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RE-PRICING OF GASOIL AND ITS EFFECTS ON AGRICULTURE

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1. INTRODUCTION AND SUMMARY

The current acute shortage of gasoil and the soaring black market price emphasizes the critical dependence of Sudanese agriculture on gasoil. Farmers who require gasoil for planting, irrigation, cultivation, harvesting and marketing have been forced to pay as much as five times the administered price.

Although the current situation is extreme, the consequences of shortages and the black market have become increasingly apparent for the last year. At the root of the problem is a lack of foreign exchange with which to satisfy the gasoil demand at the current subsidized price. Gasoil is so heavily subsidized that the real value of revenue from 100 gallons of gasoil sales is sufficient to purchase only about 60 replacement gallons.

In money terms, the nominal subsidy on gasoil last year was in excess of £S 130 millions, net of tax revenues and profits to the General Petroleum Corporation. This figure assumes that Sudanese purchases were at competitive spot market prices, which they were not. If the extra costs of special financing arrangements are eliminated, it is estimated that a further $ 40 to $ 60 millions may be saved.

The true costs of Sudan's present subsidy on gasoil are not confined to the nominal value of the subsidy. Black market premiums estimated to be in the range of 50 to 150 percent have become a regular feature of the private sector's planning process. Businessmen who must go to the black market for gasoil supplies to keep their factories and trucks running at acceptable capacity have been forced to spend time appealing for increased allocations and for permission to increase their product and service prices. Those who have been unable to pass along the cost of black market gasoil have seen their profit margins shrink and their output levels decline. In a "supply constrained" economy, reduced output and idle capacity contribute to higher consumer prices, lower output, reduced rates of domestic capital formation and an increasingly overvalued pound.

Farmers who are uncertain as to their ability to receive an assured allocation of gasoil must resort to the black market or reduce their production, or both. The net losses due to inadequate supply (exclusive of losses due to the need to pay black

market prices) have been estimated to be over £S 100 millions for the agricultural sector in 1983. There were additional losses due to interruptions in marketing, as well.

A domestic pricing policy which subsidizes gasoil unnecessarily and requires an administrative allocation system which generates an inevitable black market, is a policy which does not address the needs of gasoil security. Gasoil security and the exploitation of Sudan's comparative advantage in food, fiber and oilseed production requires that gasoil users pay the real cost of the product they use.

The private agricultural sector and most of the transport sector must pay black market prices for part of the gasoil they use. It is a credit to the basic economic viability of the private sector that it is able to pay the high black market prices. When black market gasoil in the central region sells for £S 200 per barrel, the buyer is, in effect, paying a price which would justify the import of gasoil at an exchange rate of £S 3.80/$.

The Government's Petroleum Facility will greatly improve Sudan's capacity to import more for less. This is an important short run solution and it constitutes one leg of a long run response to gasoil security. A second, critical support on which any lasting solution must rest is the re-pricing of gasoil to reflect true import parity. Taxes may be required in addition to a pricing system based on import parity, depending on the exchange rate used.

This paper is intended to provide policymakers with a better understanding of the gasoil "problem" and with estimates of the impact which import parity pricing will have on the agricultural sector. Independent estimates of the cost of supply interruptions have been made. We do not address that issue here.

Our principal findings are as follows:

1) Increases in the farm gate prices of agricultural commodities which would be required to compensate for an increase of the gasoil price by as much as £S 1.00 per gallon will be modest for most commodities. (see Table 1)

2) If marketing costs increase at all, the increase will be trivial in terms of the market value. (see Table 3)

3) If the greater part of the net increase in petroleum import capacity arising from the establishment of the Petroleum Facility is devoted to gasoil, and if the administered price is brought up to an import parity price, demand can probably be satisfied; although government should stand ready to impose additional taxes to insure that a black market does not reappear.

4) Satisfaction of gasoil demand at an administered price reflecting full import parity will destroy the black market and eliminate the need for an administrative allocation system. As a consequence, the private sector will enjoy a new measure of fuel security at prices below the black market price which has prevailed over the last few years.

Black markets fill important roles in developing economies. In the case of gasoil in Sudan, the black market has effectively redirected supplies from low value-in-use activities to higher value-in-use activities. In doing so, it has increased the total value added by gasoil. The black market has sent clear signals to the effect that consumer soverignty generates an ultimate allocation across regions and products which is different than that seen as optimal by the officials who make administrative allocation decisions.

2. THE PROBLEM AND A SOLUTION

The fundamental problem facing all gasoil users in Sudan is an inadequate supply at the administered price. This situation has arisen because of limited foreign exchange allocated to petroleum imports and an artificially low administered price at which the demand for gasoil substantially exceeds supply. This has led, in turn, to an imperfect administrative allocation of available supplies among regions and alternative uses and to the growth of a secondary ("black") market.

Non-price rationing of foreign exchange is inevitable as long as the pound is over-valued. However, there are feasible reforms in the domestic pricing of gasoil which will permit an increase in supply, drive the black market out of existence and allow Sudan to abandon a cumbersome, inefficient and controversial non-price gasoil allocation system.

For the policymaker the relevant question is: What are the likely impacts of such reforms on the agricultural sector?

2.1 Supply and Demand Analysis

The present administered price of gasoil is such that demand exceeds the supply which government has been able to make available. Figure 1 is an illustration of the problem.

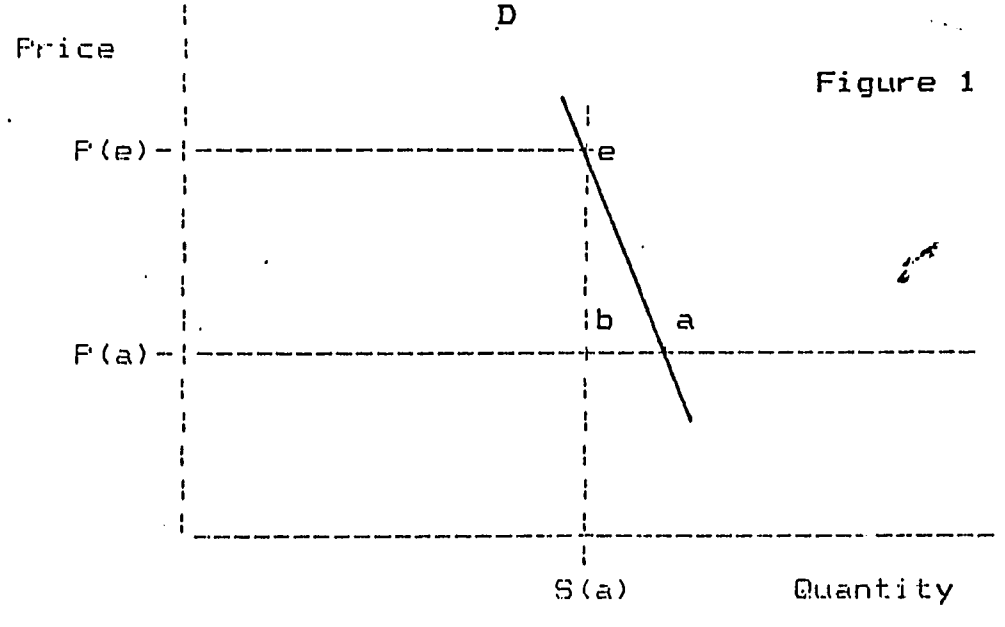

Figure 1

At the administered price P(a), the quantity demanded exceeds the quantity supplied by an amount represented by the line segment **ba.** The quantity supplied is represented as a fixed quantity, determined effectively by world oil prices and the amount of foreign exchange allocated to gasoil imports.

The existence of an excess demand gives rise to an administrative allocation system which is intended to direct the limited supplies to priority uses and locations. Excess demand also provides the economic basis for a secondary ("black") market which tends to clear at the equilibrium price P(e). The black market premium is represented by the line segment **eb**.

In the context of the simplified framework of Figure 1 it is clear that if the administered price of gasoil were increased to P(e), the black market premium would disappear and there would be no need for an allocation system because, at P(e) supply would equal demand. Policymakers are right to be concerned about the impact of this potential price increase on cost of production of key agricultural commodities (including the competitiveness of Sudan's agricultural exports). Much of the rest of this paper is taken up in economic reasoning and the presentation of data which suggest that the impact will be much smaller and more easily accomodated by the national economy than many have thought possible.

An appropriate increase in the administered price of gasoil actually holds the potential to improve gasoil supply and reduce the real supply price to many consumers.

2.2 Increasing Both the Price and the Supply

The fundamental problem of gasoil supply is that the economic or real value of gasoil sales revenue is inadequate to replace the product supplied to the market. **The simplest and most efficient solution to this problem is to supply gasoil to consumers at its replacement or import parity price.** This solution requires that revenue generated by the sale of gasoil (net of distribution costs) be sufficient to replace the quantity of gasoil sold, and that there be enough foreign exchange to satisfy demand.

The Petroleum Facility has been established to break this bottle neck in the short run and to place the petroleum using sector on what will ultimtely become a self-financing basis. The Petroleum Facility envisions a situation in which the petroleum importing sector will be able to acquire foreign exchange at a prevailing commercial bank rate which will not be substantially different from the economic value of the pound. Sudan will then price petroleum products at their import parity prices (based on the commercial bank rate of exchange), plus such domestic taxes as may be judged necessary. The Bank of Sudan and foreign donors will make available a quantity of foreign exchange which is judged to be adequate to satisfy petroleum product demand in general and gasoil demand in particular.

Figure 2 is an extension of Figure 1. The (self-financing) import parity price of gasoil has been added and identified as P(i). At this price, the petroleum importing sector will face no foreign exchange problems and will be able to import the market clearing amount S(i), assuming that the Petroleum Facility is adequately funded. Excess demand--and thus the black market premium and the black market itself--will disappear. **The equilibrium price will fall from P(e) to P(i) and the total gasoil supply will increase from S(a) to S(i)!**

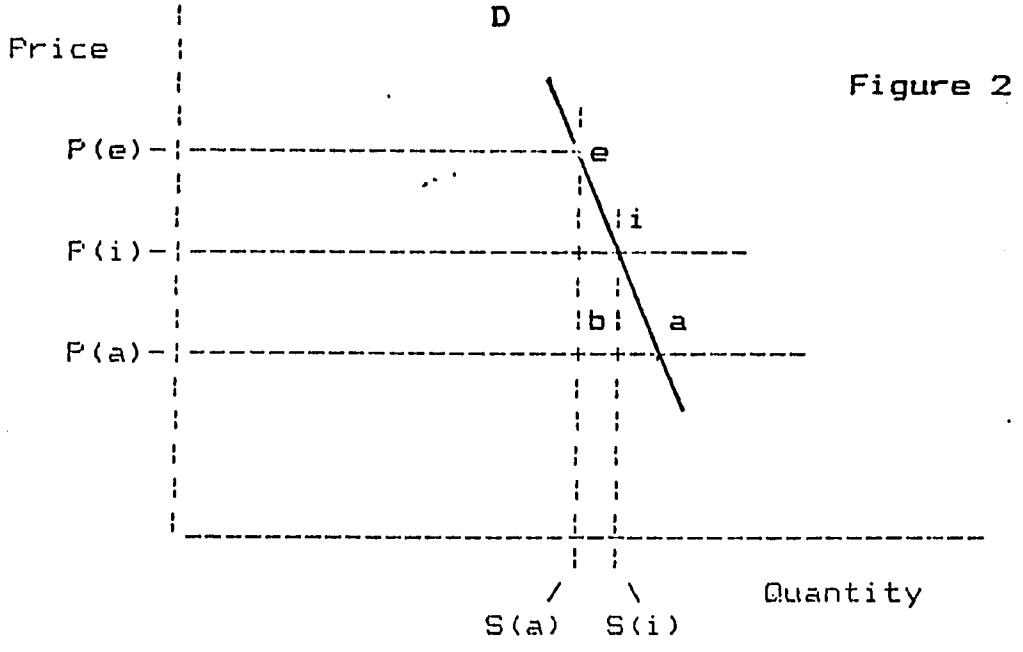

Figure 2

Under these conditions, the administrative allocation system will be redundant because imports will be able to satisfy market demand at the (self-financing) import parity price. In part, the former black market profit will accure to the Petroleum Facility and will contribute to the importation of more gasoil. It will also improve over-all economic efficiency. **For this to happen, however, it is essential that enough foreign exchange be available to satisfy the market demand for gasoil at the higher import parity price.**

Government's immediate problem is to determine the correct import parity price of gasoil. Annex I reports the Port Sudan, ex-depot price changes for gasoil which are implied by selected commercial bank exchange rates.

Using Table I-A (in Annex I) and assuming that government wishes to preserve its current nominal tax revenue and the net revenue or profits of the GPC on a per unit of gasoil basis (line 2b of Annex Table I-A), the current commercial bank exchange rate of £S 1.80/$ implies the necessity of an increase of about 29 percent in the Port Sudan ex-depot gasoil price. At an exchange rate of £S 2.00/$ an increase of about 41 percent would be required. A

shift to an exchange rate of £S 2.20/$ implies an increase of about 52 percent in the Port Sudan ex-depot price.

