opportunity costs of imports or exports to the nation. The social value for domestic factors (land, capital and labor) is found by estimating the national income that is forgone because the factor is not employed in its best alternative use. This is usually measured by accounting shadow prices. The social profit is an efficiency measure as both outputs and inputs are valued at prices that reflect scarcity.

Transfers

Transfers are the differences between private and social valuations of revenues. These differences are measured in the third row of the PAM. Transfers are explained by the effects of government policies and market failures, which cause actual (private) costs, revenues and profits to diverge from their social values. Positive transfers on outputs represent gains to the producers whereas positive transfers on inputs and factors increase producer's costs. The net balance (L) is a measure of whether the aggregate transfer is positive or negative.

Coefficients of economic protection

To compare profitability and efficiency of different crops, a common numeraire must be used throughout the analysis. Ratios are an expedient approach for avoiding the problem of a common numeraire, particularly when the production process and outputs are dissimilar. Ratios are estimated from the values of the PAM. Ratios can be used to rank alternatives according to different policy objectives. The major ratios calculated in a standard PAM include the national protection coefficient on outputs (NPC), the national protection coefficient on inputs (NPI), the effective protection coefficient (EPC) and the domestic resource coefficient (DRC).

The nominal protection coefficient on outputs (NPC): This ratio is estimated by dividing the revenue in private prices (A) by the revenue in social prices (E). It measures the extent of policy intervention on output side. If this ratio is less than one, it shows the presence of taxes on outputs. If the NPC is greater than one, it indicates the presence of subsidies. When the NPC is equal to or close to one (in the absence of market failure) it reveals the absence of government intervention in the output market.

The nominal protection coefficient inputs (NPI): The (NPI) is a similar calculation to the (NPC) applied to tradable inputs. It is calculated by dividing the value of tradable inputs at private prices by the value of tradable inputs at social prices. If the value of (NPI) is low, it implies a positive protection to farmers through input subsidy by the government, whereas a high ratio implies the opposite, i.e. inputs are taxed by the government.

The effective protection coefficient (EPC): In calculating the (NPC), no account is taken of the subsidies or lives on inputs. To correct for this defect allowance for distortions on both input and output prices is made by calculating the (EPC). The (EPC) measures the protection according to the value added rather than final product. It is calculated in the PAM by the ratio of the value added measured at market prices (A - B) to the value added measured at social prices (E - F). If the calculated ratio of (EPC) is greater than one, this indicates that the protective measures provide positive incentives to produce the commodity. A (EPC) which is less than one, on the other hand, implies net disincentives and taxation's in the system.

The domestic resource coefficient (DRC): The domestic resource coefficient (DRC) is used to determine if the production of a specific crop makes efficient use of the domestic resources. The (DRC) as a measure of efficiency or comparative advantage is calculated by dividing the factor costs (G) (Table 1), by the value added in social prices (E - F). A domestic resource coefficient (DRC) value greater than one, indicates that the value of domestic resources used to produce the commodity is greater than the contribution of its value added at social price. A (DRC) value less than one, indicate that the country has comparative advantage in producing that commodity.

The Empirical Study

Construction of the PAMs

Data for compiling PAMs of various crop include yields, input requirements and market prices of inputs and outputs. Additionally, data for transportation cost, storage cost, port charges, production/input subsidies and import/export tariffs are also required to establish social prices of inputs and outputs. Detailed information on construction of the PAM is given in FAO, 1996; Curry and Weiss, 1993 and Idris, 1993. Construction of PAMs for sorghum: As already mentioned much of the data for PAMs of sorghum, PAMs was available from unpublished statistics of the department of agricultural economics of the ministry of agriculture. These include yields and market value of outputs in addition to detailed cost of production of all crops. The derivation of social prices of outputs and tradable inputs took place as will be described below. Social prices of outputs of sorghum, is derived through adjustments of approximate FOB border prices of sorghum. The employed border prices is located at Port-Sudan. The source of the border FOB and CIF prices are annual reports of the Bank of Sudan and unpublished data from Sudan Sorghum company (SCC). These values were given for quantity and corresponding value of exported and imported crops in US $/bale for sorghum. The value of exported bale of sorghum of imported ton is converted to social market prices of these products in Sudanese currency by multiplying the products border parity prices in US $/unit of product by the shadow exchange rate. The shadow exchange rate is employed to avoid implicit export tax or import subsidy due to the overvaluation of the Sudanese official exchange rate. The employed shadow exchange rate is estimated according to the World Bank methodology as a weighted average of official and free market exchange rates (Hussein, 1992). Accordingly the shadow exchange rate is given by:

$$SER = OER\,(X) + MER\,(1 - X)$$

Where:

SER=Shadow exchange rate,
OER=Official exchange rate,
MER=Free market exchange rate,

X = the percentage of foreign transactions priced by the official exchange rate. In Sudan, X will be about 0.31, since about 31 % of foreign transactions are assumed to be priced at the official exchange rate (Elgezouli, 1994). To arrive at farm gate social prices of the various products, the normal procedure of subtracting/adding total export and marketing costs/total import and transportation costs of the given product from its border parity social price. The first step for deriving social prices of tradable inputs is the disaggregation of these inputs into domestic and foreign components. The foreign component of tradable inputs was obtained by applying the standard percentages of foreign components of tradable determined by El-Mak (Elgezouli, 1994) in consultation with officials of the Ministry of Economic Finance and Planning. The social prices of these inputs were estimated analogues to the procedure described by Idris (1993):

An alternative procedure starts with the private (financial) costs of individual inputs and then disaggregates them into their tradable, domestic resource and transfer components. Each of these components is then multiplied by the appropriate conversion factor to convert them into social prices. The transfer component is usually given a weighting of zero. The conversion factor for tradable is based on the accounting (shadow) or parallel exchange rate of the national currency. Specific economic values could be obtained by the following equation:

EP = FP + (AERP*FX*FP)

Where:

EP = Economic price of input,
FP = financial price of input,
AERP=Accounting exchange rate premium = (AER -OER)/OER,
FX = Foreign exchange component,
AER = Accounting exchange rate
OER = Official exchange rate".

Social prices of non tradable are equal to the sums of social costs of producing the non tradable goods and the social prices of domestic factors. The conversion factors for domestic resources are estimated by dividing the market price into the social price estimated as follows:

The accounting ratios for skilled and unskilled labor are assumed to be 1.0 and 0.6, respectively (Idris, 1993). Taxes and subsidies are assigned zero values in economic analysis, since they are merely transfer payments (Elgezouli, 1994). The accounting price for land was assumed to be equal to its annual lease, whereas private interest return on capital is taken as an accounting price of capital.

The steps followed in constructing the various PAMs were as follows:

The first step in compiling the PAMs has been the construction of a detailed Commodity Budget Table for each of the studied crops. The compilation of the commodity budget tables is based on the information on physical inputs and outputs for the production stage of the studied crops. The commodity budget table of each crop consists of private prices of each input and output in the form of a farm budget. The second step is the construction of an Input Disaggregation Table for each crop. This table classifies all the factors, and services which are inputs in the system into tradable and non-tradable inputs. The tradable inputs contain a domestic resource component (e.g. transport and handling costs) and a foreign exchange component. The third step is the construction of a Comparative Budget Table for each crop. The Comparative Budget Table is constructed from the Detailed Crop Budget combined with the Input Disaggregation Table. The final step is the construction of the PAMs for each crop by adding together all the private and social cost data.

Policy impact on rain-fed crop production

This chapter presents the results of the analysis conducted within the framework of this study. The prime objective of the undertaken analysis was to assess the impact of the adopted economic policies on the performance of the rain-fed agricultural subsector. Based on the available information, the most important crop within the rain-fed subsector is sorghum, the most staple food in Sudan. Nevertheless, the information required to conduct economic analysis in order to assess the impact of adopted government policy on the performance of this crops are unfortunately not available in the required quality. Therefore, the analysis conducted within the context of this study was limited to rain-fed mechanized and traditional sorghum and rain-fed sesame.

