

An Evaluation of Sudan's 75/25 Foreign  
Exchange Rate Conversion Formula

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With the assistance of  
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USAID/Sudan  
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## Summary and Conclusions

The purpose of this paper is to evaluate the appropriateness of the 75/25 Foreign Exchange Rate Conversion Formula and more specifically the effective exchange rate (US\$ 1.00 = LS 1.425) currently used to value agricultural exports. Our analysis starts with an assessment of the calculations undertaken by the IMF to evaluate Sudan's export competitiveness of agricultural crops.

A case is made that the returns to farmers as imputed by the Fund are not adequate and are based upon inappropriate criteria. Alternative methods of calculating returns to farmers are evaluated. Our analysis shows that net returns to the production of agricultural crops as measured by "excess profits", and the export competitiveness coefficients are both highly sensitive to the returns imputed to the farmers' managerial function in both the irrigated and the rainfed sectors.

A series of sensitivity analyses illustrating the effects of alternative exchange rates on production incentives and export competitiveness are undertaken. The objective is to identify the impacts of pricing policies which eliminate the overvalued exchange rate currently used to price export commodities and imported inputs. Such pricing arrangements would eliminate the heavy implicit foreign exchange rate tax burden on agricultural exporters and the implicit foreign exchange subsidies currently allocated, or provided, to producers using imported inputs. The purpose of such a policy reform would be to increase the financial incentives of exporters of agricultural products and consequently Sudan's agricultural producers. On the other hand, pricing imported inputs on the basis of their real cost to the economy would

encourage more efficient allocation and use of imported inputs and less dependence on imported inputs.

When the IMF's original recommended return to farmers (which is based upon farmer's off-farm opportunity costs as a skilled worker in Khartoum) is used in the calculations (e.g., LS 42/feddan for irrigated cotton) a foreign exchange rate of not less than US\$ 1.00 = LS 2.00 is required for all crops except Rahad sorghum to achieve the desired competitiveness coefficient. Rahad sorghum would require a greater exchange rate to achieve export competitiveness.

The higher value for returns to management as calculated by the recent IMF team (e.g., LS 164/feddan for irrigated cotton), which is based upon returns farmers earn in other developing countries producing similar crops, completely alters the results and clearly shows that the current 75/25 conversion formula does not provide adequate financial incentives to producers.

Our sensitivity analysis reveals that at an exchange rate of US\$ 1.00 = LS 2.00 or higher, strong financial incentives, significant excess profits and the necessary export competitiveness can be achieved for Sudan's principal export crops. If the government were to abandon the current Foreign Exchange Rate Conversion Formula and price commodities and traded inputs at international prices as reflected by a more appropriate exchange rate, present implicit foreign exchange rate subsidies on traded inputs and the implicit taxes on commodity export prices could give way to significant tax revenues. Pricing policies based upon international prices and consequently a real exchange rate can produce a desirable

policy result; a policy reform whereby producers, exporters and the government treasury all benefit in the short-run. In the intermediate run the added gains should translate into greater output and export earnings and an improved public revenue budget. Our analysis indicates that explicit taxes on agriculture, if present price distortions were removed, could be implemented without creating disincentives among producers.

We have extended the IMF analysis to consider net foreign exchange returns to imported inputs. The analysis shows that irrigated cotton earns by far the least amount of foreign exchange per unit of foreign exchange invested in imported inputs. Our analysis further shows that reducing the area devoted to cotton and increasing the area in groundnuts on the Gezira scheme would result in greater foreign exchange earnings and a substantial savings in imported input requirements. We have estimated the additional area that could be put into mechanized sorghum production given the savings in traded and non-traded inputs that would result from reducing cotton and increasing groundnut production in the Gezira scheme. Our analysis illustrates that such an expansion would require a relatively small amount of the savings and would generate an international value added of about LS 25 million from mechanized sorghum production.

The combined results of reducing area devoted to cotton and increasing the area of groundnuts in the Gezira scheme and also increasing the area in mechanized rainfed sorghum production would result in an estimated total increase in international value added of about LS 32 million. The overall reduction in imported input requirements is estimated to be about LS 83 million.

The following are the major conclusions of our study:

1. The present effective exchange rate used to value in Sudanese pounds agricultural exports (US\$ 1.00 = LS 1.425) is inadequate to achieve attractive financial incentives to either exporters or producers.
2. The exchange rate required to achieve export competitiveness is highly sensitive to the returns to farmers (the imputed return to producers' management function).
3. If attractive financial incentives are to be provided to exporters and producers in the irrigated and rainfed sectors in order to achieve export competitiveness and encourage increased output and export earnings, the effective exchange rate used to value output and traded inputs should be not less than US\$ 1.00 = LS 2.00.
4. Removing existing input and commodity price distortions via the exchange rate will not only generate attractive returns to producers, but also give significant scope for explicit tax revenues.
5. By reducing its dependence on irrigated cotton as the major source of foreign exchange and increasing the area devoted to groundnuts in the irrigated sector, Sudan would earn more foreign exchange and greatly reduce the requirement for imported inputs.
6. If a small proportion of the savings realized from reducing the area devoted to cotton and increasing the area under groundnuts in the Gezira scheme were invested in mechanized rainfed sorghum production, substantial returns could be realized.

7. The overall conclusion is that present pricing policy needs to be revised immediately to reflect the real cost of inputs to the economy and the real value of the commodities produced. This would encourage farmers to increase production thereby permitting the Sudan to significantly increase foreign exchange earnings during the next crop season.

## 1. Introduction

The purpose of this paper<sup>1/</sup> is to discuss the appropriateness of the current effective exchange rate (US\$1.00 = LS 1.425) used to value agricultural exports and to determine whether or not this exchange rate achieves sufficient producer incentives and the necessary export competitiveness for Sudan's major crops. Our point of departure is the Nashashibi paper, "Sudan: Competitiveness of Agricultural Crops" (August 1984). We do not subscribe to the view that the Nashashibi/IMF approach is wholly adequate to address the question at hand, although we believe it produces insights which are both useful and difficult to calculate by other methods due to present data limitations in the Sudan.

The term "competitiveness" as used in Nashashibi's analytical framework, is used in a restricted sense. It does not relate directly to Sudan's capacity to compete in world markets. However, the competitiveness coefficients do reveal whether or not it would be profitable to produce a commodity for export, given world prices, imported input requirements, domestic resource costs, an implied production function and an exchange rate to link domestic and international values. It is thus a domestic index of export competitiveness among Sudan's crops.<sup>2/</sup>

It should be recognized that there are important limitations to the analytical framework used. First, the approach is static in the sense that it cannot show a yield/production response to changes in physical inputs or

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<sup>1/</sup>This paper has benefited from the review and constructive comments of Dr. William Bateson and Dr. Sachiko Sidhu. The reviewers are not, however, responsible for errors and omissions or the conclusions drawn in our analysis.

<sup>2/</sup>If the coefficient of competitiveness is less than the exchange rate, the commodity is profitable for export oriented production.

prices. And further, the framework cannot be used alone to judge whether one exchange rate is preferable to another, once the "competitive range" has been identified, because it does not focus on such critical policy variables as net foreign exchange earnings, domestic tax revenues and domestic consumer prices. However, we attempt to deal, in a preliminary way, with net foreign exchange earnings and taxes in the last section of our paper.

Our discussion is approached in the following manner. We studied the basic table in the Nashashibi report (Table 11 Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85) and determined that two underlying assumptions require further analysis. The first is the basis upon which the "return to farmer", (i.e., return to the management function) is calculated. The second is the failure to present results if alternative exchange rates were used in the analysis. Namely, exchange rates other than the current effective exchange rate arising from the 75/25 foreign exchange rate (US\$1.00 = LS 1.425) conversion formula are included in our analysis.

We have analyzed alternative, and we believe more realistic, returns to farmers and also undertaken sensitivity analysis on the exchange rate. In the process of carrying out our study we determined that we could also address net foreign exchange earnings in agriculture, thereby extending the scope of the Nashashibi paper.

## 11. The Basic IMF Calculations

Table 1 is the basic table calculated by Mr. Nashashibi for the 1984/85 crop season. The table shows the projected costs and returns for selected crops in the irrigated and rainfed sectors -- long and medium staple cotton, groundnuts, sorghum, wheat<sup>1/</sup> and sesame. The US\$1.00 = LS 1.42 effective exchange rate resulting from the present 75/25 Exchange Rate Conversion Formula is used to value the outputs (commodities) and the traded inputs (imported) for each crop. The "return to farmer" (return to the farmer's management) under factor remuneration (line 3c) is based upon the farmer's opportunity cost as reflected by the urban wage rate for skilled workers.

Under these projected yields, commodity prices and producer costs, Table 1 shows (see line 8a) that with the exception of irrigated groundnuts and oilseeds produced in the rainfed sector, the effective exchange rate used to convert commodity prices and the cost of traded inputs is inadequate to maintain producer incentives, or Sudan's competitiveness in agricultural exports.<sup>2/</sup>

The analysis does not, however, consider alternative exchange rates, or under what cost-price structures might incentives and competitiveness be improved to stimulate production and export earnings.

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<sup>1/</sup>We are convinced that wheat is inappropriately handled in the Nashashibi table. Wheat is in no way an export crop. The question is whether or not wheat is an efficient import substitute. Thus, the transport cost to Port Sudan should be negative, not positive. While we have kept wheat in the tables, we are not addressing the policy issues associated with wheat in this analysis. No further reference is made to wheat in this paper.

<sup>2/</sup>This is the case under Nashashibi's scenario where a 12 percent value added tax is calculated on the international value added (line 5) for each crop and where the competitiveness coefficient takes account of calculated land and water charges as opposed to the subsidized (actual) charges.