Data presented in Section 3 suggest that even if such increases in the gasoil price were fully reflected in increased costs of production, they could be compensated for by small increases in commodity prices. However, the prices of those commodities which depend heavily on black market gasoil may be expected to fall as a consequence of the elimination of the black market.

If the Petroleum Facility is to be effective in placing the petroleum import sector on a self-financing basis and in eliminating the black market, government must allow importers to supply as much as is required to meet user demand at the higher import parity price. If importers are not allowed to satisfy demand at the new higher price, the present allocation system will continue to be required and the black market will continue to flourish.

Once the petroleum import sector is placed on a self-financing basis, the cost of importing too little gasoil will be a return to an administrative allocation system and a black market. The costs of importing five percent too much--perhaps two million dollars per year in interest charges, plus storage-- will be small in comparison with the costs of importing five percent too little.

The black market price over the last year (exclusive of the July-August supply hiatus) is reported to have been in the range of £S 100 to £S 150 a barrel above the administered price. On a per gallon basis this is £S 2.30 to £S 3.40 more than the administered price.

Translating this (using data from Annex I) into the implied price paid for foreign exchange, it means that black market gasoil at £S 200/bbl had a foreign exchange value of about £S 3.80/$ at a CIF price of $265/MT. That is, at a black market price of £S 200/bbl, it would have been profitabable for individuals to pay up to £S 3.80/$ for foreign exchange to import gasoil priced at $265/MT CIF. For a black market price of £S 250/bbl the implicit foreign exchange rate would be £S 4.95/$.

To appreciate fully the economic impact of an import parity based domestic price for gasoil on agriculture, it is necessary to understand the relationship between the allocation system and the black market and the relationship between the black market price and the cost of production of agricultural commodities.

2.3 The Allocation System and the Black Market

Road transport and agricultural production are estimated to account for about three-quarters of Sudan's total gasoil consumption. Much of the road transportation is related directly or indirectly to agriculture. It is inherent to the agriculture and

transport sectors that gasoil requirements of individual users can not be accurately predicted by the managers of the gasoil allocation system. No government however diligent could hope to match individual gasoil allocations to individual needs. The outcome of such an inevitably imperfect administrative allocation system is an equally inevitable black market.

2.4 The Black Market Price and Cost of Production

Annex II explains how the secondary or black market works with respect to private sector decisions about the use of gasoil. Essentially the conclusions of Annex II are:

A) Because the allocation system is (inevitably) imperfect, almost every private sector gasoil user receives either more or less than his requirements.

B) A black market exists because individuals with needs in excess of their allocations have no alternative but to forgo profitable production activities or purchase gasoil from individuals with excess allocations, at a higher price.

C) There is a restricted sense in which the "cost of production" of a gasoil-using firm is determined by the (quantity weighted) average of the administered and black market prices of gasoil. This is an ex post or accounting sense, only. It is not the concept which rational businessmen or farmers use in making their production decisions.

D) Because the black market exists, those who have surplus allocations will value gasoil in their own production decisions as if it were priced on the black market. [If gasoil used in production has a net value-in-use of £S 150/bbl when the black market price is £S 200/bbl, the rational farmer or businessman will perceive that it is more profitable to sell some or all of his allocation than to use it in production.]

E) Those who must purchase from the black market because their allocations are inadequate also make their production decisions on the basis of the black market price; and in making those decisions, they will not distinguish between the gasoil they purchased at the administered price and that purchased at the black market price. Rational businessmen and farmers will make their decisions on the basis of their opportunity cost--in this case the black market price--not on the basis of an average of the administered and black market prices.

F) Those individuals or firms who are net sellers to the black market enjoy a special source of (unearned) income associated with their privileged supply position. The unearned income arises because producers make their production decisions on the basis of the black market price and sell gasoil which will not return to them as much in production as

it will in the black market. Further, it is unearned because it is unnecessary. It will make no difference in their production decisions whether they acquired their gasoil at the administered or the black market price. They will behave as if they purchased it at the black market price.*

6) Direct effects of the black market on the cost of production in the agricultural corporations are minimal. In Gezira, for example, fuel-using activities are either performed directly by the corporation or are contracted to the private sector at negotiated rates which include a guarantee of access to fuel at the administered price.

2.5 The Problem of "Midnight" Exports

The extent of (unauthorized) trade with Ethopia and Chad is not well understood. If Sudanese gasoil were fully available in border areas at the present (subsidized) administered price, it is likely that it would be exported, unless gasoil at comparable points in Chad and Ethopia is even more heavily subsidized. However, at current black market prices, Sudanese gasoil at boarder points costs far more than its import parity price.

If Sudanese gasoil becomes fully available at border points at its true import parity price, it is quite possible that it will be smuggled out of Sudan. This would create no net hardship for Sudan, as smuggled exports of gasoil would return to the Petroleum Facility enough pounds to replace the gasoil at no real net cost to the Sudanese economy. However, if the Sudanese price is below the true import parity price, Sudan will effectively subsidize gasoil use to its neighbours.

2.6 Using Taxes to Correct for an Over-Valued Pound

A lasting and efficient solution to the gasoil supply problem lies in the establishment of the correct import parity price and an arrangement whereby the Petroleum Facility can acquire enough foreign exchange to satisfy the market demand at the import parity price.

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* There are two exceptions to this conclusion. First, if price controls are effective, consumers may enjoy part of the lower cost of administered price gasoil. However, price controls seldom achieve their intended objectives. The result is usually scarcity which gives rise to final product black markets, or suboptimal production. Second, the full difference between the allocated price and the black market price does not represent a profit to the seller of an official allocation. There are transactions costs which accrue to the seller or to specialized black market middlemen. For more about transactions costs, see Annex II.

The Petroleum Facility specifies that the import parity price will be based on the existing commercial bank foreign exchange rate. This is a convenient peg on which to hang the import parity price, but the present commercial bank rate is not sufficiently close to the true economic value of the pound to fulfill the intended objectives of generating a self-financing gasoil price.

If the price of gasoil were increased to reflect the present commercial bank rate, it would mean a price increase of about 50 Pt per gallon. A more realistic figure for the economic value of the pound would be at least £S 2.00/$ and probably much closer to £S 2.20/$. This implies that the price of gasoil would increase by 70 to 90 Pt per imperial gallon. Government can easily correct for the effects of an overvalued pound in this case by imposing additional taxes of 20 to 40 Pt per gallon.

2.7 Providing for Price Stability and Supply Security

There are strong economic arguments in favor of government intervention to insure that gasoil users are able to depend on buying gasoil at a known price at any time in the future. Price stability can serve an important role in economic efficiency in that it allows gasoil users to make production decisions efficiently.

Price stability, however, will become a reality only if gasoil users can be assured that their individual needs will be met at that price. At present, private sector gasoil users must make their production plans on the basis of a volatile and excessive black market price. Even the public sector agricultural corporations which enjoy priority access to gasoil at the administered price have been known to be unable to acquire gasoil in a timely manner.

Price stability and supply security are closely linked. Without supply security there can be no effective price stability for gasoil users. If the domestic gasoil pricing structure--working together with the Petroleum Facility--does not return adequate revenues to replace gasoil consumed at the administered price, there will be neither security of supply nor stability of price.

The Petroleum Facility will increase the total amount of petroleum which Sudan can import because it will enable imports to be more competitively purchased. It is estimated that total petroleum imports can increase by about 17 percent due to the Petroleum Facility. If the entire additional value of the Facility is directed to gasoil imports, total gasoil availability can increase by as much as 30 percent.

In Section 3.3 we estimate the increase in the price of gasoil necessitated by different exchange rates and tax regimes. In Annex V we provide a framework for estimating the amount of additional gasoil required to satisfy market demand at different prices. It is our best professional judgement that if the full

weight of the Petroleum Facility is thrown behind the import of gasoil at a true import parity price, gasoil users will be assured of adequate supplies and the elimination of both the black market and the administrative allocation system.

If the import parity price based on the commercial bank rate is too low, the additional gasoil purchased through the Petroleum Facility will not be able to satisfy demand. Government should thus stand ready to impose additional taxes on gasoil in order to be assured that the demand is satisfied. Our analysis indicates that agriculture will not be seriously disadvantaged if taxes are required to balance demand against the supply which the Petroleum Facility can provide.

If required, these taxes will contribute to recovery and growth by contributing to supply security and price stability; they will also contribute to general revenues.

3. ESTIMATED EFFECTS OF A GASOIL PRICE INCREASE

This section presents estimates of the probable effects of an increase in the gasoil price on the main sub-sectors of the agricultural sector.

3.1 Methodology

The methodology for estimating an increase in the cost of production due to an increase in the gasoil price to producers is detailed in Annex IV. The first step in the process was to estimate gasoil use per feddan for major crops. Second, these data were converted into gasoil consumption per metric ton of agricultural product. Third, using current farm gate prices, we estimated the amount that farm gate prices would have to increase to cover selected increases in the gasoil price paid by producers.

Data from Annexes I and III are used in Section 3.3 to estimate the likely increases required in regional gasoil prices at different exchange rates. Assuming that demand can be fully satisfied at those prices, estimates are derived for the potential decline in the effective private sector gasoil price.

3.2 Estimated Increase in Cost of Agricultural Production per Ton for Selected Increases in the Gasoil Price

Table 1 is constructed from data presented in Annex IV. It reports the increase in the cost of production (per metric ton) which are estimated to arise from selected increases in the actual cost of gasoil to agricultural producers.

To measure the maximum direct impact of an increase in the administered price of gasoil, use the data presented on the right side of Table 1. These figures are estimates of the increase in the 1983/84 producer prices which would be required to cover the additional production costs in the event that increases in the administered price have their full direct impact on agricultural production costs. These maximum impacts will be fully felt on the agricultural corporations where the effective gasoil price is the administered price. The impacts will be less in the private sector because the new administered price of gasoil will be less than the present black market price.

Table 1: Estimated Maximum Effects of Gasoil Price Increases on Cost of Agricultural Production and Percentage Increases in Producer Prices to Cover Increased Costs

Crop/Sector	Increase in Cost of Production in £S per Metric Ton if Gasoil Price (in £S/IG)				Implied Compensatory Percentage Increase in Farm Gate Prices if Gasoil Price (in £S/IG			
	Increases by:				Increases by:			
	.50	.70	.90	1.00	.50	.70	.90	1.00
Dura								
-Gezira	2.5	3.5	4.5	5.0	1.1	1.5	2.0	2.2
-pump schemes	11.1	15.6	20.0	22.3	5.0	6.9	8.9	9.9
-rainfed, mech.	4.1	5.8	7.4	8.2	1.8	2.6	3.3	3.7
-rainfed, trad.	---	---	---	---	---	---	---	---
Sesame								
-mechanized	9.7	13.5	17.1	19.4	1.7	2.3	3.0	3.3
-traditional	---	---	---	---	---	---	---	---
Wheat								
-Gezira	2.5	3.5	4.6	5.1	0.7	1.0	1.3	1.
-New Halfa	2.7	3.8	4.9	5.5	0.8	1.1	1.4	1.
-Zeidab	7.3	10.2	13.2	14.6	1.6	2.3	2.9	3.
-Northern trad.	7.1	9.9	12.7	14.1	1.4	2.0	2.5	2.
Cotton								
-Gezira, LS	11.2	15.7	20.2	22.5	1.5	2.1	2.7	3.
-Gezira, MS	8.2	11.5	14.8	16.4	1.4	2.0	2.6	2.
-pump schemes, LS	27.0	37.8	48.5	53.9	3.6	5.0	6.4	7.
-pump schemes, MS	18.1	25.3	32.6	36.2	3.1	4.4	5.6	6.
Ground Nut								
-Gezira	0.9	1.3	1.6	1.8	0.2	0.2	0.3	0.
-pump schemes	7.0	9.8	12.5	13.9	1.3	1.8	2.3	2.
-rainfed trad.	---	---	---	---	---	---	---	---
Sugar (Gunied)	17.5	24.5	31.5	35.0	1.4	2.0	2.5	2.
Implied Exchange Rate Corresponding to Price Increase	1.80	2.00	2.20	2.30				

[Note: Crops produced by the traditional sector assumed to use no gasoil in direct production activities. Gasoil used in marketing is discussed below. Figures for sugar are for finished product, ex-factory.

For exchange rates or price increases other than those specified, linear interpolation is appropriate.

Source: See Annex IV]

At present, only the agricultural corporations are assured of obtaining all of their gasoil needs at the administered price. Thus an increase in the cost of production due to an increase in the administered gasoil price will be fully felt by the agricultural corporations.