As already mentioned, rain-fed mechanized and traditional cultivation of sorghum and sesame is found in many areas of Sudan, like eastern Sudan in Kassala and Gedarif States, western Sudan in Kordufan and Darfur States, central Sudan in White Nile and Blue Nile States and in southern Sudan in Upper Nile State. However, this study focused on rain-fed mechanized sorghum and sesame in Gedarif State, White Nile State and Kordufan State. These States were selected as study areas because of three reasons: (1) these states represent important producing centers of the crops under study, (2) they represent a fair geographical representation of the rain-fed subsector, and (3) the availability of detailed information required for the analysis was best in these States. Based on the above, the conducted analysis focused on rain-fed mechanized sorghum and sesame in Gadarif State, White Nile State and Kordufan State, in addition to rain-fed traditional sorghum in White Nile and Kordufan State.

Policy impacts on rain-fed sorghum production: The analysis conducted in this study employs the policy Analysis Matrix (PAM). The analysis focused on assessing the impact of adopted government economic policies on the performance of the rain-fed cultivated crops i.e. sorghum and sesame in terms of the production incentives for the rain-fed producers and the efficiency of resource use within the rain-fed subsector, the competitiveness or cultivated crops and the international competitiveness of the cultivated crops. The results of the PAM analysis presented in this section shows that the case or the Sudanese rain-fed agricultural subsector is not an exception to the situation of many developing countries, as far as policy discrimination against rain-fed agricultural in Sudan. This policy discrimination is manifested in the estimated lower nominal and effective protection coefficients (NPC, EPC) for rain-fed mechanized and traditional sorghum.

The production incentives and efficiency of resource use

Based on theory, the nominal and effective production coefficients can be used to measure the divergence between domestic and world or free market prices of products (Pearson and Monke, 1987). The nominal protection coefficient (NPC) measures the output price incentive and, thus, the degree of distortion during the analyzed period. The NPC is a ratio of actual market product price received by the farmers, including distortions of government interventions to the price that would prevail in the absence of government intervention and market failure. Output price incentives: Table 2 shows the estimated nominal rates of protection for the mechanized and traditional rain-fed sorghum in Gedarif, White Nile and Kordufan States. These coefficients were determined for the period 00/01- 07/08.

Table 2: The nominal rate protection (NPC) of sorghum, Selected areas and selected years

Years	Gedarif	Kordufan		White Nile	
	Mechanized	Mechanized	Traditional	Mechanized	Traditional
2000/01	0.70	0.51	0.62	0.66	0.68
2001/02	0.54	0.65	0.63	0.60	0.66
2002/03	0.68	0.77	0.0	0.74	0.69
2003/04	0.78	0.76	0.80	0.90	0.77
2004/05	0.60	0.71	0.67	0.73	0.66
2005/06	0.82	0.87	0.77	0.80	0.79
2006/07	0.85	0.87	0.79	0.88	0.82
2007/08	0.91	0.91	0.81	0.79	0.80

The results show clearly that mechanized and traditional sorghum in the three States under investigation have been subjected to taxes during the whole period under consideration. The estimated nominal protection coefficients for sorghum range between 0.51 and 0.91. This means that the prices received by sorghum producers in Gedarif, White Nile and Kordufan were at the range 0.51 and 0.91% of sorghum world prices or of the free market prices that would prevail in the absence of the adopted government policy during the analyzed period.

The information in table 2 show that mechanized and traditional sorghum was taxes throughout the analyzed years. However, except for 03/04, the taxation magnitude was relatively higher during the early years of the 21st century, i.e. during the period 00/01-04/05. Thus, the prices received by the producers during the period 00/01- 04/05 were at the range of 50- 70% of the world or a free market price, except in 03/04, where the sorghum producers received about 76- 90% of the world or free market prices. The magnitude of the taxation during the period 05/06- 07/08 ranged between 10 – 20%. The taxes and fees changed, whether direct of indirect, apply to the crop everywhere, whether it is cultivated in the mechanized or traditional subsector. This explains the quasi uniformity of the estimated nominal protection coefficients for the crop in the three locations under study.