Table 1

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85

	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum
		Gezira	Gezira	Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Gezira	Gezira
Output Parameters		CS	MS	MS	MS	MS	MS	MS	MS	MS	MS	
Area	th/F	370.0	140.0	135.0	250.0	65.0	300.0	65.0	300.0	720.0	427.0	2947.0
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.76	0.58	0.56	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	Formula	75	25									
Official	LSd/US\$	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Free Market	LSd/US\$	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Calculated Rate	LSd/US\$	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425
Output Value												
Main Product	LSd/F	520.0	614.9	714.1	416.8	416.8	133.2	133.2	180.3	131.7	145.4	23.3
Joint Product	LSd/F	158.0	132.7	154.1	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LSd/F	684.3	747.6	868.2	470.7	470.7	182.7	182.7	213.3	185.6	145.4	102.8
Input Costs												
Traded Inputs												
Herbicides	LSd/F	24.6	24.6	27.3	6.7	0.0	1.3	0.0	2.2	0.0	0.0	0.0
Fertilizer	LSd/F	45.5	45.5	44.4	0.0	0.0	0.0	0.0	30.1	0.0	0.0	0.0
Pesticides	LSd/F	148.0	148.0	148.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0
Machinery Use	LSd/F	37.3	37.3	32.4	7.2	14.2	9.2	14.2	20.8	0.0	9.9	13.0
Seeds	LSd/F	7.0	5.6	4.8	16.1	17.0	2.1	2.0	22.7	18.4	1.1	1.1
Sacks	LSd/F	11.5	15.8	18.3	9.2	9.2	6.7	6.7	8.5	1.4	1.4	2.7
Ginning, Shelling 7/	LSd/F	33.8	46.5	54.1	5.4	5.4	0.0	0.0	0.0	1.6	0.0	0.0
Transport 7/												
to collection pts	LSd/F	4.7	6.6	9.5	3.6	3.6	2.9	2.3	7.3	2.1	2.3	5.1
to Port Sudan	LSd/F	5.0	7.6	8.8	12.7	12.7	12.0	12.0	16.8	7.7	2.0	4.4
Total Transport	LSd/F	3.9	5.6	7.4	6.5	6.5	5.9	5.7	9.6	3.9	1.7	3.2
Total Traded Inputs	LSd/F	311.6	329.0	336.7	51.1	52.4	25.3	28.7	109.9	25.3	14.1	27.0
Nontraded Inputs												
Commissions	LSd/F	17.1	19.5	22.6	7.9	7.9	2.5	2.5	5.4	3.9	0.3	0.5
Interest	LSd/F	91.9	98.7	105.9	15.3	15.9	6.9	7.7	22.5	5.1	4.6	5.1
Storage, Handling	LSd/F	18.4	23.3	27.1	9.4	9.4	4.7	4.7	4.8	3.1	3.4	6.3
Process., Cleaning	LSd/F	0.0	0.0	0.0	28.0	28.0	5.9	5.9	4.8	8.7	6.5	2.4
Insurance, Claims	LSd/F	7.7	9.0	10.4	1.5	1.5	0.5	0.5	0.6	0.5	0.5	0.2
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
Factor Remuneration												
Labor												
Harvesting	LSd/F	58.3	80.4	80.8	72.2	60.9	41.4	33.6	1.7	24.0	22.1	6.8
Other 8/	LSd/F	91.6	100.2	130.8	51.0	96.4	35.1	49.3	28.8	40.5	22.7	23.6
Total Labor	LSd/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LSd/F	72.5	72.5	138.8	36.3	93.0	36.3	73.0	44.9	0.0	5.0	5.0
of which, Actual	LSd/F	38.0	38.0	48.0	19.0	32.0	19.0	32.0	23.5	0.0	0.0	0.0
Return to Farmer	LSd/F	42.0	42.0	42.0	30.0	30.0	30.0	30.0	30.0	24.0	24.0	24.0
Total Factor Remun.	LSd/F	264.4	295.1	392.4	189.5	280.3	143.8	205.9	105.4	88.5	73.8	59.4
Total Input Costs	LSd/F	711.1	774.6	895.1	302.7	395.4	189.6	255.9	253.4	136.1	103.2	94.4
Access Profits (2-3)												
with calc. l&w chgs.	LSd/F	-26.8	-27.0	-27.0	168.0	75.4	7.9	-73.1	-40.7	49.4	42.1	8.4
with act. l&w chgs.	LSd/F	7.7	7.5	63.8	185.3	136.4	10.4	-12.1	-18.8	49.4	47.1	13.4
International Value Added (2-3.3)												
In Sudanese Pounds	LSd/F	372.7	418.6	531.4	419.6	418.4	157.4	154.1	103.3	160.2	131.2	82.4
In U.S. Dollars 9/	US\$/F	261.6	293.7	372.9	294.5	293.6	110.5	108.1	72.5	112.5	92.1	58.1
Domestic Resource Cost including 12 percent value added tax 3b+3c .12*5a)												
with calc. l&w chgs.	LSd/F	444.2	495.8	622.2	302.0	373.2	183.2	245.7	155.9	130.0	104.8	84.3
with act. l&w chgs.	LSd/F	409.7	461.3	531.4	284.7	332.2	155.9	184.7	134.5	130.0	99.6	79.3
Domestic Resource Cost 3b+3c												
with calc. l&w chgs.	LSd/F	399.5	445.6	556.4	251.6	343.0	164.1	227.2	143.5	110.8	89.1	74.4
with act. l&w chgs.	LSd/F	365.0	411.1	467.6	234.1	267.0	147.0	166.2	122.1	110.8	84.1	69.4
Competitiveness (6/5b)												
with calc. l&w chgs.	LSd/US\$	1.70	1.69	1.67	1.03	1.34	1.66	2.27	2.15	1.16	1.14	1.45
with act. l&w chgs.	LSd/US\$	1.57	1.57	1.42	0.97	1.13	1.50	1.71	1.85	1.16	1.08	1.37
Competitiveness (7/5b)												
with calc. l&w chgs.	LSd/US\$	1.53	1.52	1.50	0.85	1.17	1.49	2.10	1.98	0.99	0.97	1.28
with act. l&w chgs.	LSd/US\$	1.40	1.40	1.25	0.80	0.96	1.33	1.54	1.58	0.97	0.91	1.19

### III. Initial Sensitivity Analysis Based Upon Alternative Exchange Rates

#### A. Methodology

In our initial sensitivity analysis, all values in the Nashashibi Table (cost-price relationships) are held constant except those influenced by the exchange rate. That is, product or output values and tradeable inputs are revalued to reflect cost-price relationships under alternative exchange rates -- US\$1.00 = 1.425, 1.65, 1.80, 2.00 and 2.20 Sudanese pounds.<sup>1/</sup>

In order to make the tables more readable and consequently easier to follow, we have aggregated the costs for tradeable inputs (line 3a), non-traded inputs (line 3b), and labor costs under factor remunerations (line 3c). The tables have also been simplified by excluding actual as opposed to calculated land and water charges under the headings excess profits (line 4b), domestic resource costs (line 6b) and for the competitiveness coefficient. With regard to domestic resource costs we have included only the variant which includes the 12% value added tax as per the original Nashashibi Table.

For this initial analysis, the return to farmer (a component of line 3c) is fixed at LS42/feddan for irrigated cotton, LS30/feddan for irrigated g/nuts, sorghum and wheat, and LS24/feddan for rainfed crops, as is the case in the Nashashibi calculations. As explained below we do not consider these values adequate to provide farmers with attractive financial incentives, however at this stage of our analysis they are accepted.

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<sup>1/</sup> The 1.425 rate is the effective foreign exchange rate under the 75/25 FX Rate Conversion formula. The other exchange rates are considered shadow rates. However, the shadow rates could be the result of maintaining a conversion formula. For example, the 1.65 rate could be the result of a 50/50 formula where 50% is converted at 1.30 and 50% at US\$1.00 = LS2.00

## B. Results of the Sensitivity Analysis (Tables 2-6)

The assessment of the effect of alternative exchange rates will at this stage be based upon what happens to "excess profits" (line 4) and the competitiveness coefficient (line 7).

The term excess profit<sup>1/</sup> may be misleading. "Excess profits" arise as a residual after the cost of inputs has been deducted from the value of output. Among the costs deducted is the item designated as "return to farmer" which is a reward for his management input. The Nashashibi paper assumes a value for "return to farmer" (on a per feddan basis) and enters it as a domestic (non-tradeable) cost. Positive excess profits arise because there is a positive residual after production and marketing costs are deducted from the value of output, at a specified "return to farmer" and exchange rate. Increases in the "return to farmer" will result in an off-setting decrease in excess profits. An increase in the foreign exchange rate will increase the value of production by more than the cost of imported inputs and will result in a greater excess profits.

Negative excess profits mean that at a given exchange rate and level of resource productivity a subsidy is required in order to pay all factors of production including the return to farmer. Negative excess profits can be turned into positive excess profits by the simple expedient of using a higher (i.e., more LS/\$) exchange rate or by reducing the returns to farmer.

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<sup>1/</sup> They are "excess" in the sense they are profits to the crop sector over and above those received by producers and suppliers of inputs. In addition, they have been unallocated in the calculations. In theory, "excess profits" are normally treated as unearned income which results from temporary market imperfections where competitive forces in the market place have not had adequate time to fully adjust to demand.

Table 2

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85

Output Parameters	Units	Irrigated						Rainfed				
		C o t t o n 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Onits 2/	Sesame	Sorghum
		CS	MS	Kahad	Gezira	Kahad	Gezira	Kahad	Gezira	S. Darfur	Gezira	Gezira
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LSd/US\$	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425
Output Value												
Main Product	LSd/F	526.3	614.9	714.1	416.8	416.8	133.2	133.2	180.3	131.7	145.4	53.3
Joint Product	LSd/F	158.0	132.7	154.1	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LSd/F	684.3	747.6	868.2	470.7	470.7	182.7	182.7	213.3	185.6	145.4	102.8
Input Costs												
a. Traded Inputs												
Total Traded Inputs	LSd/F	311.6	329.0	336.7	51.1	52.4	25.3	26.7	109.9	25.3	14.1	20.0
b. Nontraded Inputs												
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	27.0
c. Factor Remuneration												
Labor	LSd/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LSd/F	72.5	72.5	138.8	35.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LSd/F	42.0	42.0	42.0	30.0	30.0	30.0	30.0	30.0	24.0	24.0	24.0
Total Factor Remun.	LSd/F	264.4	295.1	392.4	189.5	280.3	143.8	205.9	105.4	88.5	73.8	59.4
Total Input Costs	LSd/F	711.1	774.6	895.1	302.7	395.4	189.6	255.9	253.4	136.1	103.2	94.4
Excess Profits (2-3)												
Calc. L & W chgs.	LSd/F	-26.8	-27.0	-26.9	168.0	75.4	-6.9	-73.1	-40.1	49.4	42.1	8.3
International Value Added (2-3.a)												
In Sudanese Pounds	LSd/F	372.7	416.6	531.5	419.6	418.4	157.4	154.1	103.4	160.2	131.2	82.7
In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	294.4	293.6	110.5	108.1	72.6	112.4	92.1	58.1
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chgs.	LSd/F	444.2	495.8	622.2	301.9	393.2	183.2	245.7	155.9	130.0	104.8	84.3
Competitiveness (6/5b)												
Calc. L & W chgs.	LSd/US\$	1.70	1.69	1.67	1.03	1.34	1.66	2.27	2.15	1.16	1.14	1.45

Table 3

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85

	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum
		LS	MS	Rahad	Gezira	Rahad	Gezira	Rahad	Bezira	S. Darfur	Gedaref	Gedaref
Output Parameters												
Yield	kg/F	4.5	5.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	270.0
World Price	US\$/ton	0.75	0.58	0.58	500.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LS/US\$	1.650	1.650	1.650	1.650	1.650	1.650	1.650	1.650	1.650	1.650	1.650
Output value												
Main Product	Lsd/F	609.4	712.0	826.8	482.0	482.0	154.3	154.3	108.7	152.5	168.3	51.7
Joint Product	Lsd/F	183.0	153.7	178.4	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	Lsd/F	792.4	865.6	1005.3	535.5	535.5	203.8	203.8	241.7	206.4	168.3	101.2
Input Costs												
a. Traded Inputs												
Total Traded Inputs	Lsd/F	380.9	381.0	389.9	59.2	59.6	29.3	33.2	127.2	29.3	16.3	23.2
b. Nontraded Inputs												
Total Nontraded	Lsd/F	135.1	150.5	166.0	62.1	61.7	20.5	21.3	36.1	22.3	15.3	15.0
c. Factor Remuneration												
Labor	Lsd/F	149.9	180.6	211.6	123.2	157.3	77.5	87.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	Lsd/F	72.5	72.5	139.8	36.3	92.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	Lsd/F	42.0	42.0	42.0	30.0	30.0	30.0	30.0	30.0	24.0	24.0	24.0
Total Factor Remun.	Lsd/F	264.4	295.1	392.4	189.5	280.3	143.8	205.9	105.4	88.5	73.8	59.4
Total Input Costs	Lsd/F	750.4	805.6	948.3	310.8	400.6	193.6	260.4	270.7	140.1	105.4	97.6
Excess Profits (2-3)												
Calc. L & W chgs.	Lsd/F	32.0	39.1	57.0	225.7	131.9	10.1	-56.6	-29.0	66.2	62.9	13.6
International Value Added (2-3.a)												
In Sudanese Pounds	Lsd/F	431.5	484.7	615.4	477.3	470.9	174.4	170.6	114.5	177.0	152.0	88.0
In U.S. Dollars 7/	US\$/F	251.5	293.7	373.0	289.3	288.4	105.7	103.4	69.4	107.3	92.1	53.3
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chgs.	Lsd/F	451.3	503.8	632.2	308.9	400.1	185.2	247.7	157.2	132.0	107.3	85.0
Competitiveness (6/5b)												
Calc. L & W chgs.	LS/US\$	1.72	1.72	1.70	1.07	1.39	1.75	2.40	2.27	1.23	1.17	1.59