Those in the private sector who now receive gasoil at the administered price will sustain a decrease in net income due to the increase in price. However, they are not expected to reduce their production because they would have been making their production decisions on the basis of the black market price of gasoil, not the administered price. **In fact, gasoil using private sector farmers will begin to make production decisions on the basis of an import parity price which will be less than the previous black market price.** These decisions will be in the direction of increased utilization of capacity and movement toward more efficient utilization of all resources.

The additional costs associated with marketing are identified in Section 3.4.

3.3 Estimated Increase in Gasoil Price

The actual increase in the administered gasoil price will depend on the CIF price of gasoil, the exchange rate used, the extent of taxes levied and the cost of internal transportation of gasoil. The Petroleum Facility will reduce the effective CIF price by eliminating the need for costly credit arrangements. This will permit Sudan to increase total petroleum imports by an estimated 17 percent. If earmarked exclusively for gasoil imports, the total gasoil availability could increase by 30 percent.

The average CIF price for gasoil over the last six months has been $265/MT. There has been a very recent drop to $230/MT, but opinion varies as to the likelihood that this decline will last for any significant period. It is reported to be attributable to a temporary product glut.

At $265/MT CIF, the price per imperial gallon is $ .9884. For all practical considerations, then, the price of gasoil will increase by 10 Pt per gallon for each 10 Pt increase in the £S/$ exchange rate. Assuming that domestic handling and distribution costs remain unchanged, this relationship translates directly to depot prices.

Table 2 reports the approximate current administered regional price structure and the percentage increases which would occur under alternative increases in the Port Sudan Ex-Depot price. The commercial bank exchange rate which would result in each of these increases is spcified at the bottom of the table.

Table 2: Current Administered Gasoil Prices at Selected Locations and Percentage Increases for Different Price Increases

Location	Current Admin. Price £S/IG	Percentage Increase in Price If Port Sudan Ex-Depot Price Increase is: £S.50/IG	£S.70/IG	£S.90/IG	£S1.00/IG
Port Sudan	1.70	29	41	53	59
Atbara	1.93	26	36	47	52
Khartoum	2.08	24	34	43	48
Kassala	1.96	26	36	46	51
Gedaref	2.07	24	34	43	48
Wad Medani	2.15	23	33	42	47
Kosti	2.24	22	31	40	45
Renk (via Kosti)	2.49*	20	28	36	40
Dongola					
Karima + road	2.26*	22	31	40	44
El Obeid					
rail	2.41	21	29	37	41
Kosti + road	2.67*	19	26	34	37
Khartoum + road	2.64*	19	27	34	38
Nyala					
rail	2.71	18	26	33	37
Kosti + road	3.73*	13	19	24	27
Khartoum + road	3.61*	14	19	25	28
Implied Exchange Rate Corresponding Price Increase:		1.80	2.00	2.20	2.30

[* Estimated on basis of lorry hauling costs from rail or pipe head.
Source: See memorandum of 5th December 1983 from the State Minister of Energy and Mining.]

3.4 Marketing Costs

The effects of an increase in the administered price of gasoil on marketing costs are difficult to estimate in general because we do not have useful estimates of the average distance over which different commodities are transported to markets. Gezira dura, for example, is mostly consumed by the tenants. Under normal conditions, dura from the mechanized rainfed sector may travel hundreds of kilometers. Almost all cotton is transported to Port Sudan, but about two thirds of the weight of seed cotton is transported only short distances to oil mills. Part of the oilseed production of Kordofan and Darfur travels only a few hundred kilometers; and, part travels as much as 2000 kilometers to Port Sudan.

Table 3: Representative Increase in Marketing Costs due to Increases in Gasoil Prices and the Percentage Increase in the Port Sudan Price Required to Cover the Additional Cost

Example	Gasoil Consumed in IG/MT	Value of Crop in £S/MT	Implied Percentage Increase in Export Price to Compensate for Increase in Gasoil Price if Gasoil Price Increase is:			
			£S.50/IG	£S.70/IG	£S.90/IG	£S1.00/IG
A	12.5	820	.76	1.07	1.37	1.53
B	5.9	2220	.13	.19	.24	.27
C	6.1	1225	.25	.35	.45	.50
D	1.8	215	.42	.59	.75	.84
E	8.8	1300	.34	.47	.61	.68
Implied Exchange Rate Corresponding to Price Increase			1.80	2.00	2.20	2.30

[Example A: El Obeid to Port Sudan, Groundnuts
Example B: Wad Medani to Port Sudan, Cotton
Example C: Nyala to Port Sudan (by Rail) Gum Arabic
Example D: Gedaref to Port Sudan, Dura
Example E: Dongola to Khartoum, Broadbeans

Notes: Distances and fuel consumption per MT/km as per Annex III. Cotton valued Port Sudan at $.65/lb, converted to £S using 50/50 (official/bank) exchange rates. Gum Arabic price courtesy of GAC. Groundnut price $ 575/MT, Port Sudan converted at 73/25 (official/bank) rates.]

It is clear from Table 3 that increases of up to £S 1.00 per gallon in the gasoil price will have no substantial effect on marketing costs. Even if the figures in Table 2 are increased by a factor of four, the increases are not substantial. Further, the figures in Table 3 assume that trucking costs will actually increase as the result of an increase in the administered price of gasoil. In Table 4 we have estimated the extent to which gasoil prices in Western and Northern Sudan might be expected to decline as a result of eliminating the black market by satisfying demand at higher administered prices.

3.5 Costs that May Decline

Throughout this paper we have argued that the black market price of gasoil is the relevant decision-making price for the private sector. Although this argument must be qualified in the case of

final products and services which are subject to effective price control, it can not be discounted in the case of most private sector agriculture and dirt road transport.

In this section we estimate the benefits of gasoil pricing reform on the assumption that increases in the administered price will be accompanied by a full satisfaction of demand at the new prices. The magnitude of these benefits depend on the present black market price structure. In the current environment, an accurate estimate of black market premiums is difficult to make. We have been obliged to rely on the estimate of the Khartoum black market premium of £S 100 to £S 150/bbl above the administered price.

Table 4 is an estimate of how much the private sector decision making price would decline if increases in the administered gasoil price were to eliminate the black market. The figures in the body of Table 4 are based on a Khartoum black market premium of £S 100/bbl. They can be easily re-estimated for different premiums by simple proportional scaling.

Table 4: Estimated Changes in Marginal Private Sector Gasoil Prices if Gasoil Pricing Reform Eliminates the Blac Market. (Changes are in £S per gallon assuming a Khartoum Black Market Premium of £S 100/barrel)

Location	Change in Private Sector Gasoil Decision-Making Price I Increase in Administered Gasoil Price is:			
	£S.50/IG	£S.70/IG	£S.90/IG	£S1.00/IG
Khartoum	- 1.77	- 1.57	- 1.37	- 1.27
El Obeid	- 2.82	- 2.62	- 2.42	- 2.32
Nyala	- 3.72	- 3.52	- 3.32	- 3.22
Dongola	- 3.32	- 3.12	- 2.92	- 2.82

[Notes: Assumes that Khartoum is the present source of black market gasoil for these points and that transport is by lorry at £S .35/MT/km over dirt roads. Road distances given in Annex III. Assumes 20 percent risk premium black market acquisition cost plus transportation cost, except for Khartoum. Figures in body of table are for the present administered price (see col. 1, Table 2), adjusted upward for indicated increase in administered price. To find the change for a Khartoum based black market premium of £S 50/bbl, divide by 2; for £S 150/bbl, multiply by 1.5 etc.]

The National Energy Administration estimates fuel consumption at 60 grams (.016 IG) per ton per kilometer for lorries on dirt roads. At this rate, a decline of £S 1.00 per gallon in the cost

of gasoil to dirt road truckers means a reduction of £S 1.60 per ton per hundred kilometers. If gasoil prices paid by private haulers in Dongola were to decline by only £S 2.00 per gallon, this would translate into a reduction in the cost of transporting broadbeans to Khartoum of £S 17.40/MT. Given the strong demand for broadbeans, most of the cost savings would accrue to Dongola farmers, where it would encourage an increase in production with eventual beneficial effects to consumers.

A decline in gasoil prices would be especially beneficial to cooperatives and small private farmers in the Northern Region. Using data presented in Table IV-1, a decline of £S 2.00 in the gasoil price at Dongola would reduce production costs by as much as £S 28 per ton of wheat. The same figure would hold for broadbeans. Even more important to farmers with private pumpsets would be supply security.

3.6 How Much More Gasoil Will Be Required?

Annex V provides a framework for estimating the increased amount of gasoil required (in percentage terms over 1983/84) in order to completely satisfy demand at alternative prices. This is not a simple issue. **Based on the analysis of Annex V, we believe that it is quite possible to break the black market and scrap the administrative allocation system if gasoil is priced at an implied exchange rate of £S 2.20/$.** This may require that the entire added import capacity of the Petroleum Facility be held ready to supply gasoil at the implied price. If gasoil is priced on the basis of a £S 2.20/$ exchange rate--or a £S 1.80/$ rate plus 40 PT per gallon in taxes--we estimate that demand will be fully satisfied by an increase in supply of between 10 and 25 percent.

The data on which these estimates have been prepared is limited. Further, there may be a substantial demand by the private sectors arising from the need to re-build inventories. Government should monitor the increase in demand very carefully and should stand ready to increase the tax rate if demand appears to exceed 25 percent. Increased taxes will discourage hoarding and send a clear signal to the private sector that government intends to insure an adequate supply at an efficient price.

3.7 Conclusions

In sum, the maximum likely increase in the cost of agricultural production arising from the establishment of import parity prices for gasoil will be managable. The agricultural corporations--especially the pump schemes--will be most seriously affected. Producer prices for cotton produced on pump schemes will have to increase, but by less than ten percent.

Even if the new administered prices for gasoil are passed fully to the private sector, the impacts will be small.

It appears to be within the scope of the Petroleum Facility to accomodate the increase in gasoil demand which may be reasonably expected if the administrative allocation system is scrapped and the price is increased to reflect a realistic foreign exchange rate. Government should stand ready, however, to impose additional taxes on gasoil in order to insure that the quantity demanded by the private sector does not exceed the quantity which the Petroleum Facility is capable of supplying.

We have not attempted an independent assessment of benefits which may be expected as a result of certainty of supply which would follow the elimination of the administrative allocation system.* There would also be a budgetary saving to government from the elimination of the administrative allocation system.

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*See Mekki, Rashid. "Disrupted Energy Supplies in Agriculture", NEA Energy News, March 1984. Mekki estimates a net loss to agriculture of over £S 130 millions in 1983. Mekki's estimates may be a bit high as he appears to have netted out the value of energy not used at administered rather than economic prices. We believe a realistic re-evaluation would show losses of only about £S 100 millions. On the other hand Mekki does not attempt to estimate losses due to idle capital, sub-optimal cropping patterns, idle labor or spoilage of crops due to disrupted energy supplies. In the Northern Province, we are aware of extensive areas which are reported to be idle because of uncertain gasoil supply.

ANNEX I: EFFECTIVE TAXATION, SUBSIDIES AND CHANGES IN THE PORT SUDAN EX-DEPOT PRICE REQUIRED TO GENERATE IMPORT PARITY PRICES AT ALTERNATIVE EXCHANGE RATES

The purpose of these calculations is to determine the import parity price of gasoil based on alternative assumptions about the exchange rate and the CIF price of gasoil.

The choice of an appropriate exchange rate is not a trivial matter. Inherent in the concept of an import parity price is the availability of the commodity in question, at the import parity price. The appropriate exchange rate is that rate at which the GFC can buy all the foreign exchange it need to purchase all the gasoil it can sell at the import parity. This is clearly not the case at £S 1.30/$.