This result appears to be in line with the realized impacts of the adopted government policy towards the agricultural sector in general. The fulfillment of the declared taxes and fees reductions and improvements in the marketing and export facilities, in addition to abolition of taxes on imported inputs seem to slow and sluggish. Accordingly its effect during the first years of the period under study is still little. The situation appears to have improved during the last years of the studies period, resulting in relatively higher nominal protection coefficients, which imply a reduction of the adopted taxation. The declared government policy since the 1990's attempts to promote exports of sorghum and attain a higher rate of food self-sufficiency. The estimated results suggest that the declared government policy have failed to achieve its objectives of export promotion and staining a higher degree of food security. The only success of the adopted government policy is that it brought higher output prices for sorghum producers.

The overall production incentives: Generally speaking the impacts of adopted policies, which can be measured in terms of price incentives do not only affect output prices. Thus, the impact of adopted policies in terms of incentives affects the whole investment. Therefore, the prices of inputs used in the production process will also be affected by the adopted policies. The incentives to producers as a result of adopted policies on prices of outputs and tradable inputs are measured by the effective protection coefficient. The estimated effective protection coefficients (EPC) of mechanized and traditional sorghum in Gedarif, White Nile and Kordufan during the period 00/0- 07/08 are presented in table 3.

Table 3: The effective protection coefficient (EPC) of sorghum, Selected areas and selected years

Years	Gedarif	kordufan		White Nile	
	mechanized	mechanized	traditional	mechanized	traditional
2000/01	0.50	0.58	0.63	0.55	0.62
2001/02	0.74	0.67	0.68	0.60	0.63
2002/03	0.59	0.70	0.69	0.56	0.60
2003/04	0.62	0.62	0.70	0.50	0.71
2004/05	0.59	0.66	0.59	0.60	0.67
2005/06	0.68	0.76	0.70	0.69	0.66
2006/07	0.72	0.65	0.69	0.70	0.68
2007/08	0.69	0.74	0.71	0.69	0.68

These results appear to be in line with the results estimated for the nominal protection coefficient. The taxation of sorghum, whether mechanized or traditionally produced, in each of the States focused in the analysis continued throughout the period under study, hence the magnitudes of the effective protection coefficients for the analyzed period ranged between 0.5 – 0.76. accordingly, this result implies that the adopted government policies within the rain-fed subsector do not provide incentives to sorghum producers. Thus, the estimated EPX's in table 3.2 shows that the production of rain-fed sorghum has been subjected to government taxation.

However, it seems from the results that the impact of the adopted government policies in Gedarif and White Nile states is almost similar and comparatively higher in magnitude than in the other states, particularly during the period 00/01 – 04/05. Moreover the estimated results show that the government taxation for the utilized rain-fed sorghum inputs became less all over the studied production areas during the years 05/06 through 07/08, thus showing an improvement in government support to rain-fed sorghum producers.

Relative crop competitiveness: The coefficients of relative competitiveness of rain-fed sorghum cultivated in Gedarif, Kordufan and White Nile States between 00/01- 07/08 are shown in table 2. As it can be seen from table 4. it appears that the relative competitiveness of mechanized and traditional sorghum range between 0.12- 0.84, thus indicting that rain-fed sorghum is relatively competitive all over the production areas under study. However, the measure of relative competitiveness, i.e. the domestic resource coefficient (DRC) fluctuated among areas under study in any one year one year and within the same crop subsystem over the analyzed years.

The higher relative competitiveness or rain-fed sorghum in the production areas under study is a direct result of the compatibility of the crop with the overall environmental conditions. the relatively good environmental factors, especially the rainfall during the analyzed period, in addition to the prevailing macroeconomic conditions (liberalization and free market) rendered sorghum highly competitive and profitable. The estimated DRC's for rain-fed sorghum imply that its relatively higher competitiveness was sustained throughout the analyzed period. The relative competitiveness of sorghum was, however, higher in Gedarif and White Nile States as compared to Kordufan. Thus, the estimated DRC's ranged between 0.18- 0.42 for mechanized sorghum in Gedarif and between 0.12- 0.41 and 0.12- 0.28 for mechanized and traditional sorghum in White Nile State, respectively, while the estimated DRc's for mechanized and traditional sorghum in Kordufan ranged between 0.28- 0.84 and 0.15- 0.76 respectively. Based on the above results, it could be concluded that the adopted government policies managed to enable rain-fed mechanized and traditional sorghum to use the available domestic resource in the various rain-fed production areas efficiently.