Table 4

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85

	Units	Irrigated						Rainfed				
		Location 1/ CS			Groundnuts 2/ MS		Sorghum 3/ MS		Wheat 4/ MS	Gnuts 2/ MS	Sesame MS	Sorgh MS
		Gezira	Gezira	Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Bedaref	Gezira
<b>Output Parameters</b>												
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	170.0	270.0
World Price	US\$/ton	6.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LSd/US\$	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800
<b>Output Value</b>												
Main Product	LSd/F	664.8	776.7	902.0	526.5	526.5	168.3	168.3	227.7	166.3	183.6	67.3
Joint Product	LSd/F	199.6	167.6	194.7	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LSd/F	864.4	944.3	1096.7	580.4	580.4	217.8	217.8	260.7	220.2	183.6	116.8
<b>Input Costs</b>												
<b>a. Traded Inputs</b>												
Total Traded Inputs	LSd/F	393.7	415.6	420.3	64.6	66.1	32.0	36.2	138.8	32.0	17.8	25.3
<b>b. Nontraded Inputs</b>												
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
<b>c. Factor Remuneration</b>												
Labor	LSd/F	149.5	180.6	211.6	123.2	157.3	77.5	82.9	30.5	61.5	44.8	30.4
Land, Water, Admin.	LSd/F	72.5	72.5	138.3	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LSd/F	42.0	42.0	42.0	30.0	30.0	30.0	30.0	30.0	24.0	24.0	24.0
Total Factor Remun.	LSd/F	264.4	295.1	392.4	189.5	280.3	143.8	205.9	105.4	89.5	73.8	59.4
Total Input Costs	LSd/F	793.2	861.2	983.7	316.2	409.1	196.3	263.4	282.3	142.8	106.9	99.7
<b>Excess Profits (2-3)</b>												
Calc. L & W chgs.	LSd/F	71.3	83.1	112.9	264.2	171.3	21.5	-45.6	-21.6	77.4	76.7	17.1
<b>International Value Added (2-3.a)</b>												
In Sudanese Pounds	LSd/F	470.8	518.7	671.3	515.8	514.3	185.8	181.6	121.9	188.2	165.8	91.5
In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	286.6	285.7	103.2	100.9	67.7	104.6	92.1	50.8
<b>Domestic Resource Cost including 12 percent value added tax</b>												
Calc. L & W chgs.	LSd/F	456.0	509.0	639.0	313.5	404.7	186.6	249.0	158.1	133.4	109.0	85.4
<b>Competitiveness (6/5b)</b>												
Calc. L & W chgs.	LSd/US\$	1.74	1.73	1.71	1.09	1.42	1.81	2.47	2.33	1.28	1.18	1.66

Table 5

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85

Output Parameters	Units	Irrigated						Rainfed				
		Location 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Units 2/	Sesame	Sorghum
		Gezira	Gezira	Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Gedaref	Gedaref
Yield	kg/F	4.5	5.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.75	0.58	0.58	600.0	600.0	170.0	170.0	230.0	500.0	850.0	170.0
Exchange Rate	LSd/US\$	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
<b>Output Value</b>												
Main Product	LSd/F	738.7	863.0	1002.2	585.0	585.0	187.0	187.0	253.0	184.8	204.0	74.8
Joint Product	LSd/F	221.8	186.3	215.3	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LSd/F	960.5	1049.3	1218.5	638.9	638.9	236.5	236.5	286.0	238.7	204.0	124.3
<b>Input Costs</b>												
<b>a. Traded Inputs</b>												
Total Traded Inputs	LSd/F	437.4	461.8	472.6	71.6	71.6	35.6	40.2	154.2	35.6	19.8	20.1
<b>b. Nontraded Inputs</b>												
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.1	70.5	21.3	38.1	22.3	15.3	15.0
<b>c. Factor Remuneration</b>												
Labor	LSd/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LSd/F	72.5	72.5	138.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LSd/F	42.0	42.0	42.0	30.0	30.0	30.0	30.0	30.0	24.0	24.0	24.0
Total Factor Remun.	LSd/F	264.4	295.1	392.4	189.5	280.3	143.8	205.9	105.4	88.5	73.8	59.4
Total Input Costs	LSd/F	836.9	907.4	1031.0	323.4	416.5	199.9	267.4	297.7	146.4	108.9	102.5
<b>Excess Profits (2-3)</b>												
Calc. L & W chqs.	LSd/F	123.6	141.9	187.5	315.5	222.4	36.6	30.7	-11.7	92.3	95.1	21.8
<b>International Value Added (2+3.a)</b>												
In Sudanese Pounds	LSd/F	523.1	587.5	745.9	567.1	565.4	100.9	196.3	131.8	203.1	184.2	95.2
In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	283.5	282.7	100.5	98.1	65.9	101.6	92.1	48.1
<b>Domestic Resource Cost including 12 percent value added tax (3b+3c+(12*5a))</b>												
Calc. L & W chqs.	LSd/F	462.3	516.1	647.9	319.7	410.9	188.4	250.8	159.3	135.2	111.2	85.9
<b>Competitiveness (6/5b)</b>												
Calc. L & W chqs.	LSd/US\$	1.77	1.76	1.74	1.13	1.45	1.88	2.56	2.42	1.33	1.21	1.79

Table 6

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85

	Units	Irrigated						Rainfed					
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/		Sesame	Sorghum
		CS Gazira	MS Gazira	MS Kahad	Bezirra	Kahad	bezirra	Kahad	Bezirra	S. Darfur	Gedaref	bedaref	
<b>Output Parameters</b>													
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0	
World Price	US\$/ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0	
Exchange Rate	LSd/US\$	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	
<b>Output Value</b>													
Main Product	LSd/F	812.5	949.3	1102.4	643.5	643.5	205.7	205.7	276.3	203.3	224.4	82.3	
Joint Product	LSd/F	244.0	204.9	237.9	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5	
Total Output	LSd/F	1056.5	1154.2	1340.4	697.4	697.4	255.2	255.2	311.3	257.2	224.4	131.8	
<b>Input Costs</b>													
<b>a. Traded Inputs</b>													
Total Traded Inputs	LSd/F	481.1	506.0	519.9	79.0	80.8	39.1	44.2	169.6	39.1	21.8	31.0	
<b>b. Nontraded Inputs</b>													
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.6	
<b>c. Factor Remuneration</b>													
Labor	LSd/F	149.9	180.6	211.6	123.2	157.1	77.5	82.9	30.5	64.5	44.8	30.4	
Land, Water, Admin.	LSd/F	72.5	72.5	138.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0	
Return to Farmer	LSd/F	42.0	42.0	42.0	30.0	30.0	30.0	30.0	30.0	24.0	24.0	24.0	
Total Factor Remun.	LSd/F	264.4	295.1	392.4	189.5	280.3	143.8	205.9	105.4	88.5	73.8	59.4	
Total Input Costs	LSd/F	880.6	953.6	1078.3	330.6	423.8	203.4	271.4	313.1	149.9	110.9	105.4	
<b>Excess Profits (2-3)</b>													
Calc. L & W chgs.	LSd/F	175.9	200.6	262.1	360.8	270.6	51.8	-16.2	-1.8	107.3	113.5	26.4	
<b>International Value Added (2-3, 9)</b>													
In Sudanese Pounds	LSd/F	575.4	646.2	820.5	618.4	618.6	216.1	211.0	141.7	218.1	202.6	100.8	
In U.S. Dollars 97	US\$/F	261.5	293.7	373.0	281.1	280.3	98.2	95.9	64.4	99.1	92.1	45.8	
<b>Domestic Resource Cost including 12 percent value added tax (3+3c+1.12x5a)</b>													
Calc. L & W chgs.	LSd/F	468.5	523.1	656.9	325.8	417.0	190.2	252.5	160.5	137.0	113.4	86.5	
<b>Competitiveness (6/5b)</b>													
Calc. L & W chgs.	LSd/US\$	1.79	1.78	1.76	1.16	1.49	1.94	2.63	2.49	1.38	1.23	1.89	

The Competitiveness Coefficient indicates whether or not the exchange rate used to value output and traded inputs will result in adequate financial incentives to producers and, consequently, if the crops under review can be produced competitively for export.<sup>1/</sup> Therefore, the competitiveness coefficient (line 7) should be less than the exchange rate used in the calculations.

#### 1. Excess Profits

At the current effective exchange rate used to value outputs and tradeable inputs (i.e., US\$1.00 = LS1.425) excess profits are negative for all irrigated crops except groundnuts. When this overvalued exchange rate is used to price traded inputs used in the rainfed sector, the three crops produced in the rainfed sector all have positive excess profits.

At the 1.65 shadow exchange rate (US\$1.00 = LS1.65) all crops have positive excess profits, except irrigated sorghum (Rahad). At a shadow rate of 2.20, the excess profits for Rahad sorghum remain negative although greatly reduced.

#### 2. Coefficient of Competitiveness

At the 1.425 foreign exchange rate only irrigated groundnuts and rainfed groundnuts,<sup>2/</sup> and oilseeds are within the competitive range. It is only at the 1.80 exchange rate that irrigated cotton and rainfed

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<sup>1/</sup> The competitiveness coefficient is not a measure of how competitive Sudan is in the production of crops under review relative to other exporters in the international market. That is, it is not a measure of international comparative advantage.

<sup>2/</sup> We are puzzled why Darfur is used as opposed to En Nahud in the Kordofan region. The latter would have been more appropriate as it is the center of groundnut production in the rainfed sector and the transfer costs to Port Sudan are substantially less due to relative distances and the cost per ton kilometer.

sorghum realize the desired competitiveness coefficients, namely a coefficient less than the exchange rate used to value output and traded inputs. Radad sorghum remains, however, outside the range of competitiveness. This is the case even at the 2.20 shadow rate of exchange.

### 3. Conclusion

At a low return to the management function (e.g., LS 42/feddan in the case of irrigated cotton) a foreign exchange rate of not less than US\$1.00 = LS2.00 is required for all crops except Rahad sorghum to achieve the desired competitiveness coefficient. A movement on the exchange rate is thus required.

#### IV. Reassessing Returns to Farmers, or the Financial Return to Management

##### A. Introduction

The following analysis questions the assumption which is built into the initial IMF analysis:

"Factor remunerations include an 'adequate' return to the farmer, which is distinct from his labor earnings, to compensate him for his managerial function. Such income is defined as adequate if, in conjunction with his labor earnings, it would provide him with an income which would be commensurate with that of a skilled worker in urban areas. In other words, it should be sufficient to keep him and his family on the farm" (p.3).

We believe returns which are adequate to prevent rural-urban migration are neither sufficient nor the appropriate criterion to use for agricultural pricing policy in the Sudan. Our view is based upon the following rationale: Sudan has an extraordinary external debt; foreign exchange earnings are not sufficient to pay for a modest level of imports and contribute significantly toward servicing the country's international debt. In short, Sudan is foreign exchange poor. The country's sources of foreign exchange are largely limited to agricultural exports and remittances from Sudanese working abroad. In addition, producers operate in a difficult economic environment.

Consequently, we have taken the position that the structure of agricultural incentives, in an economically harsh environment, must be both positive and sufficient to stimulate significant increases in production and export earnings. The economic environment is harsh because inputs often do not arrive in the right place at the right time, mechanical services are often delayed, irrigation is not applied in a timely and adequate fashion and fuel supplies in outlying areas are not available or inadequate in quantity to transport necessary supplies of inputs, migrant labor or

commodities to market, etc. We believe that returns to farmers under existing pricing policies are not sufficient for farmers and marketing agents to take the real risks in a supply-short environment, or face the uncertainties resulting from an unpredictable policy environment. For an economy requiring major increases in agricultural production and foreign exchange earnings we do not believe the urban wage rate is the appropriate basis to value returns to farmers -- more is required.