TABLE I-A: Approximate Gasoil Cost, Effective Taxes and Subsidies Ex-Depot Port Sudan if CIF Price is $ 265/MT

	Exchange Rate in £S/$					
	1.30	1.80	2.00	2.10	2.20	2.30
1) Economic Costs/MT						
a) CIF @ $265/MT	£S 344.50	477.00	530.00	556.60	583.00	609.50
b) Domestic costs(a)	£S 41.53	41.53	41.53	41.53	41.53	41.53
c) Total	£S 386.03	518.53	571.53	598.03	624.53	651.03
2) GFC Ex-Depot(Port Sudan)						
a) Current price	£S 455.61					
b) Current effective tax (b)	£S69.58 (at CIF = $265/MT and current price (2a))					
3) Implicit Tax or Subsidy Ex-Depot Port Sudan per MT (per IG)						
a) At zero effective tax (c)						
i) per MT	£S 69.58	62.92	115.92	142.42	168.92	195.42
ii) per IG	.260	.235	.432	.531	.630	.729
iii) % change required (d)	- 15.3	+ 13.8	+ 25.4	+ 31.3	+ 37.1	+ 42.9
b) At current effective tax (e)						
i) per MT	£S 0	132.50	185.50	212.00	243.50	265.00
ii) per IG	0	.494	.692	.791	.891	.988
iii) % change required (d)	0	+ 29.1	+ 40.7	+ 46.5	+ 52.3	+ 58.2

Notes following Table I-B

TABLE I-B: Approximate Gasoil Cost, Effective Taxes and Subsidies Ex-Depot Port Sudan if CIF Price is $ 230/MT

		Exchange Rate in £S/$					
		1.30	1.80	2.00	2.10	2.20	2.30
1) Economic Costs/MT							
a) CIF @ $230/MT	£S	299.00	441.00	460.00	483.00	506.00	529.00
b) Domestic costs(a)	£S	41.53	41.53	41.53	41.53	41.53	41.53
c) Total	£S	340.53	455.53	501.53	524.53	547.53	570.53
2) GPC Ex-Depot Price							
a) Current price	£S	455.61					
b) Current effective tax(b)		115.08 (at CIF = $230/MT and current price (2a))					
3) Implicit Tax or Subsidy Ex-Depot Port Sudan per MT (per IG)							
a) At zero effective tax (c)							
i) per MT	£S	115.08	.08	45.92	68.92	91.22	114.20
ii) per IG		.429	0	.171	.257	.343	.429
iii) % change required (d)		- 25.3	0	+ 10.1	+ 15.1	+ 20.2	+ 25.2
b) At current effective tax (e)							
i) per MT		0	115.00	161.00	184.00	207.00	230.00
ii) per IG		0	.429	.601	.686	.772	.958
iii) % change required (d)		0	+ 25.2	+ 35.3	+ 40.4	+ 45.5	+ 50.5
c) At effective tax=69.58 (f) (from CIF = $265 and current price (2a))							
i) per MT	£S	45.50	69.50	115.50	138.50	161.50	184.50
ii) per IG		.170	.259	.431	.517	.602	.688
iii) % change required		- 10.0	+ 15.3	+ 25.4	+ 30.4	+ 35.4	+ 40.5

(a) Quay costs for unloading tankers given by GPC as £S 2.258/MT and apparently represent an historic cost which is assumed not to cover depreciation on facilities at current replacement cost. Accordingly, the cost is increased arbitrarily to £S 9.00/MT. Quay fees are assessed on the basis of a fraction of an arbitraty customs index cost. Since there is no economic reason for them to vary according to the CIF value, no variation is allowed over different CIF costs.

Administrative costs of the GPC are reported to be £S 8.3/MT. No reason was seen to vary these costs over different CIF costs.

Distribution costs, including profits for the distribution companies given by GPC as £S 16.63/MT. If distribution companies pay GPC for product at Port Sudan, there is a strong argument for showing an increasing distribution cost at higher CIF prices in order to reflect opportunity rate of return on funds of distribution companies. This cost item may be re-calculated only on the basis of a study of the various elements in the distribution cost.

Bank charges reported by GPC at £S 7.6/MT for unspecified services. (notes continued at foot of following page)

At $265/MT, gasoil costs Sudan $ .9884/IG, CIF. Since domestic costs of distribution have been characterized as constant per unit, it follows that a 10 Pt increase in the exchange rate generates almost exactly a 10 Pt increase in the import parity price. Thus, if the present Port Sudan ex-depot price is £S 1.70/IG at an exchange rate of £S 1.30/$. it will increase to £S 2.70/IG if the exchange rate is increased to £S 2.30/$. This is not precise beyond two decimal points because it requires gasoil to move gasoil. For example, a ton of gasoil moved by rail to Khartoum and thence by truck to El Fasher requires about 70 kg of gasoil. Thus, the greater the distance moved, the greater the effect of a Port Sudan price increase. The difference it makes in using 10 Pt/10Pt rule of thumb is trivial, however.

At $230/MT CIF Port Sudan, gasoil costs Sudan $ .8579/IG. Thus an increase in the exchange rate of 10 Pt would translate into only at 8.58 Pt domestic price increase.

Note that if one is given the black market price it is possible to compute the effective exchange rate as follows:

$$E = (P - C)/CIF,$$

where E is the exchange rate in £S/$, P is the domestic black market price, C is the domestic (£S) cost of handling, distribution, transportation, taxes and GPC profits (given here line 1b plus 2b plus transportation at administered rates [see Annex III] to the place of black market.) and CIF is the CIF price in dollars. For example, if the black market price at Khartoum is £S 200/bbl:

P = £S 1,218.64/MT
C = £S 41.53/MT + 69.58/MT + £S 103.75/MT (transpt)
= £S 214.86
P - C = £S 1,003.77
CIF = $265/MT
E = £S 3.79/$

Notes to Table I-A (continued)

(b) Current effective tax is 2a - 1c. This may be more than government thinks it is receiving as a tax, as it includes retained earnings of profits of the GPC. Given that GPC is a parastatal, it is appropriate to consider its "profits" as if they were taxes.

(c) Zero effective tax assumes that all nominal taxes are removed and that the GPC sets its ex-depot (Port Sudan) price so that the GPC earns no profits.

(d) Percentage ex-depot (Port Sudan) price required to eliminate implicit tax or subsidy, i.e. to generate an ex-depot price which is exactly the import parity price.

(e) Same as (c) except that absolute effective tax given at (2b) is passed along in the GPC ex-depot (Port Sudan) price.

(f) Current effective tax at $265/MT CIF price and GPC ex-depot price of £S 455.61/MT is £S 69.58/MT (see Table I-A).

The value of foreign exchange as imputed by the black market price for gasoil is as follows for other selected gasoil prices, computed at Khartoum:

Table I-C: Shadow Price of Foreign Exchange as Imputed from Khartoum Black Market Prices

Black Market Price per bbl	Black Market Price per gal	Imputed Value of Foreign Exchange (in £S/$)
91.83	2.087	1.30
125.00	2.84	2.06
150.00	3.41	2.64
175.00	3.98	3.21
200.00	4.55	3.79
250.00	5.68	4.94
300.00	6.82	6.09

ANNEX II: ECONOMIC REASONING ABOUT THE BLACK MARKET

Excess Demand and the Secondary Market Premium

Figure 1 is a stylized representation of the gasoil market. Figure 1a assumes that gasoil demand by the government/parastatal sector (G-Sector or GS) is not price responsive. This is probably a fair assumption. Further, it assumes that G-Sector demand, D(g), in Figure 1a is just matched by the allocation to the GS, S(g). In fact, S(g) probably exceeds D(g). It has been suggested that the "stated" D(g) may exceed the "true" D(g) by as much as twenty percent and that the difference "leaks" to the private sector. Whatever the extent of "leakage", the total national supply is unchanged. The introduction of a "leakage" function would not improve the understanding of the basics involved here.

In Figure 1b the primary private sector (PPS) allocation, S(p'), is assumed to satisfy PPS demand, D(p'), at the administered price, P(a). Figure 1b is drawn that way for simplicity; it could have been drawn differently without detracting from the main argument of this paper. By definition there is no formal allocation to the secondary private sector (SPS), as shown in Figure 1c. The SPS is secondary because it receives no direct allocation.

The total demand by the private sector (PS) is shown as D(p) in Figure 1d. The market clearing price is represented as P(e); the extent of excess demand at P(a) is measured by the line segment hf. Perhaps of greater interest is the line segment hd which measures the difference between the price paid by PPS allocatees, P(a), and the price paid by buyers in the secondary market P(e). This difference is the "black" market premium which originates because of the joint existence of an allocation system, an administered price and a vigorous private sector.

Figure 1e represents the national market for gasoil. Total supply, S(t), is perfectly inelastic, as the quantity imported is determined exclusively by government. Total demand, D(t), is the horizontal summation of D(g) and D(p). The market clearing price P(e) is the same in Figures 1d and 1e.*

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* Leakage from the GS would have the effect of reducing S(g) by the same ammount that it increased S(p). [Footnote continued next page.]

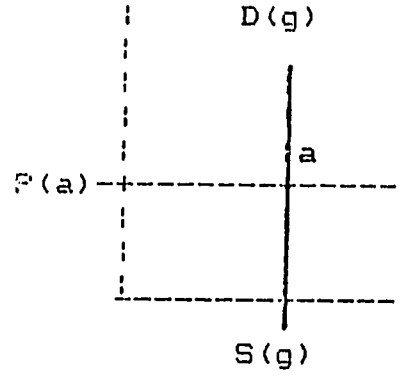


Figure 1a: Government Sector (GS)

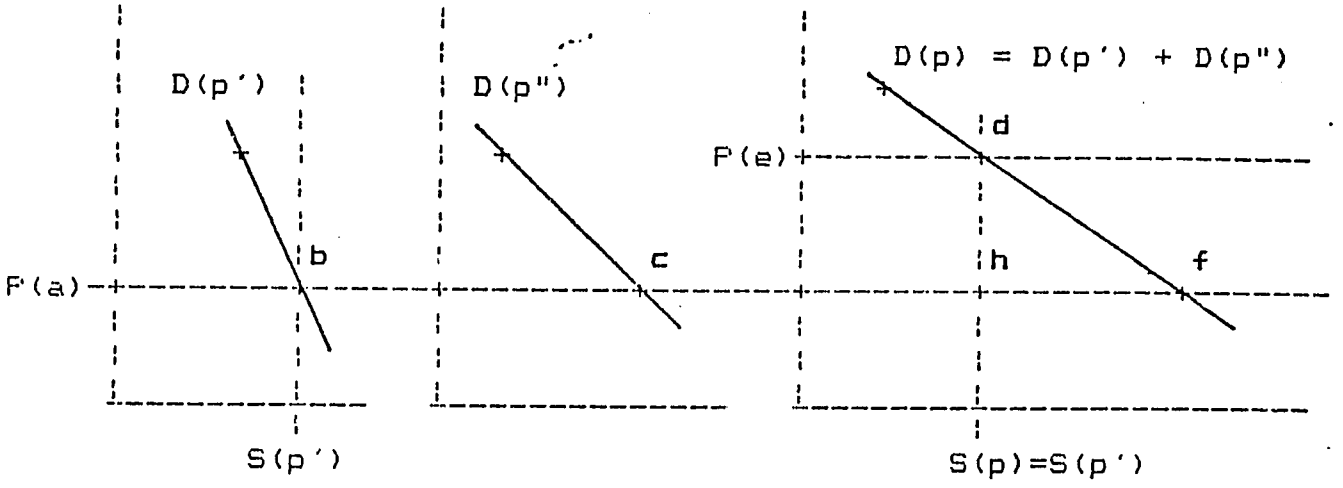


Figure 1b: Primary Private Sector

Figure 1c: Secondary Private Sector

Figure 1d: Total Private Sector (PS)

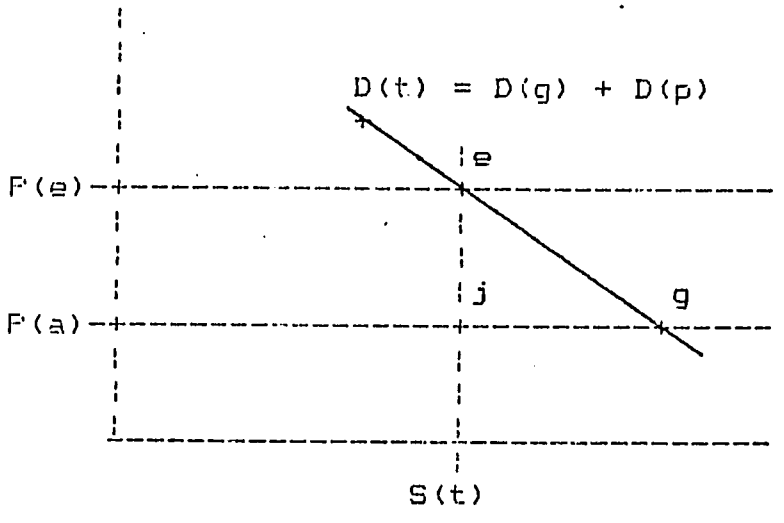


Figure 1e: Total Market for Gasoil

Figure 1:

Figure 1a characterizes the gasoil "market" in the government sector (including parastatals). Supply, S(g), and demand, D(g), are perfectly inelastic and matched. This market would clear at any price. The administered price, P(a), is simply an accounting price in this market.

Figure 1b characterizes an ideal gasoil market for the primary private sector. The primary private sector demand is represented by the demand curve D(p'). The allocation to this market (supply) is S(p'). At this allocation, the primary private sector market clears at the administered price, P(a).

Figure 1c depicts a secondary private sector market with the demand curve D(p") and no allocation.

Figure 1d is the aggregate private sector demand, D(p), which is derived as the horizontal summation of D(p') and D(p"). Given that the total private sector allocation is fixed at S(p), there is an excess demand at P(a) as depicted by the line segment **hf**. The market clearing or equilibrium price is P(e).

Figure 1d depicts the entire gasoil market. The demand curve, D(t) is the horizontal summation of D(p) and D(g). Excess demand is represented by the line segment jg = hf. The market clearing or equilibrium price is P(e).