Table 4: Domestic resource coefficient (DRC) of rain-fed sorghum, selected areas 00/01 – 07/08

Season	Location Gedarif	kordufan		White Nile	
2000/01	0.22	0.38	0.15	0.41	0.27
2001/02	0.26	0.84	0.51	0.20	0.23
2002/03	0.18	0.44	0.34	0.29	0.16
2003/04	0.22	0.41	0.35	0.12	0.12
2004/05	0.29	0.44	0.76	0.19	0.04
2005/06	0.29	0.49	0.41	0.18	0.21
2006/07	0.30	0.57	0.48	0.30	0.28
2007/08	0.42	0.75	0.74	0.23	0.23

International competitiveness: The results of international competitiveness (IVA) of the rain-fed mechanized and traditional sorghum are presented in table 3.4 it appears that in terms of international value, both types of sorghum i.e. mechanized and traditional sorghum recorded fluctuating figures during the whole analyzed period. However, it appears from the estimated value added that traditional sorghum, especially in White Nile and Kordufan State, record higher international value added as compared to mechanized sorghum.

The lower international competitiveness of mechanized sorghum as compared to traditional sorghum, can be explained by the low yields of mechanized sorghum, due to the low input intensity level of crop management that characterizes mechanized farming. The international competitiveness of rain-fed mechanized and traditional sorghum improved in 05/06 all over studied areas and continued its improvement through 07/08 especially in the White Nile State. This improvement might be due to high yield levels attained as a results of widespread use of improved seeds, employment of appropriate inputs and proper cultural practices.

The IVA's reflecting an improvement in the international competitiveness of rain-fed sorghum amounted to $54/feddan, thus suggesting the potential level of IVA of the rain-fed sorghum. Nevertheless, the estimated IVAs reflected high variability in international competitiveness of the studied crop during the analyzed period from year to year within the different locations and within the different crop subsystems. This variability was due primarily to changes in exchange rate, in addition to changes in yields and annual changing world prices. In addition, the realized output value, measured in dollars, appears to be very low for sorghum. On this basis, it could conclusively be said that the implemented government policies during the analyzed period failed to exhaust the potential of rain-fed sorghum to attain higher levels of international competitiveness.

Table 5: International value added or rain-fed sorghum US $fedd.

	Location				
Season	Gedarif	Kordufan		White Nile	
2000/01	23.1	28.4	34.9	26.1	35.2
2001/02	22.7	22.8	29.0	25.6	33.7
2002/03	31.2	30.3	36.6	28.9	33.5
2003/04	33.5	27.2	28.1	42.2	44.0
2004/05	28.8	29.6	30.8	25.9	33.4
2005/06	35.8	34.3	39.2	34.2	36.0
2006/07	36.7	32.8	37.7	46.1	46.1
2007/08	38.1	30.9	35.9	53.7	53.7

Conclusions

The adopter government policy during the period 00/01- 07/08 is a continuation of the government policies declared since the 1990's. As already mentioned, these policies envisaged promotion of exports, substitution of imports and attaining higher rates of food self-sufficiency. However, as far as export promotion is concerned, the obtained results show that the declared government policy failed to achieve its objectives, especially with respect to sorghum. This fact, however, rests on the obtained result, which show that sorghum output prices of export have been subjected to implicit taxes throughout the analyzed years. In addition, the impact of adopted policies affected sorghum output negatively, thus, resulting in a failure to attain higher rates of food self-sufficiency. On this basis, it can be concluded that the structure of incentive of the implemented policy implied pronounced bias against export of food crop (sorghum). Given the fact that sorghum crop is well adapted to the climatic conditions and the nature of available resources, it could be concluded that the implemented policy recorded a success is manifested in encouraging appropriate choice of cropping pattern through the expansion of the areas of rain-fed sorghum that reflects the policy success to increase the efficiency of domestic resource use.

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