The real problem is "how much more?" We sympathize with Nashashibi's dilemma in fixing an appropriate value for "return to farmer." The criterion used is a conventional approach, but it completely ignores the scope for interaction between yields and returns to the farmer. Unfortunately, there is no data base from which to estimate the desired relationship.

The 75/25 foreign exchange rate conversion formula imposes a 21% implicit FX rate tax on exporters and consequently agricultural producers, if one considers the present commercial bank rate (1.80) as the appropriate foreign exchange rate.<sup>1/</sup> We believe financial incentives need to be improved above the current effective export rate (US\$1.00 = LS1.425) to encourage producers to intensify or expand export production at the margin.<sup>2/</sup> This will most likely involve somewhat higher than average production costs. But these need not be a constraint, if financial returns to producers are increased. This provides the justification for increasing returns to farmers -- to improve their cash liquidity and consequently incentives to increase production.

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<sup>1/</sup> However, the commercial bank rate is also overvalued, compared to the open market rate which has been above US\$1.00 = LS2.30 in recent months.

<sup>2/</sup> The extent to which this is possible in the irrigated sector, in the short run, will depend upon the flexibility tenants have, in terms of more or less land devoted to a given crop, or in terms of choice of land allocations among cotton, groundnuts and sorghum. In the rainfed sector producers already have this flexibility.

## B. The Recent IMF Revision

We have voiced our criticism to the IMF on the criterion they have used to value "returns to the management function." The recent IMF Mission to Harbom in late August apparently accepted the view that the "return to farmer" used in the calculations was too low. Namely, incentives at this rate (e.g., LS42/ feddan for irrigated cotton) are inadequate to encourage increased production.

In practical terms, improving incentives can be achieved by adjusting the exchange rate or increasing the return to the management function (return to farmer). We will argue that both are required.

In the analysis which follows, the increased "return to farmer", imputed for line 3c, is based upon a World Bank study of what farmers earn as a return to management in other developing countries producing similar crops. We do not believe this is an appropriate approach to value returns to management and we will return to this point later in our analysis.

The recent IMF Mission recalculated, based upon the above mentioned criterion, the returns to management on a per feddan basis as follows:

LS 164.4	for irrigated cotton
LS 152.4	irrigated groundnuts, sorghum and wheat; and
LS 146.4	rainfed groundnuts, sesame and sorghum

Our calculations which follow incorporate these imputed returns to management, and a sensitivity analysis using alternative exchange rates is undertaken. It should be noted here that the new returns to management as imputed by the recent IMF Mission are approximately 300% greater in the case of irrigated cotton, 400% in the case of irrigated groundnuts, sorghum and wheat, and 500 % greater for rainfed oilseeds and sorghum than the original Nashashibi calculations.

1. Results of the Sensitivity Analysis (Tables 7-10)

(a) Excess Profits

At the present effective foreign exchange rate (1.425) under the conversion formula, negative excess profits are realized for all crops except Gezira groundnuts. Excess profits do not become positive for irrigated cotton until a US\$1.00 = LS2.00 exchange rate is used in the calculations. However, at this exchange rate, negative excess profits are maintained for irrigated sorghum and the rainfed crops. This remains the case even if a shadow rate of 2.20 is used in the calculations.

(b) Competitiveness Coefficient

At the 1.425 foreign exchange rate all irrigated and rainfed crops do not achieve the necessary competitiveness with the new higher valuation of returns to management. At the 1.80 foreign exchange rate only Gezira irrigated groundnuts become competitive. At the US\$1.00 = LS2.20 rate irrigated medium staple cotton just becomes competitive as do irrigated Rahad groundnuts.<sup>1/</sup>

(c) Conclusion

The new higher value for returns to management, as imputed by the recent IMF team, based upon returns to management for farmers producing similar crops in other developing countries, completely alters the results and clearly shows that the current FX Rate Conversion Formula does not provide adequate financial incentives to producers. Nor does it allow producers to achieve export competitiveness. This is due to two factors: (1) basing of pricing policy on exogenous (and external)

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<sup>1/</sup>Under the IMF revision none of the rainfed crops achieve the necessary competitiveness coefficient. In fact, the return to farmer is greater than the value of output in this sector!

Table 7

Sudan: Cost Structure and Competitiveness of Selected Crops Including (a), 1984/85  
(Incorporating New IMF Figures for Return to Farmers)

Output Parameters	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum
		Gezira	Gezira	Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Durtur	Gedaref	Gedaref
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/Ton	0.75	0.58	0.58	600.0	500.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LS\$/US\$	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425
Output Value												
Main Product	LS\$/F	526.3	614.9	714.1	416.8	416.8	133.2	133.2	180.3	131.7	145.4	53.3
Joint Product	LS\$/F	158.0	132.7	154.1	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LS\$/F	684.3	747.6	868.2	470.7	470.7	182.7	182.7	213.3	185.6	145.4	102.8
Input Costs												
a. Traded Inputs												
Total Traded Inputs	LS\$/F	311.6	329.0	336.7	51.1	51.1	25.3	26.7	109.9	25.3	14.1	20.0
b. Nontraded Inputs												
Total Nontraded	LS\$/F	135.1	150.5	166.0	62.1	62.7	20.5	11.3	38.1	22.3	15.3	15.0
c. Factor Remuneration												
Labor	LS\$/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.0
Land, Water, Admin.	LS\$/F	72.5	72.5	138.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LS\$/F	164.4	164.4	164.4	152.4	152.4	152.4	152.4	152.4	146.4	146.4	146.4
Total Factor Remun.	LS\$/F	386.8	417.5	514.8	311.9	402.7	266.2	328.3	227.8	210.9	196.2	181.6
Total Input Costs	LS\$/F	833.5	897.0	1017.5	425.1	517.8	312.0	378.3	375.6	258.5	225.6	216.6
Excess Profits (2-3)												
Calc. L & W chgs.	LS\$/F	-149.2	-149.4	-149.3	45.6	-47.0	-129.3	-195.5	-162.5	-73.0	-80.3	-116.1
International Value Added (2-3.a)												
a. In Sudanese Pounds	LS\$/F	372.7	416.6	531.5	419.6	418.4	157.4	154.1	103.4	160.2	131.2	82.7
b. In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	294.4	293.6	110.5	108.1	72.6	112.4	92.1	58.1
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chgs.	LS\$/F	566.6	618.2	744.6	424.3	515.8	305.6	368.1	278.3	252.4	227.2	206.7
Competitiveness (6/5b)												
Calc. L & W chgs.	LS\$/US\$	2.17	2.10	2.00	1.44	1.76	2.77	3.40	3.84	2.24	2.47	3.56

Table 8

Sudan: Cost Structure and Competitiveness of Selected Crops including Tax, 1964/65  
(Incorporating New IMF Figures for Return to Farmers)

	Units	Irrigated						Rainfed				
		Location 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum
		LS	MS	RS	Bezira	Rahad	Bezira	Rahad	Bezira	S. Darfur	Gedaret	Gedaret
1. Output Parameters												
Yield	Kg/F	4.5	5.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/Ton	0.75	0.58	0.58	500.0	500.0	170.0	170.0	230.0	500.0	850.0	170.0
Exchange Rate	LS\$/US\$	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800
2. Output Value												
Main Product	LS\$/F	564.8	775.7	902.0	526.5	526.5	168.3	168.3	227.7	156.3	187.6	67.3
Joint Product	LS\$/F	199.6	157.6	194.7	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LS\$/F	864.4	944.3	1096.7	580.4	580.4	217.8	217.8	260.7	220.2	187.6	116.8
3. Input Costs												
a. Traded Inputs												
Total Traded Inputs	LS\$/F	393.7	415.6	425.3	64.6	66.1	32.0	36.2	138.8	32.0	17.8	25.3
b. Nontraded Inputs												
Total Nontraded	LS\$/F	155.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
c. Factor Remuneration												
Labor	LS\$/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LS\$/F	72.5	72.5	135.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LS\$/F	164.4	164.4	164.4	152.4	152.4	152.4	152.4	152.4	146.4	146.4	146.4
Total Factor Remun.	LS\$/F	386.8	417.5	514.8	311.9	402.7	266.2	328.3	227.8	210.9	196.2	181.8
Total Input Costs	LS\$/F	915.6	983.6	1106.1	438.6	531.5	318.7	385.8	404.7	265.2	229.3	222.1
Excess Profits (2-3)												
Calc. L & W chgs.	LS\$/F	-51.1	-39.3	-9.5	141.8	48.9	-100.9	-168.0	-144.0	-45.0	45.7	-105.3
International Value Added (2-3.2)												
a. In Sudanese Pounds	LS\$/F	470.8	526.7	671.3	515.6	514.3	185.8	181.6	121.9	186.2	165.8	91.5
b. In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	286.5	285.7	103.2	100.9	67.7	104.7	92.1	50.8
Domestic Resource Cost including 12 percent value added tax: (3b+3c+1.12*3b)												
Calc. L & W chgs.	LS\$/F	578.4	631.4	751.4	435.9	527.1	309.0	371.4	280.5	255.8	231.1	207.2
Competitiveness (6/5b)												
Calc. L & W chgs.	LS\$/US\$	2.21	2.15	2.04	1.52	1.84	2.99	3.68	4.14	2.45	2.51	4.09

Table 9

Sudan: Cost Structure and Competitiveness of Selected Crops, including 13%, 1994/95  
(Incorporating New IMF Figures for Return to Farmers)

	Units	Irrigated						Rainfed				
		Location 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum
		LS Gezira	MS Gezira	MS Khartoum	Gezira	Khartoum	Gezira	Khartoum	Gezira	S. Darfur	Gezira	Gezira
1. Output Parameters												
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.75	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LS\$/US\$	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
2. Output Value												
Main Product	LS\$/F	738.7	863.0	1002.2	585.0	585.0	187.0	187.0	253.0	184.0	204.0	74.8
Joint Product	LS\$/F	221.8	186.3	216.3	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LS\$/F	960.5	1049.3	1218.5	638.9	638.9	236.5	236.5	286.0	238.7	204.0	124.3
3. Input Costs												
a. Traded Inputs												
Total Traded Inputs	LS\$/F	437.4	461.8	472.6	71.8	71.5	35.6	40.2	154.2	35.6	19.8	39.1
b. Nontraded Inputs												
Total Nontraded	LS\$/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
c. Factor Remuneration												
Labour	LS\$/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LS\$/F	72.5	72.5	138.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LS\$/F	164.4	164.4	164.4	152.4	152.4	152.4	152.4	152.4	146.4	146.4	146.4
Total Factor Remun.	LS\$/F	386.8	417.5	514.8	311.9	402.7	266.2	328.3	227.8	210.9	196.2	181.8
Total Input Costs	LS\$/F	959.3	1029.8	1153.4	445.8	538.9	322.3	389.8	420.1	268.8	231.3	224.9
Excess Profits (2-3)												
Calc. L & W chgs.	LS\$/F	1.2	19.5	65.1	193.1	100.0	-65.8	-153.3	-134.1	-30.1	-27.3	-100.6
International Value Added (2-3.3)												
a. In Sudanese Pounds	LS\$/F	523.1	587.5	745.9	567.1	565.4	200.9	196.3	131.8	203.1	191.2	96.2
b. In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	283.6	282.7	100.5	98.1	65.9	101.6	92.1	48.1
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chgs.	LS\$/F	584.7	638.5	770.3	442.1	533.3	310.8	373.2	281.7	257.6	233.6	208.3
Competitiveness (6/5b)												
Calc. L & W chgs.	LS\$/US\$	2.24	2.17	2.07	1.56	1.89	3.09	3.80	4.28	2.54	2.54	4.33

Table 10

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Incorporating New IMF Figures for Return to Farmer)