Subsidies that Fail to Produce the Intended Results

There is apparently no strong social objection to the subsidy which arises from the use of administered price gasoil in the PPS. This may be because of a public perception that the subsidy is passed along to consumers either by competition or by administrative controls on consumer prices. However, it is not clear that the subsidy is in fact effectively and directly passed along to the intended consumers.

In almost every sub-sector of the private economy, some producers must go to the black market for gasoil (and other inputs). This means that their marginal supply price will reflect the cost of inputs which are available only on black markets. Those who administer prices understand this problem and set the market prices of goods to allow producers and traders to cover the costs of gasoil and other inputs available only in black markets. When this is done, the administered price allocatees, not the intended consumers, benefit from the effective subsidy. If those administering market prices do not allow the prices to cover the costs of producers who must acquire inputs on black markets, a final goods black market will develop.

The allocation of gasoil exclusively to allocatees at the administered price creates a subsidy to private sector allocatees for the amount that they use directly in their productive activities. The existence of a vigorous private sector generates the SPS demand, D(p"). This SPS demand creates the incentive for PPS allocatees to "sell on the black" (or otherwise divert gasoil from PPS activities to SPS activities in the case of a businessman who has enterprises in both sectors). **The rational PPS businessman will use his allocation for the intended purpose only as long as the intended purpose is more profitable than selling the allocation into the black market.**

Optimal Secondary Market Diversion

Figure 2a is a scaled-up version of Figure 1d, with some additions. D(p') is also shown in Figure 2a. In Figure 2a the PPS allocatees may elect to use their allottments in production, in which case the "value-in-use" is described by their demand curve for gasoil, D(p'). Alternatively they may elect to sell it into the black market at P(e). As a simplification, transactions costs associated with the diversion of gasoil from the PPS to the SPS are assumed to be zero. Transactions costs are introduced below.

[footnote continued from previous page]
Leakage would not alter P(e). Just how P(e) is discovered is not an issue here. In general, unless transactions or information costs are prohibitive, markets find an equilibrium. Exceptions may be found only if supply or demand curves have perverse slopes or if a cob-web adjustment process is implicit. Neither of these cases is relevant here.

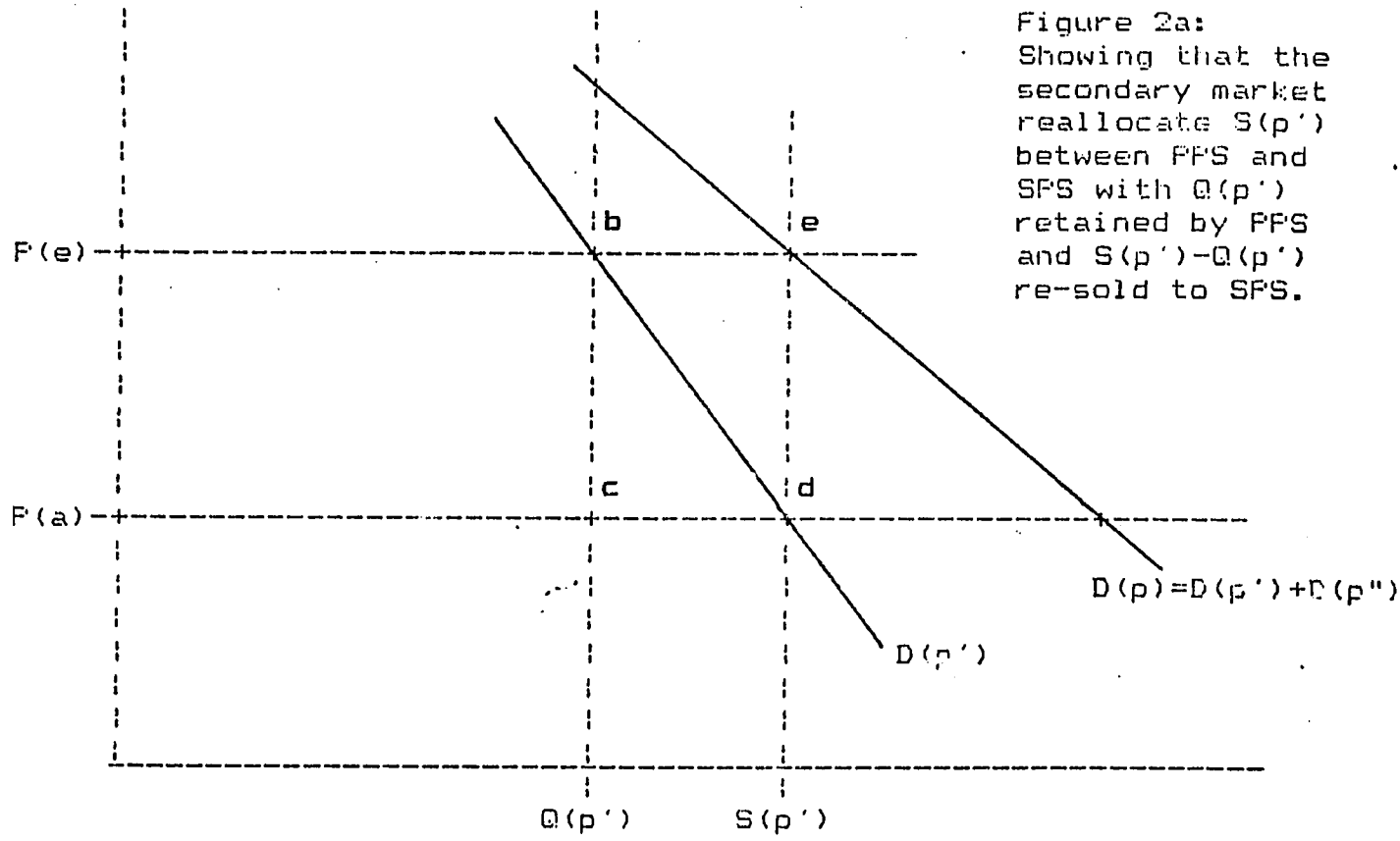


Figure 2a: Showing that the secondary market reallocate S(p') between PPS and SPS with Q(p') retained by PPS and S(p')-Q(p') re-sold to SPS.

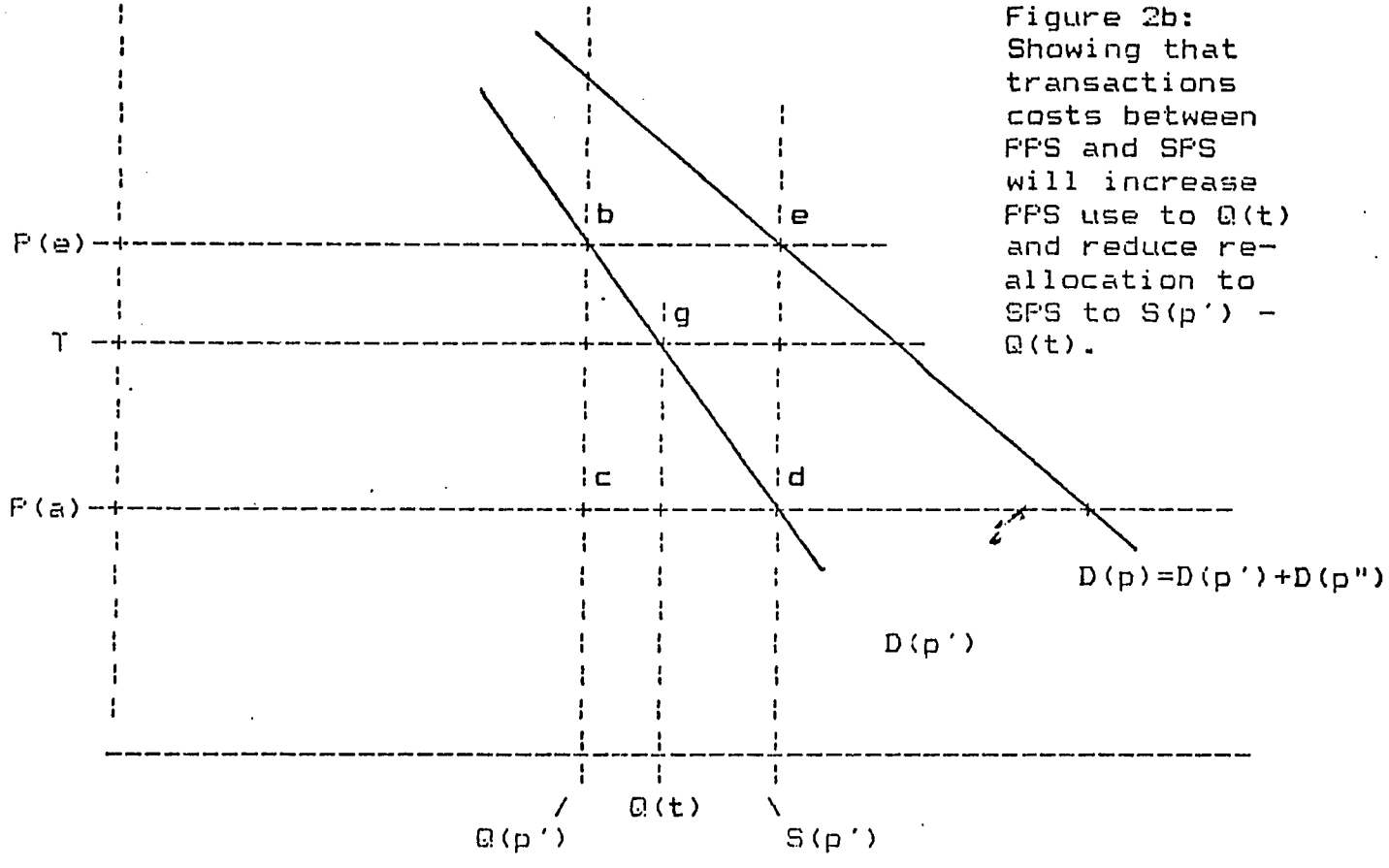


Figure 2b: Showing that transactions costs between PPS and SPS will increase PPS use to Q(t) and reduce re-allocation to SPS to S(p') - Q(t).

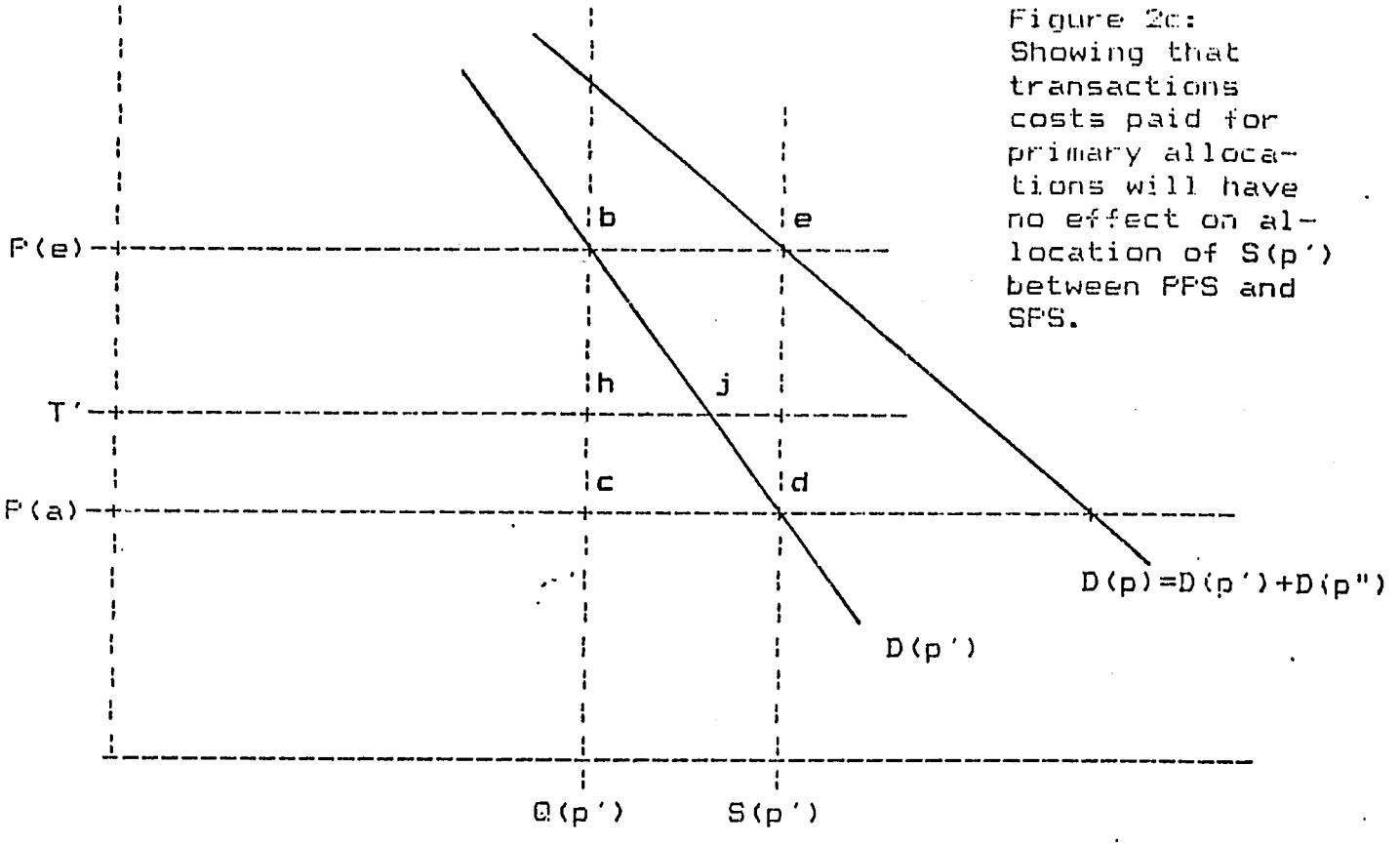


Figure 2c:
Showing that transactions costs paid for primary allocations will have no effect on allocation of S(p') between PPS and SPS.