Crops	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Onions 2/	Sesame	Sorghum
		CS Gezira	MS Gezira	MS Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Dantur	Gedaref	Gedaref
<b>1. Output Parameters</b>												
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	500.0	850.0	170.0
Exchange Rate	LS\$/US\$	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200
<b>2. Output Value</b>												
Main Product	LS\$/F	812.5	949.3	1102.4	643.5	643.5	205.7	205.7	278.3	203.3	224.4	82.3
Joint Product	LS\$/F	254.0	291.9	237.9	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LS\$/F	1056.5	1154.7	1340.4	697.4	697.4	255.2	255.2	311.3	257.2	224.4	131.8
<b>3. Input Costs</b>												
<b>a. Traded Inputs</b>												
Total Traded Inputs	LS\$/F	481.1	508.0	519.9	79.0	80.8	59.1	44.2	169.5	39.1	21.8	31.0
<b>b. Nontraded Inputs</b>												
Total Nontraded	LS\$/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
<b>c. Factor Remuneration</b>												
Labor	LS\$/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LS\$/F	72.5	72.5	138.9	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LS\$/F	164.4	164.4	164.4	152.4	152.4	152.4	152.4	152.4	146.4	146.4	146.4
Total Factor Remun.	LS\$/F	386.8	417.5	514.9	311.9	402.7	266.2	328.3	227.8	210.9	196.2	181.8
Total Input Costs	LS\$/F	1003.0	1076.0	1200.7	453.0	546.2	325.8	393.8	435.5	272.3	233.3	227.8
<b>4. Excess Profits (2-3)</b>												
Calc. L & W chgs.	LS\$/F	53.5	78.2	139.7	244.4	151.2	-70.0	-138.6	-124.2	-15.1	-8.9	-96.0
<b>5. International Value Added (2-3, a)</b>												
a. In Sudanese Pounds	LS\$/F	575.4	646.2	820.5	618.4	618.6	216.1	211.0	141.7	218.1	202.5	100.8
b. In U.S. Dollars 9/	US\$/F	251.5	293.7	373.0	281.1	280.3	98.2	95.9	64.4	99.1	92.1	45.3
<b>6. Domestic Resource Cost including 12 percent value added tax (3b+3c+(12%5a))</b>												
Calc. L & W chgs.	LS\$/F	590.9	645.5	779.3	448.2	539.4	312.5	374.9	282.9	259.4	233.8	208.9
<b>7. Competitiveness (6/5b)</b>												
Calc. L & W chgs.	LS\$/US\$	2.26	2.20	2.09	1.59	1.92	3.16	3.91	4.39	2.62	2.56	4.56

returns to management and an overvalued exchange rate, and (2) the need to improve the underlying production functions in order to increase low yields and consequently production efficiency.

In the following sections alternative methods of imputing returns to management are considered.

## C. An Alternative Approach Based Upon Returns to Factors of Production

### 1. Methodology

We believe it is inappropriate to impute an average return to management on either criterion used thus far, whether it be the off-farm opportunity cost as reflected by an urban wage rate, or by what farmers receive as a return to management in other developing countries.

The reasons are the following: First, farmers in other countries undoubtedly operate with different technology, under different market conditions and in different policy environments. Second, a farmer's return to his management skill should be based upon his relative production efficiency compared to the average production costs of other producers of the same crop. A producer's relative production efficiency will depend upon the prices he pays and receives and how well he manages his scarce factors of production.<sup>1/</sup> Consequently, the imputed "return to farmer" should be linked, in part, to real production costs, not to his opportunity cost as a skilled worker in urban areas or what farmers earn in other countries.

In the analysis which follows, we assume the return to management, after the commodity and the traded (imported) inputs have been appropriated:

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<sup>1/</sup>In the irrigated sector, an issue can be raised as to the extent to which tenants have freedom to exercise management decisions. While it is true many field operations and input allocations are determined and carried out by scheme management, the tenant does have some control over the standard at which he tends his crop and manages his field labor. The tenant's decisions and standards will affect yields and consequently returns to the tradeable inputs provided by scheme management.

priced, should be based upon a percentage rate of return on the costs of scarce factors of production. The scarce factors of production are the sum of all traded inputs (excluding non-traded inputs) and total labor costs. We have calculated a 15 percent rate of return on these factors of production and assigned this value as the return to farmer (line 3c). What we are saying here is that a farmer's management skill should be rewarded on this basis and at this rate.<sup>1/</sup> In this way the farmer's return will be a function of how well he manages the scarce factors of production under his control. As a consequence, his returns become a function of his production efficiency.

## 2. Results of the Sensitivity Analysis (Tables 11 - 14)

When valuing the returns to management on the basis of actual costs incurred for tradeable inputs and labor, the imputed value to management varies across all crops (unlike in the IMF calculation) since actual costs for both are different for each crop under review. However, since irrigated cotton requires the greatest expenditure for imported inputs as well as the most input of labor per feddan, the imputed return to management is the highest for irrigated cotton of all of the crops included in this analysis. At the other end of the continuum are the rainfed crops which under existing technology utilize little imported inputs and substantially less labor per unit of land.

### (a) Return to Farmer

By following this approach to calculating returns to management, it may appear that the relatively low imputed "returns to farmer",

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<sup>1/</sup> A legitimate question is why this rate? We are placing an emphasis on the return to (scarce) capital. And it has been estimated that the opportunity cost of capital in the Sudan approximates 15-18 percent. In addition, in the Sudan, hired labor is also considered a scarce resource, and as calculations show a major input in the production process. Consequently, effective supervision of labor will influence production efficiency and consequently yields and net returns to all factors of production.

Table 11

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Return to Farmer Based Upon a 15 Percent Management Return on Total Factor Costs)

	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum
		LS	MS		Gezira	Kahad	Gezira	Kahad	Gezira	S. Darfur	Gedaref	Gedaref
		Gezira	Gezira	Kahad	Gezira	Kahad	Gezira	Kahad	Gezira	S. Darfur	Gedaref	Gedaref
1. Output Parameters												
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/Ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LSd/US\$	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425
2. Output Value												
Main Product	LSd/F	526.3	614.9	714.1	416.8	416.8	133.2	133.2	180.3	131.7	145.4	53.3
Joint Product	LSd/F	158.0	132.7	154.1	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LSd/F	684.3	747.6	868.2	470.7	470.7	182.7	182.7	213.3	185.6	145.4	102.8
3. Input Costs												
a. Traded Inputs												
Total Traded Inputs	LSd/F	311.6	329.0	336.7	51.1	52.4	25.3	28.7	109.9	25.3	14.1	20.0
b. Nontraded Inputs												
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
c. Factor Remuneration												
Labor	LSd/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LSd/F	72.5	72.5	139.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LSd/F	69.2	76.4	62.2	26.2	31.4	15.4	16.7	21.1	13.5	8.8	7.6
Total Factor Remun.	LSd/F	291.6	329.5	432.6	185.7	281.7	129.2	192.6	96.5	78.0	58.6	43.0
Total Input Costs	LSd/F	738.4	809.1	935.4	298.9	396.8	175.1	242.6	244.4	125.6	86.0	78.0
Excess Profits (2-3)												
Calc. L & W chqs.	LSd/F	-54.0	-61.5	-67.2	171.8	73.9	7.7	-59.8	-31.2	60.0	57.3	24.8
International Value Added (2-3.a)												
a. In Sudanese Pounds	LSd/F	372.7	418.6	531.5	419.6	418.4	157.4	154.1	103.4	160.2	131.2	82.7
b. In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	294.4	293.6	110.5	108.1	72.6	112.4	92.1	58.1
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chqs.	LSd/F	471.5	530.3	562.4	298.1	394.7	168.6	232.4	147.0	119.5	89.7	67.7
Competitiveness (6/5a)												
Calc. L & W chqs.	LSd/US\$	1.80	1.81	1.78	1.01	1.34	1.53	2.15	2.03	1.06	0.97	1.17

Table 12

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Return to Farmer Based Upon a 15 Percent Management Return on Total Factor Costs)

	Units	Irrigated						Rainfed				
		C o l t o n 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum
		LS	MS	MS	Gezira	Kahad	Gezira	Kahad	Gezira	S. Darfur	Bedaref	Gezira
1. Output Parameters		Gezira	Gezira	Kahad								
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LSd/US\$	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800
2. Output Value												
Main Product	LSd/F	664.8	776.7	902.0	526.5	526.5	168.3	168.3	227.7	166.3	183.6	67.3
Joint Product	LSd/F	199.6	167.6	194.7	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LSd/F	864.4	944.3	1096.7	580.4	580.4	217.8	217.8	260.7	220.2	183.6	116.8
3. Input Costs												
a. Traded Inputs												
Total Traded Inputs	LSd/F	393.7	415.5	425.3	64.6	66.1	32.0	36.2	138.8	32.0	17.8	25.3
b. Nontraded Inputs												
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
c. Factor Remuneration												
Labor	LSd/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LSd/F	72.5	72.5	138.8	36.3	93.0	36.4	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LSd/F	81.5	89.4	95.5	20.2	33.5	16.4	17.9	25.4	14.5	9.4	8.4
Total Factor Remun	LSd/F	303.9	342.5	445.9	189.7	283.8	130.2	193.8	100.8	79.0	59.2	43.8
Total Input Costs	LSd/F	832.7	908.7	1037.3	314.4	412.6	182.7	251.3	277.7	133.3	92.3	64.1
Excess Profits (2-3)												
Calc. L & W chgs.	LSd/F	31.7	35.7	59.4	266.0	167.8	35.1	-33.5	-17.0	86.9	91.3	32.7
International Value Added (2-3.a)												
a. In Sudanese Pounds	LSd/F	470.8	528.7	671.3	515.8	514.3	185.8	181.6	121.9	188.2	165.8	91.5
b. In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	286.6	285.7	103.2	100.9	67.7	104.6	92.1	50.8
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chgs.	LSd/F	495.5	556.5	692.5	311.7	408.2	173.0	236.9	153.5	123.9	94.4	69.7
Competitiveness (6/5b)												
Calc. L & W chgs.	LSd/US\$	1.89	1.89	1.86	1.09	1.43	1.68	2.35	2.27	1.18	1.02	1.37

Table 13

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Return to Farmer Based Upon a 15 Percent Management Return on Total Factor Costs)

	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Onions 2/	Sesame	Sorghum
		LS Gezira	MS Gezira	MS Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Bedaref	Bedaref
<b>Output Parameters</b>												
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	170.0
World Price	US\$/ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LS\$/US\$	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
<b>Output Value</b>												
Main Product	LS\$/F	738.7	863.0	1002.2	585.0	585.0	187.0	187.0	253.0	184.8	204.0	74.8
Joint Product	LS\$/F	221.8	186.3	216.3	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LS\$/F	960.5	1049.3	1218.5	638.9	638.9	236.5	236.5	286.0	238.7	204.0	124.3
<b>Input Costs</b>												
<b>a. Traded Inputs</b>												
Total Traded Inputs	LS\$/F	437.4	461.8	472.6	71.8	73.5	35.6	40.2	154.2	35.6	19.8	28.1
<b>b. Nontraded Inputs</b>												
Total Nontraded	LS\$/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
<b>c. Factor Remuneration</b>												
Labor	LS\$/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LS\$/F	72.5	72.5	139.8	36.3	73.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LS\$/F	88.1	76.4	102.6	29.2	34.6	17.0	18.5	27.7	15.0	6.7	8.8
Total Factor Remun.	LS\$/F	310.5	349.5	453.0	188.7	264.9	130.8	194.4	103.1	79.5	59.5	44.2
Total Input Costs	LS\$/F	883.0	961.8	1091.6	322.6	421.1	186.8	255.9	295.4	137.4	94.6	87.3
<b>Excess Profits (2-3)</b>												
Calc. L & W chgs.	LS\$/F	77.5	87.5	126.9	316.3	217.8	49.7	-19.4	-9.4	101.3	109.4	37.0
<b>International Value Added (2-3.a)</b>												
a. In Sudanese Pounds	LS\$/F	523.1	587.5	745.9	567.1	565.4	200.9	196.3	131.8	203.1	184.2	96.7
b. In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	283.6	282.7	100.5	98.1	65.9	101.6	92.1	48.1
<b>Domestic Resource Cost including 12 percent value added tax</b>												
Calc. L & W chgs.	LS\$/F	509.4	570.5	709.5	318.9	415.5	175.4	239.2	157.0	126.2	96.9	70.7
<b>Competitiveness (6/5b)</b>												
Calc. L & W chgs.	LS\$/US\$	1.94	1.94	1.90	1.12	1.47	1.75	2.44	2.38	1.24	1.05	1.47

Table 14

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Return to Farmer Based Upon a 15 Percent Management Return on Total Factor Costs)

	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum
		LS	MS	MS	Gezira	Kahad	Gezira	Kahad	Gezira	S. Darfur	Bedaref	Gezira
<b>Output Parameters</b>												
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.75	0.58	0.58	600.0	500.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LS\$/US\$	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200
<b>Output Value</b>												
Main Product	LS\$/F	812.5	949.3	1102.4	643.5	643.5	205.7	205.7	278.3	203.3	224.4	87.3
Joint Product	LS\$/F	244.0	204.9	237.9	53.9	53.9	49.5	49.5	33.0	53.9	0.0	47.5
Total Output	LS\$/F	1056.5	1154.2	1340.4	697.4	697.4	255.2	255.2	311.3	257.2	224.4	134.8
<b>Input Costs</b>												
<b>a. Traded Inputs</b>												
Total Traded Inputs	LS\$/F	481.1	508.0	519.9	79.0	80.8	39.1	44.2	169.6	39.1	21.8	31.0
<b>b. Nontraded Inputs</b>												
Total Nontraded	LS\$/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	36.1	22.3	15.3	15.0
<b>c. Factor Remuneration</b>												
Labor	LS\$/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LS\$/F	72.5	72.5	138.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LS\$/F	94.7	103.3	109.7	30.3	35.7	17.5	19.1	30.0	15.5	10.0	9.2
Total Factor Remun.	LS\$/F	317.1	356.4	460.1	189.8	286.0	131.3	195.0	105.4	80.0	59.8	44.6
Total Input Costs	LS\$/F	933.3	1014.9	1146.0	330.9	429.5	190.9	260.5	313.1	141.5	96.9	50.6
<b>Excess Profits (2-3)</b>												
Calc. L & W chgs.	LS\$/F	123.2	139.3	194.4	366.5	267.9	64.3	-5.3	-1.8	115.7	127.5	11.2
<b>International Value Added (2-3.a)</b>												
a. In Sudanese Pounds	LS\$/F	575.4	646.2	820.5	618.4	616.6	216.1	211.0	141.7	218.1	202.6	100.8
b. In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	281.1	280.3	98.2	95.9	64.4	99.1	92.1	45.8
<b>Domestic Resource Cost including 12 percent value added tax</b>												
Calc. L & W chgs.	LS\$/F	521.2	584.4	724.6	326.1	422.7	177.7	241.6	160.5	128.5	99.4	71.7
<b>Competitiveness (6/50)</b>												
Calc. L & W chgs.	LS\$/US\$	1.99	1.99	1.94	1.16	1.51	1.81	2.52	2.49	1.30	1.08	1.56

in the rainfed sector appear inadequate. However, one must keep in mind that these are returns per feddan. The returns to the farmer and his household will, even under these "relatively low" per feddan returns, be highly positive incentive returns to the producers of rainfed crops, since rainfed farms are often 1000 feddans or more (for sesame and sorghum in the mechanized rainfed sector) compared to the 10-15 feddans a tenant operates in the irrigated sector.<sup>1/</sup>

(b) Excess Profits

At the current effective exchange rate used to value output and traded inputs (1.425), under the present scenario, negative excess profits are realized for all irrigated crops except groundnuts and Gezira sorghum. Rainfed oilseeds and sorghum on the other hand realize positive excess profits.

At the current commercial bank rate (US\$1.00 = LS 1.80) all crops, except Rahad sorghum would realize positive excess profits if this method of valuing the returns to management were employed. Even at the shadow rate of 2.20 Rahad sorghum would still realize negative excess profits.

(c) Coefficient of Competitiveness

If pricing policy were to adopt this method of imputing a value for the return to management, the coefficient of export competitiveness would be unsatisfactory at the current effective exchange rate (1.425) for all crops except irrigated groundnuts and the rainfed crops. At

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<sup>1/</sup> One might ask how the IMF rationalizes such high Returns to Farmer PER HECTARE in the rainfed sector? If these per feddan returns are approached it can explain production at the extensive margin (very low yields), abandoning large tracks of land after 3-5 years, massive land clearing of scrubs and trees and in part, the consequent desertification taking place in much of the mechanized rainfed sector.

the shadow rate of US\$1.00 = LS1.80 irrigated sorghum becomes competitive, but irrigated long and medium staple cotton remain outside the competitive range as do Rahad sorghum and Gezira wheat. However, at the shadow FX Rate of US\$1.00 = LS2.00, all crops except Rahad sorghum and Gezira wheat would fall within the competitive range.<sup>1/</sup>

(d) Conclusion

If the return to management is calculated on the basis of a 15 percent return on tradeable inputs, plus labor costs, the returns to farmers, we believe, represent positive incentives for producers to expand output in both the irrigated and rainfed sectors. The returns to management, at an effective exchange rate of US\$1.00 = LS2.00 for irrigated cotton, will be greater than imputed in the original Nashashibi calculation, (LS92 vs LS42/feddan), but less than calculated by the recent IMF Mission (LS92 vs LS164/feddan). The returns to management for producers of irrigated groundnuts will be about the same as Mr. Nashashibi's original imputed return of LS30/feddan. Returns to management for irrigated sorghum will be less (about LS18/feddan vs LS30/feddan) but we believe still represent positive incentives to increase production.

For rainfed sector crops the returns to farmers are substantially less per feddan than originally imputed in Mr. Nashashibi's calculations for reasons explained above (see 2a above). We believe they

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<sup>1/</sup> It will be recalled that the necessary competitiveness coefficient is achieved, if the coefficient (line 7) is less than the exchange rate used to value output and the traded inputs.

represent incentive returns.<sup>1/</sup>

At the effective exchange rate of US\$1.00 = LS2.00 all crops except Rahad sorghum fall within the competitive range. Thus, if an exchange rate of US\$1.00 = LS2.00 were used to price or value tradeable inputs and outputs, Sudan would achieve the necessary export competitiveness coefficient and producer incentives as reflected by "Returns to Farmers".

In addition, at the US\$1.00 = LS2.00 exchange rate, "excess profits" would be realized for all crops except Rahad sorghum and Gezira wheat. We believe these represent potential tax revenues under the assumption that production costs (particularly labor) do not increase significantly over the next production season.

The above conclusions are further reinforced at a shadow FX Rate of US\$1.00 = LS2.20.

#### D. An Alternative Method: Producers and Society Sharing Net Returns From Agricultural Production

##### 1. Introduction

Our sensitivity analysis reveals at an exchange rate of US\$1.00 = LS2.00 or higher, the following could be achieved: (a) strong financial incentives as reflected in the returns to producers' management, (b) significant "excess profits" and (c) the necessary export competitiveness coefficients.

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<sup>1/</sup> As explained earlier, this is because of the size of farms and the production technology in current use in the mechanized rainfed sector. Because of the factor-price distortions that have prevailed in this sector over the past 4-5 years and the fact that these producers faced a highly subsidized export price (Saudi Arabia offered a price for Sudanese sorghum which was, three years ago, over 100 percent above the international price) producers in the mechanized rainfed rapidly expanded farm size to 1000 feddans or more. The factor costs and commodity price encouraged these producers to follow a low yield, land extensive and partially mechanized (land preparation) approach to sorghum production.

Thus, if the government were to abandon the current Foreign Exchange Rate Conversion Formula and price commodities and tradeable inputs at international prices, as reflected by more appropriate exchange rates, the present implicit foreign exchange rate subsidies on traded inputs and the implicit taxes on commodity export prices (in Sudanese Pounds), could give way to explicit tax revenues for the government and society at large.

## 2. Methodology

To illustrate how (more appropriate) shadow exchange rates could achieve these policy objectives, we have revised our calculations in the following manner. First, we have calculated the excess profits for each crop with zero imputed returns to management, given all other cost price relationships as previously assumed. Second, we have taken the resulting excess profits and divided them equally between (a) imputed returns to farmers and (b) excess profits, which would result from each crop production system under alternative exchange rates. That is, returns to farmers and excess profits for each crop are calculated to be equal. Following this approach and under selected exchange rates, we attempt to show how agricultural producers and society, by way of government taxes, could share from the net returns to agricultural production.

## 3. Results of the Sensitivity Analysis (Tables 15 - 18)

### a. Returns to Farmer

At the current effective foreign exchange rate under the present conversion formula (US\$1.00 = LS1.425) equal returns to producers and society as reflected by excess profits are low for irrigated cotton, substantial for irrigated groundnuts, inadequate for irrigated sorghum, and very good for oilseeds and sorghum in the mechanized rainfed sector.<sup>1/</sup> These returns

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<sup>1/</sup> These are admittedly normative judgments.

Table 15

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Excess Profit Equals Return to Farmer)

Output Parameters	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Onits 2/	Sesame	Sorghum
		US Gezira	MS Gezira	MS Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Gedaref	Gedaref
Yield	kg/f	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LSd/US\$	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425
Output Value												
Main Product	LSd/F	526.3	614.9	714.1	416.8	416.8	133.2	133.2	180.3	131.7	145.4	53.3
Joint Product	LSd/F	158.0	132.7	154.1	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LSd/F	684.3	747.6	868.2	470.7	470.7	182.7	182.7	213.3	185.6	145.4	102.8
Input Costs												
a. Traded Inputs												
Total Traded Inputs	LSd/F	311.6	329.0	336.7	51.1	52.4	25.3	28.7	109.9	25.3	14.1	20.0
b. Nontraded Inputs												
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	5.3	12.0
Factor Remuneration												
Labor	LSd/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LSd/F	72.5	72.5	138.9	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LSd/F	7.6	7.5	7.5	99.0	52.7	11.6	-21.6	-5.1	36.7	33.1	16.2
Total Factor Remun.	LSd/F	230.0	260.6	357.9	258.5	303.0	125.4	154.3	70.3	101.2	82.9	51.6
Total Input Costs	LSd/F	676.7	740.1	860.7	371.7	418.0	171.2	204.3	218.3	148.9	112.3	86.6
Excess Profits (2-3)												
Calc. L & W chgs.	LSd/F	7.6	7.5	7.5	99.0	52.7	11.6	-21.6	-5.1	36.7	33.1	16.2
International Value Added (2-3.a)												
In Sudanese Pounds	LSd/F	372.7	418.6	531.5	419.6	418.4	157.4	154.1	103.4	160.2	131.2	82.7
In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	294.4	293.8	110.5	108.1	72.6	112.4	92.1	58.1
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chgs.	LSd/F	409.8	451.3	587.7	370.9	415.9	164.7	194.1	120.9	142.7	113.9	76.5
Competitiveness (5/5b)												
Calc. L & W chgs.	LSd/US\$	1.57	1.57	1.58	1.26	1.42	1.49	1.80	1.67	1.27	1.24	1.32

Table 16

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Excess Profit Equals Return to Farmer)