Figure 3a:
Showing the supply curve cs from the PPS to the SPS.

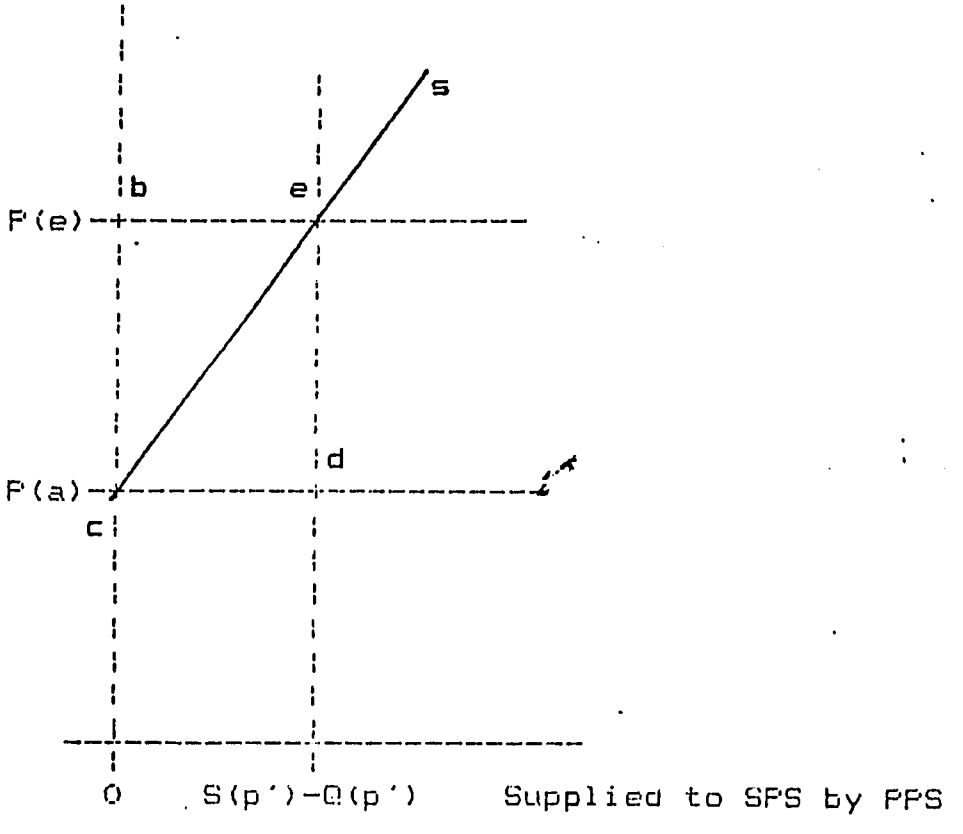


Figure 3b: Showing an upward (leftward) shift in the supply curve to c's' due to transanctions costs between PPS and SPS.

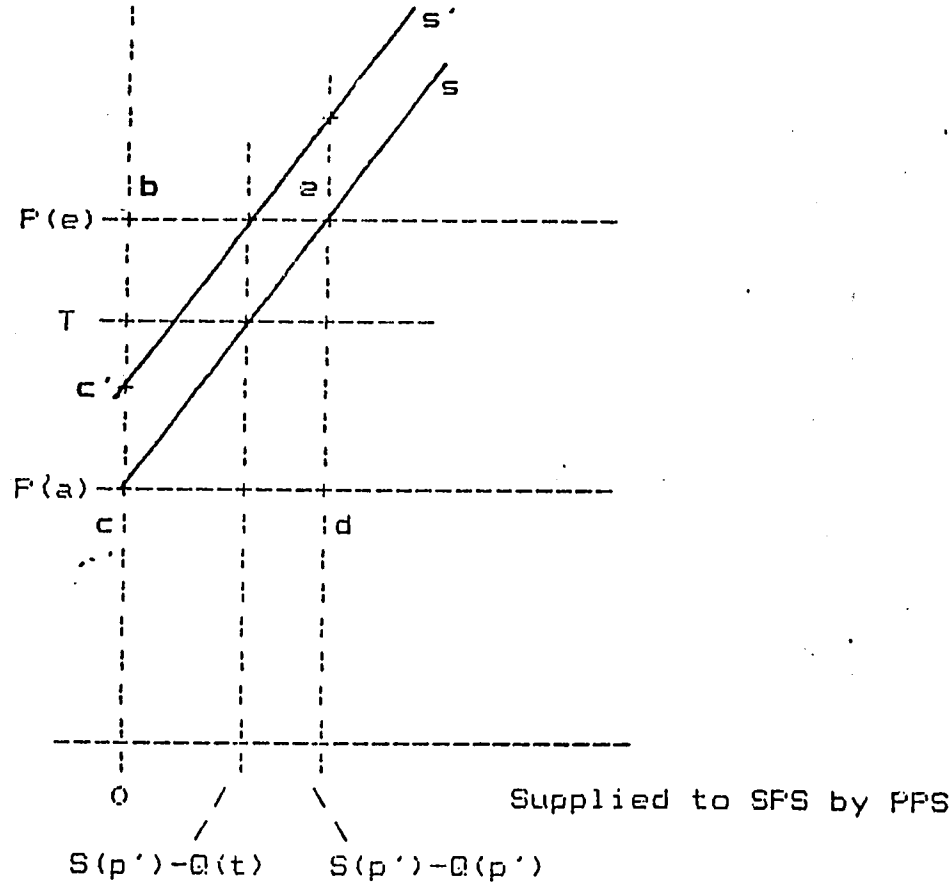
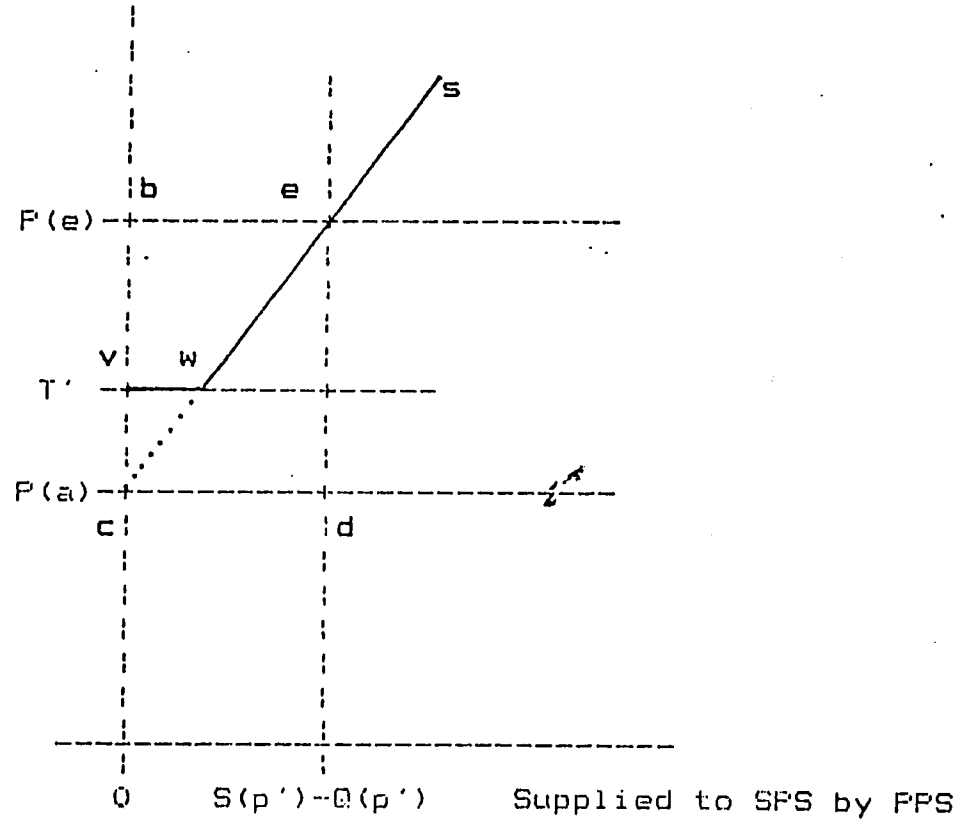


Figure 3c: Showing effect transactions costs paid for the primary allocation by the PPS; new supply curve becomes vws.



The solution to the situation represented in Figure 2a is clear. PPS allocations up to the amount D(p') earn the allocatees a higher value-in-use than in sale to the secondary market. For quantities behond Q(p'), P(e) is greater than the PPS value-in-use as represented by the demand curve, D(p'). The quantity S(p') - Q(p') will be sold into the black market. In the case of businessmen having both PPS and SPS enterprises, no sale is required, of course. As a consequence of sale to the black market, goods which government may have intended to be produced by the PPS are not produced or are produced by the SPS.

Figure 2a suggests that the black market supply function is a "step function". This is jointly a consequence of showing D(p) and D(p') in the same figure and a limitation of two dimensional geometry. Figure 3a looks exclusively at the black market. In Figure 3a, the black market supply curve is shown as the line cs. It is derived from the PPS demand curve D(p') in Figure 2a. Figure 3a is the more familiar representation of markets; however, it too is of limited use in the case at hand because of what it assumes about the factors which determine P(e). If P(e) rises or falls due to an righward or leftward shift in the SPS demand, D(p"), the supply curve in Figure 3a is correnr. If P(e) changes because of a shift in S(p'), it is necessary to show a shift in the supply function in Figure 3a. Note for example that as D(p') and D(p) are drawn in Figure 2a, an increase in S(p') would result in both a lower P(e) and a greater market diversion. Unless the supply curve in 3a is shifted to the right, it gives the impression that the volume in the black market would decline as the result of a decrease in P(e).

Quasi-Rents and "Black" Profits

As a consequence of acquiring gasoil worth P(e) at P(a), PPS allocatees earn a quasi-rent equal to P(e) - P(a) per unit. From an economy-wide perspective, this is "unearned income" irrespective of whether it arises as profits from the resale of gasoil acquired at P(a) or from the subsidy value of P(a) in the production of PPS goods and services. The goods in question would be produced without the quasi-rent and "black" profit if government would simply increase the administered price to P(e).

One might argue that there are special circumstances in which the social desirability of income subsidies to producers from government warrants the establishment of a quasi-rent income transfer via an administered price and quota system. Rationed low price food and special educational investments for the poor are examples that come to mind. However, it would be difficult to sustain that argument for gasoil in Sudan where the beneficiaries of the quasi-rent in question are not among the poorer classes.

Transactions Costs

Figure 2a assumes that there are no transactions costs associated with diversion of gasoil from PPS to SPS uses. This is only approximately true. We see two kinds of transactions costs in

the gasoil market:

A) costs of acquiring an allocation in the first place; and

B) costs of diverting it from PPS to SPS uses.

Consider first the transactions costs of inter-market (PPS to SPS) diversion. Fear of detection of an unsanctioned trade in gasoil may be seen as a transactions cost, irrespective of whether the cost is monetized or only psychic. Prior to the introduction of harsh penalties for trading activities which were long "accepted"--but not officially sanctioned--transactions costs between the primary and secondary markets appear to have been modest. At a minimum they would have reflected the real economic costs of physical handling, and an opportunity cost on investment. We were told by one individual that the difference between the amount paid for black market gasoil by the final consumer and the amount received by the individual selling into the black market was in the range of £S 30 to £S 40/bbl in the period prior to the introduction of harsh penalties.

In Figure 2b an inter-market transactions cost (to sellers) is represented by the line T. In this case, PPS allocatees face a transactions cost per unit of gasoil sold in the black market equivalent to P(e) - T. Accordingly, they will increase their PPS use to the point Q(t) and sell only S(p') - Q(t) to the secondary market. This however, introduces a degree of inefficiency. The demand curve measures the value in use of gasoil. In Figure 2a the value-in-use of S(p') was maximized when the PPS used Q(p') and sold S(p') - Q(p') to the SPS. In Figure 2b, the amount Q(t) - Q(p') is used in the PPS when it would have a higher-value-in use in the SPS. The consequence is a decline in gross domestic product. By making transactions costs high enough, the black market could be eliminated completely, but at a cost in terms of the total value added by gasoil.