	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/	Sorghum 3/		Wheat 4/	Onions 2/	Sesame	Sorghum	
		Gezira	Gezira	Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Bedaref	Gezira
Output Parameters												
Yield	kg/f	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LS\$/US\$	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800
Output Value												
Main Product	LS\$/F	664.8	776.7	902.0	526.5	526.5	168.3	168.3	227.7	166.3	183.6	67.3
Joint Product	LS\$/F	199.5	167.6	194.7	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LS\$/F	864.4	944.3	1096.7	580.4	580.4	217.8	217.8	260.7	220.2	183.6	116.8
Input Costs												
a. Traded Inputs												
Total Traded Inputs	LS\$/F	393.7	415.6	425.3	64.6	66.1	32.0	36.2	138.8	32.0	17.6	25.3
b. Nontraded Inputs												
Total Nontraded	LS\$/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
c. Factor Remuneration												
Labor	LS\$/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	LS\$/F	72.5	72.5	138.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LS\$/F	56.6	62.6	77.5	147.1	100.6	25.6	-7.8	4.2	50.7	50.3	50.3
Total Factor Remun.	LS\$/F	279.0	315.7	427.9	306.6	350.9	139.6	168.1	79.6	115.2	100.1	85.7
Total Input Costs	LS\$/F	807.8	881.8	1019.2	433.3	479.8	192.1	225.6	256.5	169.5	133.3	96.3
Excess Profits (2-3)												
Calc. L & W chgs.	LS\$/F	56.6	62.6	77.5	147.1	100.6	25.6	-7.8	4.2	50.7	50.3	50.3
International Value Added (2-3.a)												
In Sudanese Pounds	LS\$/F	470.8	528.7	671.3	515.8	514.3	185.8	181.6	121.9	188.2	165.6	91.5
In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	286.6	285.7	103.2	100.9	67.7	104.6	92.1	50.8
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chgs.	LS\$/F	470.6	529.6	674.4	430.6	475.3	182.3	211.2	132.3	160.1	135.3	81.9
Competitiveness (6/5b)												
Calc. L & W chgs.	LS\$/US\$	1.80	1.80	1.81	1.50	1.66	1.77	2.09	1.95	1.53	1.47	1.31

Table 17

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Excess Profit Equals Return to Farmer)

Output Parameters	Units	Irrigated						Rainfed				
		Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	bnuts 2/	Sesame	Sorghum
		ES Gezira	MS Gezira	MS Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Bedaref	Bedaref
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LS\$/US\$	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Output Value												
Main Product	Lsd/F	738.7	863.0	1002.2	585.0	585.0	187.0	187.0	253.0	184.8	204.0	74.8
Joint Product	Lsd/F	221.8	186.3	215.3	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	Lsd/F	960.5	1049.3	1218.5	638.9	638.9	236.5	236.5	286.0	238.7	204.0	124.3
Input Costs												
a. Traded Inputs												
Total Traded Inputs	Lsd/F	437.4	461.8	472.6	71.8	73.5	35.5	40.2	154.2	35.6	19.8	28.1
b. Nontraded Inputs												
Total Nontraded	Lsd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
Factor Remuneration												
Labor	Lsd/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.8	30.4
Land, Water, Admin.	Lsd/F	72.5	72.5	138.8	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	Lsd/F	82.8	91.9	114.8	172.8	126.2	33.3	-0.5	9.1	58.2	59.6	22.9
Total Factor Remun.	Lsd/F	305.2	345.0	465.2	332.3	376.5	147.1	175.4	84.5	122.7	109.4	58.3
Total Input Costs	Lsd/F	877.7	957.3	1103.8	466.1	512.7	203.2	237.0	276.8	180.5	144.5	101.4
Excess Profits (2-3)												
Calc. L & W chqs.	Lsd/F	82.8	91.9	114.8	172.8	126.2	33.3	-0.5	9.1	58.2	59.6	22.9
International Value Added (2-3.a)												
In Sudanese Pounds	Lsd/F	523.1	587.5	745.9	567.1	565.4	200.9	196.3	131.8	203.1	184.2	90.2
In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	283.6	282.7	100.5	98.1	65.9	101.6	92.1	45.1
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chqs.	Lsd/F	503.1	566.0	720.7	462.4	507.1	191.7	220.3	138.5	169.3	146.8	84.8
Competitiveness (6/50)												
Calc. L & W chqs.	LS\$/US\$	1.92	1.93	1.93	1.63	1.79	1.91	2.24	2.10	1.67	1.57	1.76

Table 18

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Excess Profit Equals Return to Farmer)

Output Parameters	Units	Irrigated						Rainfed				
		Location 1/ [S] MS			Groundnuts 2/ Gezira Rahad		Sorghum 3/ Gezira Rahad		Wheat 4/ Gezira	Units 2/ S. Darfur	Sesame Gedaref	Sorghum Gedaref
		Gezira	Gezira	Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Gedaref	Gedaref
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/ton	0.75	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LSd/US\$	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200
Output Value												
Main Product	LSd/F	812.5	949.3	1102.4	443.5	643.5	205.7	205.7	278.3	203.3	224.4	82.3
Joint Product	LSd/F	244.0	204.9	237.9	53.9	53.9	49.5	49.5	33.0	53.9	0.0	49.5
Total Output	LSd/F	1056.5	1154.2	1340.4	497.4	697.4	255.2	255.2	311.3	257.2	224.4	131.8
Input Costs												
Traded Inputs												
Total Traded Inputs	LSd/F	481.1	508.0	519.9	79.0	80.8	39.1	44.2	169.6	39.1	21.8	31.0
Nontraded Inputs												
Total Nontraded	LSd/F	135.1	150.5	166.0	62.1	62.7	20.5	21.3	38.1	22.3	15.3	15.0
Factor Remuneration												
Labor	LSd/F	149.9	180.6	211.6	123.2	157.3	77.5	82.9	30.5	64.5	44.6	30.4
Land, Water, Admin.	LSd/F	72.5	72.5	139.9	36.3	93.0	36.3	93.0	44.9	0.0	5.0	5.0
Return to Farmer	LSd/F	108.9	121.3	152.0	198.4	151.8	40.9	6.9	14.1	65.6	68.8	25.7
Total Factor Resun	LSd/F	331.3	374.4	502.4	357.9	402.1	154.7	182.8	89.5	130.1	118.6	60.6
Total Input Costs	LSd/F	947.6	1032.9	1188.3	499.0	545.6	214.3	248.3	297.2	191.5	155.4	106.6
Excess Profits (2-3)												
Calc. L & W chgs.	LSd/F	108.9	121.3	152.0	198.4	151.8	40.9	6.9	14.1	65.6	68.8	25.2
International Value Added (2-3.5)												
In Sudanese Pounds	LSd/F	575.4	646.2	820.5	616.4	616.6	216.1	211.0	141.7	218.1	202.7	100.8
In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	281.1	280.3	98.2	95.9	64.4	99.1	92.1	45.8
Domestic Resource Cost including 12 percent value added tax												
Calc. L & W chgs.	LSd/F	535.5	602.5	766.9	494.2	538.8	201.1	229.4	144.6	179.6	158.2	87.7
Competitiveness (6/5b)												
Calc. L & W chgs.	LSd/US\$	2.05	2.05	2.06	1.76	1.92	2.05	2.39	2.25	1.80	1.72	1.91

improve, particularly for irrigated cotton, at the exchange rate of US\$1.00 = LS2.00 or better.

b. Excess Profits

The magnitude of excess profits is equal to the return to farmers and increase equally as the exchange rate moves from 1.425 to 2.20. The equality is achieved by definition under the methodology employed.

c. Competitiveness Coefficient

At an exchange rate of US\$1.00 = LS1.80, the competitiveness coefficient for irrigated cotton is just within the competitive range, whereas for all other crops except Rahad sorghum and Gezira wheat they are well within the range of export competitiveness. At the US\$1.00 = LS2.20 exchange rate, the competitiveness coefficient for irrigated cotton continues to improve as it does for all other crops.

d. Potential Tax Revenues

Assuming average total input costs have been correctly estimated (particularly for labor and marketing costs and margins) our analysis clearly shows there is scope for (1) producer incentives, (2) export competitiveness and (3) explicit tax revenues from Sudan's major export crops. The potential explicit tax revenues under this scenario are represented by "excess profits". For irrigated cotton and groundnuts these potential taxes are possibly more than LS100 per feddan!<sup>1/</sup> In the case of groundnuts it is nearly double. For sesame and sorghum produced in the mechanized rainfed sector, particularly when one takes account of the vast areas devoted to these crops in this sector, the tax revenues are potentially substantial.

4. Conclusion

The logical conclusion which results from this scenario is that pricing

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<sup>1/</sup> At an exchange rate of US\$1.00 = LS 2.20 (See Table 18 ).

policies based upon international prices and consequently a real exchange rate (i.e., not an overvalued exchange rate) can produce a desirable policy result; a policy reform whereby producers, exporters and the government treasury all benefit even in the short-run. In the intermediate run the added gains should translate into greater output and export earnings and an improved public revenue budget. Given the recurring problem of budget deficits, and the likelihood that a budget deficit will persist in the immediate years ahead, not to mention the need to create a budget surplus to finance increased public expenditures for "public goods" and social services, we believe identified alternatives to increase explicit taxes require serious consideration by policy makers. Our analysis indicates that explicit taxes on agriculture, if present price distortions were removed, could be implemented without creating disincentives among agricultural producers.<sup>1/</sup> Since yields are currently very low, part of the tax revenue should be reinvested in agriculture to spur development and achieve even greater export earnings.

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<sup>1/</sup> A caveat is in order. Our conclusion on the scope for explicit taxes is preliminary and will require additional, independent analysis by fiscal experts to confirm our result.

Table 19

Sudan: Cost Structure and Competitiveness of Selected Crops Including Tax, 1984/85  
(Net Foreign Exchange Earnings)

Units	Irrigated						Rainfed					
	Cotton 1/			Groundnuts 2/		Sorghum 3/		Wheat 4/	Gnuts 2/	Sesame	Sorghum	
	CS Gezira	MS Gezira	MS Rahad	Gezira	Rahad	Gezira	Rahad	Gezira	S. Darfur	Bedaref	Bedaref	
Output Parameters												
Yield	kg/F	4.5	6.2	7.2	750.0	750.0	550.0	550.0	550.0	220.0	120.0	220.0
World Price	US\$/Ton	0.76	0.58	0.58	600.0	600.0	170.0	170.0	230.0	600.0	850.0	170.0
Exchange Rate	LS\$/US\$	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425	1.425
Output Value	LS\$/F	684.3	747.6	868.2	470.7	470.7	182.7	182.7	213.3	135.6	145.4	102.8
Traded Inputs	LS\$/F	311.6	329.0	336.7	51.1	52.4	25.3	28.7	109.9	25.3	14.1	20.0
International Value Added (2-3)												
In Sudanese Pounds	LS\$/F	372.7	418.6	531.5	419.6	418.4	157.4	154.1	103.4	160.2	131.2	82.7
In U.S. Dollars 9/	US\$/F	261.5	293.7	373.0	294.4	293.6	110.5	108.1	72.6	112.4	92.1	58.1
Net Foreign Exchange Earnings Ratio (5a/3a)		1.20	1.27	1.58	8.20	7.99	6.21	5.38	0.94	6.32	9.30	4.13
Net Foreign Exchange Earnings \$ Earned / LS of Traded Inputs	(5b/3)	0.84	0.89	1.11	5.76	5.61	4.36	3.77	0.66	4.44	6.53	2.90

## V. Extending the Analysis to Account for NET Foreign Exchange Earnings

### A. Introduction

The methodology used to estimate the competitiveness of selected crops, at a given exchange rate, calculates what Nashashibi calls the "International Value Added", Line 5. (It is actually "domestic value added", at international prices). It is based upon output value (line 2), less the value of traded inputs (line 3a) and is expressed in both dollars and pounds for each crop included in the analysis.