Transactions costs are represented in Figure 3b as the vertical distance cc' which effectively shifts the black market supply curve upward (and leftward) from cs to c's'. An identical result is obtained if the inter-market transaction cost is seen as reducing the price received by PPS sellers from P(e) to T.

The elimination of a black market by increasing inter-market transactions costs would create a new set of entrepreneural incentives. Figures 2b and 2c takes no account of the fact that many PPS allocatees have SPS enterprises. For these businessmen, the recently imposed inter-market transactions costs will not be great. For example, a truck owner who is also a tenant in one of the mechanized farming schemes may face low transactions costs in distributing his allocation between the two activities in an efficient way. High transactions costs may thus be expected to create incentives for product diversification. Small businessmen will probably lose out in this process. Further, this sort of diversification may be expected to result in lower over-all efficiency due to a reduction in entrepreneurial specialization.

In addition to inter-market transactions costs there are transactions costs associated with acquiring a PPS allocation in the first place. One can not obtain a PPS allocation at the administered price simply by asking. There are a number of options open to businessmen. They might engage in outright bribery or they might establish "dummy" firms which have fictional gasoil input requirements. Further, a PPS allocatee will have costs associated with waiting in line or holding a private inventory to reduce waiting time. None of these expedients is costless, however.

In Figure 2c, acquisition transactions costs are represented by the difference between the line T' and P(a). This acquisition transactions cost has quite different implilcations from the inter-market transactions cost seen in Figure 2b. In and of itself, it does not disturb the efficiency of the total PS market because it does not alter the allocation of S(p') between the PPS and SPS. However it does generate a shift in income distribution. Part of the quasi-rent appearing in Figure 2a is no longer available to PPS allocatees. In particular, the amount of quasi-rent which was P(e) - P(a) per unit of gasoil in Figure 2a is reduced to P(e) - T' per unit in Figure 2c. The amount T' - P(a) per unit goes to pay the transactions costs associated with acquiring a PPS allocation.

In Figure 3c, acquisitions transactions costs are seen to give the black market supply curve a flat portion represented by the line segment vw.

The important thing about acquisition transactions costs is that they have no substantial direct effect on the extent of diversion of gasoil from the PPS to the SPS because they reduce the quasi-rent equally for that fraction of gaasoil which is used in the PPS and that fraction which is diverted into the black market. "Black" profits and subsidies to PPS allocatees are replaced by the cost of bribes, the costs of waiting in line, etc.

This proposition is almost, but not quite correct. As long as there is a positive quasi-rent from diversion, businessmen will respond to the incentives of diversion. If, however, the acquisition transactions costs were to increase until they absorbed the entire quasi-rent--i.e. to the point where T' = P(e)- there would be no incentive to divert and PPS allocatees would have no incentive to acquire more than the amount Q(p'). The remainder, S(p') - Q(p') would be unclaimed at the pump. That remainder would, of course be just exactly the amount that the SPS would demand at P(e). This condition would develop, however, only if all PPS allocatees paid the same effective acquisition transactions costs. Since this is an unlikely case, it is improbable that the amount S(p') - Q(p') would become suddenly available as acquisition transactions costs reached their maximum sustainable level.

The simplest way to eliminate the quasi-rent (and "black" profits) would be to increase P(a) to P(e). This would also elim-

inate incentives for corruption, wasteful waiting time and the need for businessmen to keep larger than otherwise optimal stocks of gasoil. Government could accomplish this simply by increasing the administered price. Black profits and quasi-rents would then accure to government where they could be used to purchase increased supplies of gasoil.

ANNEX III: TRANSPORTATION OF GASOIL

For points other than Port Sudan, petroleum products are priced ex-depot on the basis of rail transport to main rail terminals. We assume that the rail charges represent full cost rail rates. Gasoil is also transported by the private sector in large bulk tankers on tarmac roads, in lorries on dirt roads and in various combinations of conveyances. A pipeline serves Atbara and Khartoum. Transportation of gasoil by the pipeline is priced at the rail transport rate.

Any increase in the ex-depot Port Sudan price of gasoil will result in a de facto increase in transportation costs because gasoil transport involves gasoil use. Accordingly, this annex reports current transportation costs where quoted and estimates transportation costs for destinations where quotes are unavailable. Published coefficients for the consumption of gasoil in transportation are used to estimate the the effect of a gasoil price increase on the cost of transporting gasoil itself.

In Tables III-A through III-C, column (1) is the final destination. Column (2) reports quoted [estimated] hauling rates. Column (3) reports actual and [estimated] distances. Column (4) is our estimate of the gasoil consumed per unit of gasoil transported.

Contract bulk tanker road hauling rates represent a competitive private sector solution. The competitive rate structure is profoundly influenced by the back-haul opportunities for molasses. Without this opportunity, trucks would return empty and contract rates would be much greater. The extent to which road hauling to Medani-Kosti destinations could increase without exhausting the molasses back-haul opportunities is not known. If haulers should be unable to secure back-haul contracts, the forward-hauling rates for gasoil would increase.

The last column of these tables reports our estimates of the increase in the cost of gasoil transportation to selected destinations which will arise from an increase in the cost of gasoil to transporters if there is an increase in the ex-depot price at Port Sudan. Thus, if the price of gasoil to road haulers at Port Sudan were to increase by £S 1.00/IG, the cost of competitively delivered gasoil at Kosti would increase by £S 1.0272/IG (Table III-B). If the Port Sudan price increase were £S .50/IG, the increase would be £S .50136/IG at Kosti. This analysis assumes that large haulers bid for contracts on the basis of the Port Sudan administered price rather than on the basis of the secondary market price. Given Port Sudan's reputation as a nearly "free port" for gasoil used in transportation, this may be a valid assumption. If truckers are able to purchase more gasoil

than they require for their trip at Port Sudan prices, the n secondary market value of that fuel represents a joint product haulers and will be reflected in lower transportation bids in competitive environment. If the tarmac fuel hauling sector we non-competitive or were a net purchaser of gasoil on the secon ary market, the assumption would be jeopardized.

It is argued in the text that this interpretation is likely to invalid for points beyond the tarmac or pipeline where gasoil transported by small and medium trucks. For these destination the cost of hauling depends on the secondary market price f gasoil, not the administered price.

The effects of an ex-depot price increase on road gasoil tran portation costs for the railroad/pipeline and for railroad/pip line-truck combinations are reported in Tables III-A and III respectively.

Rail rates for gasoil are greater than truck rates for all poin served by tarmac roads, eventhough rail is less consumptive gasoil in the transportation process. For Karima and points Western Sudan rail transportation is cheaper than road transpor given the high fuel consumption of lorries on dirt roads.

TABLE III-A: Transportation Costs, Distances and Estimated Gaso Consumed (in IG/IG) in Transportation by Rail a Pipeline

Destination	Quoted and [Estimated] Hauling costs in MMS/IG (a)	Distance (in kms) (b)	Est. Gasoil Consumed in IG/IG Loaded at Port Sudan (c)
(1)	(2)	(3)	(4)
Khartoum	387	[830]	.0083
Atbara	227	[515]	.0052
Kassala	290	[630]	.0063
Gedaref	386	[850]	.0085
Medani	454	[1,005]	.0101
Senar	487	[1,130]	.0113
Singa	517	[1,250]	.0125
Kosti	538	[1,235]	.0124
El Obeid	706	[1,560]	.0156
Nyala	1,007	[2,285]	.0229
Karima	333	[965]	.0097

TABLE III-B: Transportation Costs, Distances and Estimated Gasoi Consumed (in IG/IG) in Transportation by Road.

Destination	Quoted and [Estimated] Hauling costs in MMS/IG (a)	Distance (in kms) (b)	Est. Gasoil Consumed in IG/IG Loaded at Port Sudan (c)
(1)	(2)	(3)	(4)
Kassala	232	630	.0139
New Halfa	242	[750]	.0165
Gedaref	310	850	.0187
Medani	250	1,005	.0221
Senar	270	1,130	.0249
Singa	290	1,250	.0275
Kosti	290	1,235	.0272
Dongola (via)			
unspecified	704	1,100 ?	.0603
Port Sudan	[1,256]	1,100	.0603
El Obeid (via)			
Kosti	[714]	1,235 + 325	.0467
El Fasher (via)			
Kosti	[1,628]	1,235 + 1,025	.0887
Nayala (via)			
Kosti	[1,661]	1,235 + 1,090	.0926
Renk (via)			
Kosti	[581]	1,235 + 175	.0377

TABLE III-C: Transportation Costs, Distances and Estimated Gasoil Consumed (in IG/IG) in Transportation by Combined Methods

Destination	Contract and [Estimated] Hauling Costs in MMS/IG (a)	Distance (in kms) (b)	Est. Gasoil Consumed in IG/IG Loaded at Port Sudan (c)
(1)	(2)	(3)	(4)
		Rail/ Pipe + Dirt Road	
Dongola (via)			
Atbara	[991]	515 + 585	.0403
Khartoum	[1,089]	830 + 545	.0410
Karima	[561]	965 + [175]	.0202
El Obeid (via)			
Kosti	[960]	1,235 + 325	.0221
Khartoum	[920]	830 + 415	.0332
El Fasher (via)			
Kosti	[1,876]	1,235 + 1,025	.0739
Khartoum	[1,703]	830 + 1,015	.0692
Nyala	[1.301]	2,285 + 225	.0364
Nyala (via)			
Kosti	[1,909]	1,235 + 1,050	.0754
Khartoum	[1,801]	830 + 1,090	.0737
Renk (via)			
Kosti	[766]	1,235 + 175	.0228

Notes:

(a) Rail transport charges inferred from regional ex-depot price structure specified by GPC. Truck transport contract delivery costs as quoted by Shell for current private sector road hauling contracts. No quotes available for El Obeid, El Fasher and Nayala. Estimates of these costs made on the basis of estimated £S .350/MT/km cost for small and medium trucks operating on dirt roads. This assumed cost represents inflation compensated adjustment of cost figure given in Truck Operating Characteristics in The Sudan, 1982/83 by Transport and Communication Sector, Ministry of Finance and Economic Planning.

(b) Distances taken from Sudan Yearbook (Khartoum, Sudanow: 1983), p.66. Note that Sudan Yearbook table of road distances is a minimum distance table; thus, Port Sudan-Khartoum is reported as 828 km (via Atbara) rather than by the more prevalent all tarmac route (via Kassala, Gedaref and Medani). Distance to Singa estimated as 120 km beyond Senar. Routes to Dongola, El Obeid, El Fasher and Nyala all involve combinations of tarmac and dirt surfaces. The following distances were used in computing column (4):

Destination	Distance on Tarmac Highway			Distance on Dirt Roads		
	from	to	km	from	to	km
Dongola	P.Sud.	Haiya	210	Haiya	Dongola	890
El Obeid	P.Sud.	Kosti	1,235	Kosti	El Obeid	325
El Fasher	P.Sud	Kosti	1,235	Kosti	El Fasher	1,025
Nayala	P.Sud	Kosti	1,235	Kosti	Nayala	1,050

Rail distances assumed approximately equal to road distances.

(c) Gasoil consumed in transportation calculated on the following basis:

Class of Conveyance	Est. Gasoil Consumed (in g/MT/km)
Heavy truck (tarmac only)	22
Light/Medium trucks	
tarmac	33
dirt	60
Railroad/pipeline	10
Imperial gallons per metric ton (IG/MT)	268.1
kg/IG	3.73

Gasoil transported from Port Sudan to Dongola entirely by road is assumed to move in barrels on lorries at tarmac consumption rates to Haiya and at dirt road consumption rates from Haiya to Dongola. The resultant figure (0.0902 IG consumed in tansport per IG loaded at Port Sudan) is probably an over estimate, as an unknown fraction of gasoil moved by truck to Dongola originates from the pipeline at Atbara. Gasoil moving by rail/pipeline to Atbara and thence by road to Dongola consumes only 55 percent of the amount of gasoil required for exclusive road transport. Gasoil moving by rail to Kerima and barge to Dongola is even more efficient in terms of gasoil consumption, but is reportedly highly unreliable in terms of supplying private sector needs. Rail transport to Western Sudan is also reportedly unable to meet private sector requirements.

[Source: for gasoil consumption in g/MT/km see Democratic Republic of Sudan, Ministry of Energy and Mining, National Energy Administration. Base Year Energy Supply/Demand Balances and Demand Projection Methodology, Annex 1 (Khartoum, National Energy Administration: March 1983) (bound mimeo.) Tables III-32, III-33 and III-34, pp.58-60.]