However, it is important to realize that the international value added is an absolute amount per feddan. We believe it is misleading because it implies that Gezira long staple cotton (which has an international value added of \$261 per feddan) is a more efficient user of foreign exchange than irrigated sorghum (\$110 per feddan) or sesame produced in the rainfed sector (\$92 per feddan). While cotton generates more foreign exchange per feddan than any crop produced in the rainfed sector, it does not earn more foreign exchange per dollar (foreign exchange) invested per feddan. Nor does it mean that more land should be allocated to cotton than sorghum in the irrigated sector. Given Sudan's meagre foreign exchange supplies, it is tempting to express foreign exchange earnings in net terms per unit of foreign exchange invested in each crop. In the analysis which follows we calculate the foreign exchange input/output relationship for each crop under study.

### B. Methodology

In the analysis which follows we have calculated and consequently expressed net foreign exchange earnings in terms of a ratio in the following way:

$$\text{Net FX Earnings Ratio} = \frac{\text{International Value Added In LS (5a)}}{\text{Value of Traded Inputs in LS (3a)}}$$

This formula expresses the net foreign exchange earned per unit of foreign exchange invested. Since both the numerator and denominator are expressed in Sudanese Pounds (both are converted from dollars at the same exchange rate), the ratio indicates the dollars earned per dollar invested in traded or imported inputs.

### C. Results (Table 19)

The ratio of net foreign exchange earnings does not change as the exchange rate is increased from US\$1.00 = LS 1.425. This is because both the numerator and denominator in the formula are equally adjusted by whatever exchange rate is used in the calculation. The net Foreign Exchange Earnings Ratio is a straight forward approach to evaluating how efficient each crop is in its use of foreign exchange invested in (imported) traded inputs.

Our analysis shows that irrigated cotton earns the lowest rate of return per dollar invested in traded inputs of all the crops under review. The relative ranking of crops on this basis is as follows:

<u>Rank</u>	<u>Crop</u>	<u>Dollars Earned per Dollar Invested in Tradeable Inputs</u>
1	Rainfed Sesame	\$9.30
2	Gezira Groundnuts	8.20
3	Rahad Groundnuts	7.99
4	Rainfed Groundnuts	6.32
5	Gezira Sorghum	6.21
6	Rahad Sorghum	5.38
7	Rainfed Sorghum	4.13
8	Irrigated Cotton	1.35 (average)

Since cotton has the highest import content of all the crops produced in the Sudan, the GOS must make available a great deal of foreign exchange to produce cotton. However, per dollar invested in traded inputs, Sudan earns from cotton the least amount of foreign exchange.

The conclusion to be drawn from this analysis is that a shift away from irrigated cotton to irrigated groundnuts or the production of oilseeds in the rainfed sector would create a greater rate of net foreign exchange earnings than the historically favored crop -- cotton. However, before drawing conclusions it is necessary to take account of domestic resource costs (non-traded inputs, plus factor remunerations) and their contribution to output and their opportunity costs.

#### D. Limitation of Net Foreign Exchange Earnings Approach

The above analysis assumes that foreign exchange for the procurement of traded inputs is the only limiting (scarce) factor involved in crop production. This is of course not true.

The output value of each crop depends upon contributions from three types of inputs. And consequently the "international value added" (which is output value less traded inputs) is also a function of not only traded inputs, but also non-traded inputs and factor remunerations. The latter two types of inputs are "domestic resource costs".

The issue at hand is, how mobile or transferable are the domestic resources involved in cotton production since the above analysis indicates that Sudan potentially could earn more foreign exchange if crops other than cotton were produced. What kinds of shifts are possible in the short to intermediate term?

## E. Considering Foreign Exchange Requirements and Domestic Resource Costs

In this section we will consider what the impact would be if there were a partial shift away from the production of irrigated cotton.

### 1. Within the Irrigated Sector

The above analysis implies that shifting acreage from cotton to groundnuts would earn more foreign exchange (as represented by international value added) given relative border prices, yields and the costs of production (both traded inputs and domestic resource costs). Such a shift would also result in more foreign exchange per dollar invested in traded inputs (net foreign exchange earnings).

However, we need to be concerned about the mobility of domestic resources. Can non-traded inputs, labor, and land and water charges be readily applied to groundnuts? We are of the view that non-traded inputs which are largely financing and market costs can either be reallocated to groundnuts or saved. We believe the same case can be made for factor remunerations, principally labor and land and water charges. The return to management in cotton production will be simply saved by such a shift.

To illustrate the savings and the increase in foreign exchange earnings that would result from a partial reduction in the land area devoted to cotton and increasing the area devoted to groundnuts within the Gezira scheme, we have assumed that 250,000 feddans would be taken out of cotton <sup>1/</sup> and groundnuts produced in its place.

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<sup>1/</sup> In our example we have proportionately reduced the area devoted to long- (180,000 feddans) and medium-staple cotton (69,000 feddans).

## F. Results

If the government were to decide to take advantage of the higher international value added and the lower traded input requirement for irrigated groundnuts, relative to cotton, Table 20 illustrates the results that would be achieved: <sup>1/</sup>

1. Increase in international value added	=	LS 6.6 million
2. Savings in imported traded inputs	=	93.1 "
3. Savings in non-traded inputs	=	19.3 "
4. Savings in factor remunerations	=	33.1 "
5. Increase in excess profits	=	59.0 "

Our analysis shows that Sudan could reduce its import requirement for traded inputs by LS 93.1 million or \$46.5 (at the US\$1.00 = LS 2.00 exchange rate). For an economy that is foreign exchange short this is not an insignificant amount. In addition LS 6.6 million (or \$3.3 million) in additional foreign exchange earnings would result. The largest savings are on the import-side.

One fact not illustrated in the table is what would happen to labor requirements. Given the relative financial requirements for labor per feddan, less labor will be required. The financial savings in labor would be about LS 8.8 million. <sup>2/</sup> However, this would not represent unemployment since a high proportion of the labor involved in the Gezira scheme is migratory labor. This labor, which is highly mobile, could be "transferred" to other sectors of the economy.

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<sup>1/</sup> Output and traded inputs are valued at the US\$1.00 = LS 2.00 rate.

<sup>2/</sup> From Table 17 the relative labor requirements per feddan are:

LS Cotton	LS 149.9/feddan
MS Cotton	180.6/feddan
Groundnuts	123.2/feddan

Therefore,  $(181,000 \times \text{LS } 149.9 + 69,000 \times \text{LS } 180.6) - (250,000 \times \text{LS } 123.2) = \text{LS } 8,793,000.$

Table 20 Net Gains and Losses From Shifting 750,000 Feddans Out of Cotton Into Groundnuts on the Gezira Scheme (in LS 1000)

Crop	International Value Added	Traded Inputs	Non Traded Inputs	Factor Remuneration	Excess Profits	Area (actual change)	New Area
1. LS Cotton	- 94,681	- 79,169	- 24,453	- 56,200	- 14,027	-181,000	189,000
2. MS Cotton	<u>- 40,537</u>	<u>- 31,864</u>	<u>- 10,384</u>	<u>- 24,115</u>	<u>- 6,037</u>	<u>- 69,000</u>	<u>71,000</u>
3. Sub-Total	-135,218	-111,035	- 34,837	- 80,315	- 20,064	-250,000	260,000
4. Groundnuts	141,775	17,950	15,525	47,175	79,075	250,000	500,000
5. NET: GAIN	6,557	- 93,083	- 19,312	- 33,140	59,011	-0-	

<sup>1/</sup> Above calculations are based upon valuing output and traded inputs at the US\$1.00 = LS 2.00 foreign exchange rate. See Table 1 for disaggregated traded input costs. Values for international value added non-traded inputs, factor remuneration excess profits are based upon Table 13.

### G. Applying Savings on Traded Inputs to Mechanized Sorghum Production

Table 13 shows that mechanized sorghum production in Gedaref is both financially profitable and under assumed cost-price relationships achieves the necessary export competitiveness.

What would happen if the foreign exchange savings on (imported) traded inputs realized from shifting 250,000 feddans out of cotton to groundnuts on the Gezira were at least in part allocated to Gedaref sorghum?

Given traded input requirements per feddan for Gedaref sorghum (LS 28.1 at the 2.0 exchange rate), LS 93.1 million would hypothetically permit an expansion of 3.3 million feddans ( $93,083 \div 28.1$ ). However, this is not possible for several reasons, not least of all because of a labor constraint.

However, we believe it is likely that an expansion of 280,000 feddans in Gedaref sorghum is possible. We have derived this estimate under the assumptions that the LS 8.8 million saved in labor resulting from shifting 250,000 feddans out of cotton and into irrigated sorghum on the Gezira could be transferred to Gedaref as seasonal migrant labor.<sup>1/</sup>

To make our calculations more realistic in the current situation we have adjusted the traded input requirements to reflect the open market foreign exchange rate (US\$1.00 = LS 2.35). Thus, the LS 28.1/feddan for traded inputs at the 2.0 rate has been increased to LS 33/feddan.

The following table shows under these assumptions what the costs and benefits would be if part of savings resulting from the cotton-groundnut shift were invested in Gedaref sorghum.

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<sup>1/</sup> Labor requirement for Gedaref sorghum is LS 30.4/feddan.  
LS 8,793,000  $\div$  LS 30.4 = 289,243 feddans.

Table 21 Net Gains and Losses From Shifting 250,000 Feddans Out of Cotton into Groundnuts on the Gezira Scheme and Expanding Gedaref Sorghum by 280,000 Feddan (in LS 1000)

	International Value Added	Traded Inputs	Non Traded Inputs	Factor Remuneration	Excess Profits
From Table 20	6,557	-93,083	-19,312	-33,140	59,011
Gedaref Sorghum Expansion	<u>25,564</u>	<u>9,240</u>	<u>4,200</u>	<u>12,376</u>	<u>8,988</u>
NET GAIN	32,121	-83,843	-15,112	-20,764	67,999

s a v i n g s

## II. Results

Table 21 shows that expanding Gedaref sorghum by 280,000 feddans under present technology and prices of traded inputs (valued at the US\$1.00 = LS 2.35 rate), would utilize only LS 9.2 million of LS 93.1 million saved in traded inputs resulting from a shift from cotton to groundnuts on the Gezira scheme.

Because of the substantially lower traded input requirement per feddan, the increase in international value added from this expansion of Gedaref sorghum is estimated to be LS 25.6 million pounds.

The combined results of the earlier described shift on the Gezira scheme and the expansion of Gedaref sorghum illustrates that savings in (1) traded inputs, (2) non-traded inputs, and (3) factor remunerations resulting from the partial shift away from cotton could be mobilized and reallocated to pay for the Gedaref expansion in sorghum (See Table 21 ). After these adjustments take place, the Bank of Sudan's foreign exchange requirements for imported traded inputs would be greatly reduced and if an exportable supply of sorghum can be achieved, Sudan's export earnings would also increase substantially.

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<sup>1/</sup> At a F.O.B. price of \$170/MT Gedaref sorghum achieves the necessary export competitiveness (See Table 16 ).

## I. Conclusion

Our analysis shows that on a per feddan basis, irrigated cotton earns, by a substantial margin, the least amount of foreign exchange per unit of foreign exchange invested in traded inputs.

The analysis shows that if the area devoted to irrigated cotton on the Gezira was reduced by 250,000 feddans (from 510,000 to 260,000) and if the area devoted to groundnuts were increased by the same amount, foreign exchange earnings would be increased by LS 6.6 million. Such a shift would reduce Sudan's imported input requirements by LS 93 million pounds. Savings in domestic resource costs would be LS 52 million pounds.

If the area devoted to mechanized sorghum production in the rainfed sector was expanded by 280,000 feddans only a relatively small proportion of the savings in imported inputs requirements (LS 9.2 million) and domestic resource costs (LS 16.6 million) resulting from the cotton shift would be required. The international value added that would result from an expansion in sorghum production is estimated to be about LS 25 million.

The combined results of equally reducing the area (250,000 feddans) devoted to cotton and increasing the area devoted to groundnuts in the Gezira scheme and increasing the area devoted to mechanized rainfed sorghum production would result in an estimated total increase in international value added of about LS 32 million. The net reduction in imported input requirements would be about LS 83 million.