ANNEX IV: GASOIL CONSUMPTION DATA FOR SELECTED CROPS AND SECTORS

This annex reports gasoil consumption coefficients for selected important crops and techniques of production.

TABLE IV-A: Major Crop Yields, Prices and Consumption of Gasoil

Crop/ Sector	Five-Year Average Yield in Kg/fed.	Farm Gate Price in £S/MT for 1983/84	Consumption of Gasoil in IG/Feddan			Consumption of Gasoil in IG/MT of Production
			Irrig.	Cultiv.	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dura						
-Gezira	404	225	0	2	2	5.0
-Pump Sch.	404	225	7	2	9	22.3
-RF:Mech.	292	225	0	2.4	2.4	8.2
-RF:Trad.	206	225	0	0	0	0
Sesame						
-RF:Mech.	124	579	0	2.4	2.4	19.4
-RF:Trad.	93	579	0	0	0	0
Wheat						
-Gezira	493	360	0	2.5	2.5	5.1
-New Halfa	458	360	0	2.5	2.5	5.5
-Zeidab	650	400	7	2.5	9.5	14.6
-Nor:Trad.	850	500	12	0	12	14.1
Cotton						
-Gezira LS	445	756	0	10	10	22.5
-Gezira MS	608	579	0	10	10	16.4
-Pump Sch LS	445	756	14	10	24	53.9
-Pump Sch MS	608	579	12	10	22	36.2
Ground Nut						
-Gezira	826	534	0	1.5	1.5	1.8
-Pump Sch.	826	534	10	1.5	11.5	13.9
-RF:Trad.	263	534	0	0	0	0
Sugar (Guneid)						35*

* Gasoil consumption per ton of finished sugar.

Notes to Table IV-:

1) Crop and production technique selected for representativeness and availability of data.

2) Crop yields (in Kg/feddan) indicated in col. (2) are five year averages for the period 1979/80 - 1983/84. Source: MOA, PAEA, Department of Statistics. Area, Yield and Production, 9 Major Crops, Sudan, 1961/62 - 1983/84, May 1984.

3) Crop prices for 1983/84 shown in col. (3) are estimates from unpublished sources.

4) Estimates for consumption of gasoil (in IG/feddan) for pump scheme irrigation, cultivation of crops and total are shown in cols. (4) - (6), respectively. The estimates for gasoil consumption for irrigation of different crops in col. (4) were first derived from total gasoil consumption, crop areas and number of irrigations per feddan for each crop in Blue Nile Scheme (1983/84). The details of these calculations are shown in Table VI-2. The data for total crop areas and total gasoil use of 1.5 million gallons were from: Annual Work Programme, 1983/84 for Blue Nile Agricultural Production Croporation. The per feddan gasoil consumption figures for irrigation of different crops are reproduced in Table VI-3. In this table, similar data calculated for White Nile Schemes (1983/84) are shown on line 2, and those derived from data in Table 2.10 of Blue Nile Waters Study, Vol 3, are shown on line 3. Finally, the average per feddan consumption of gasoil for pup irrigation of different crops are shown in col (4) in Table IV-1.

Estimates for consumption of gasoil in cultivation of different crops were made as follows:

a) Gezira Dura. The estimate of 2 IG/f was provided by Sudan Gezira Board.

b) Dura and Sesame - Rainfed and Mechanized. These estimates were derived from Tables 8.29 and 8.33, respectively of the study by Dr. Abdus Sattar: Study of Cost of Production and Comparative Advantage of Crops in Sudan, May 1982. The data in those tables are as per feddan costs of petrol (or diesel), oil and lubricants and pertain to the crop year 1980/81. These costs were divided by the 1980/81 administered price of gasoil (£S .75/IG) to obtain per feddan use of gasoil (in IG/feddan). These figures most likely are over estimates.

c) Wheat, cotton and groundnut figures were obtained in discussions with officials of the Sudan Gezira Board.

) Gasoil consumptio. per ton of crop output reported in col. (7). hese data were obtained from cols. (2) and (6).

6) Consumption of gasoil for sugar production was calculated from 1980/81 data for Guneid Sugar Factory. Fuel costs of producing one ton of sugar are reported at £S 26, which converts to 35 gallons of gasoil per ton of sugar at the 1980/81 price of gasoil (£S .75/gallon.)

Table IV-B: Irrigation Requirements for Gasoil in Blue Nile Scheme by Crop for Total Scheme Consumption of 1.5 million Gallons

	Cotton	Dura	Groundnut	Vegetables
Area ('000 fed.) 1983/84	75	51.55	1.5	2.21
Irrigations/feddan	8	4	8	14
Water used ('000 M^3)	600	206.18	12	29.94
Crop's share of water	.7075	.2431	.1410	.0353
Gasoil consump. ('000 IG)	1,061.25	364.65	21.15	52.95
Gasoil consumption (IG/F)	14	7	14	24

Table IV-C: Irrigation Requirements for Gasoil by Crop (IG/feddan)

	Cotton LS	Cotton MS	Dura	G'Nut	Vegs.	Wheat
Blue Nile Sch. (Table 2)	14	--	7	14	24	---
White Nile Sch 1983/84 a	15	--	8	15	--	---
Blue Nile Waters Study b	14	12	7	14	--	10
Average (IG/feddan)	14	12	7	14	24	10

a. Requirements for White Nile Schemes were worked out in the same way as for Blue Nile Schemes in Table IV-2. Assumed gasoil consumption = 2.3 million gallons.

b. Calculated from per feddan water requirements in cubic meters in Table 2.10 of Blue Nile Waters Study, Vol 3.

It should be noted that increases in the cost of production at Gezira due to an increase in the gasoil price are minimal because Gezira enjoys a substantial advantage from its gravity flow irrigation system. In fact, economic efficiency and equity principles suggest that gravity flow irrigation charges to tenants should reflect the opportunity cost of lift irrigation. Assuming that reforms in the land and water charges at Gezira will be based on the opportunity cost of pumped water, farm gate crop prices at Gezira will need to be increased by about the same ammount as in the pump schemes. Pump schemes using electric power should not be distinguished from pump schemes using gasoil, as the opportunity cost of electric power is power provided by gasoil.

ANNEX V: ADDITIONAL GASOIL REQUIRED TO SATISFY DEMAND AT ALTERNATIVE PRICES

The purposes of this annex is to estimate the approximate increase in gasoil supply which would be required to satisfy market demand at alternative prices. The methodology used here is the application of economic theory in order to reduce the range in which key elasticity and excess demand parameters are likely to lie. The methodology is crude, but the outcome is instructive. The reader should note that this methodology is valid only in the special case of a supply curve which is perfectly inelastic.

First, an effort is made to "corner" the range of probable demand elasticities for gasoil, based on alternative assumptions about the market clearing gasoil price last year and the extent of excess demand. Then, a range of possible elasticities is selected and the increase in quantity demanded is estimated on the basis assumed 1983/84 equilibrium prices and potential new administered prices. Given that the Petroleum facility is estimated to have the capacity to increase total imports by 17 percent and gasoil imports by 30 percent (if all the added import capacity were directed to gasoil), these figures are especially identified.

Table V-A: Arc-Elasticities of Demand for Selected Levels of Excess Demands and Equilibrium Prices

Excess Demand (%)	Equilibrium Price of Gasoil in £S/bbl				Implied Idle Capacity in Gasoil-Using Sector (%)
	150	200	250	300	
100	-1.4	-.91	-.72	-.63	50
80	-1.2	-.78	-.62	-.54	44
60	-.97	-.63	-.50	-.44	38
40	-.70	-.45	-.36	-.32	29
20	-.38	-.25	-.20	-.17	17
10	-.20	-.13	-.10	-.09	9

Arc elasticities computed as average precentage change in quantity implied by assumed excess demand divided by the average change in price between administered price (here approximated as £S 2.10/IG) and assumed equilibrium price. The black market price is the best available estimate of an equilibrium price.

It is hard to believe that excess demand could have been as great as 80 percent, as that figure implies that 44 percent of the private gasoil-using sector was idle for want of gasoil. It should be remembered that part of the gasoil-using sector is stand-by and seasonal use capacity and is intended to be idle under normal conditions.

Hearsay evidence supports the view that the black market price in 1983/84 (prior to the July-August supply hiatus) was in the range of £S 200 to £S 250/bbl in the Central Region; the black market may have been as low as £S 150/bbl in the Eastern Region and as high as £S 300/bbl in the Northern Region as well as parts of Kordofan and Darfur. Accordingly, we have "lined off" the most relevant part of Table V-1. The most likely elasticity values are highlighted.

This process suggests that the very maximum plausible demand elasticity would be unity. Note that this process will generate lower demand elasticities for higher equilibrium prices. Table V-2 reveals that lower elasticities at higher equilibrium prices does not necessarily mean that higher equilibrium prices are irrelevant.

Table V-B: Increases in Gasoil Consumption at Selected Demand Elasticities and Prices

Price in £S/IG (Cent. Regn.)	Percentage Increase in Quantity Demanded at Indicated Price if Demand Elasticity Is:					Percent Change from Black Market Price	Percent Change from Current Admin. Price	Implied Foreign Exchange Rate in £S/$
	-.10	-.25	-.50	-.75	-1.00			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
--Equilibrium Price = £S 150/bbl (£S 3.41/IG)--								
2.59	2	6	12	18	24	-24	+23	1.80
2.79	2	5	9	14	18	-18	+33	2.00
2.89	2	4	6	11	15	-15	+38	2.10
2.99	1	3	6	9	12	-12	+42	2.20
3.09	1	2	5	7	9	- 9	+47	2.30

Table V-B (continued)

Price in £S/IG (Cent. Regn.)	Percentage Increase in Quantity Demanded at Indicated Price if Demand Elasticity Is:					Percent Change from Black Market Price	Percent Change from Current Admin. Price	Implied Foreign Exchange Rate in £S/$
	-.10	-.25	-.50	-.75	-1.00			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
--Equilibrium Price = £S 200/bbl (£S 4.55/IG)--								
2.59	4	11	22	32	43	-43	+23	1.80
2.79	4	10	19	29	39	-39	+33	2.00
2.89	4	9	18	27	36	-36	+38	2.10
2.99	3	9	17	26	34	-34	+42	2.20
3.09	3	8	16	24	32	-32	+47	2.30
3.19	3	7	15	22	30	-30	+52	2.40
3.29	3	7	14	21	28	-28	+57	2.50
3.39	3	6	13	19	25	-25	+61	2.60
3.49	2	6	12	17	23	-23	+66	2.70
3.59	2	5	11	16	21	-21	+71	2.80
--Equilibrium Price = £S 250/bbl (£S 5.68/IG)--								
2.59	5	14	27	41		-54	+23	1.80
2.79	5	13	25	38		-51	+33	2.00
2.89	5	12	25	37		-49	+38	2.10
2.99	5	12	24	36		-47	+42	2.20
3.09	5	11	23	34		-46	+47	2.30
3.19	4	11	22	33		-44	+52	2.40
3.29	4	11	21	32		-42	+57	2.50
3.39	4	10	20	30		-40	+61	2.60
3.49	4	10	19	29		-39	+66	2.70
3.59	4	9	18	28		-37	+71	2.80
3.69	4	9	18	26		-35	+76	2.90
3.79	3	8	17	25		-33	+80	3.00
3.89	3	8	16	24		-32	+85	3.10
--Equilibrium Price = £S 300/bbl (£S 6.82/IG)--								
2.59	6	16	31	47		-62	+23	1.80
2.79	6	15	30	44		-59	+33	2.00
2.89	6	14	29	43		-58	+38	2.10
2.99	6	14	28	42		-56	+42	2.20
3.09	5	14	27	41		-55	+47	2.30
3.19	5	13	27	40		-53	+52	2.40
3.29	5	13	26	39		-52	+57	2.50
. . . . .								
4.09	4	10	20	30		-40	+95	3.30
. . . . .								
4.49	3	9	17	26		-34	+114	3.70
4.59	3	8	16	25		-33	+119	3.80

The data of principal interest in Table V-2 are in columns (2) through (6). These are the estimates of the percentage by which gasoil supply must increase at the indicated prices (col. 1) if demand at those prices is to be satisfied. Percentages less than 17 are "lined off"; percentages greater than 30 are highlighted. Percentage increases were not estimated for an elasticity of minus one for the case of the equilibrium price of gasoil at £S 250 and £S 300/bbl. These estimates are ruled out by Table V-1.

The question of how much gasoil will be demanded at the import parity price is crucial to the success of the Petroleum Facility. If the new price is set too low, the administrative allocation system will continue to be required. If this happens, the black market will continue to be required to make up for the inadequacies of the allocation system.

Government would be well advised to consider the implication of the data in Tables V-1 and V-2. Table V-2 can be used to estimate an appropriate tax for gasoil so that the quantity constraints of the Petroleum Facility will not be violated.

ANNEX VI: DEFINITIONS

The following abbreviations and definitions are used in the text and appendices:

GPC = General Petroleum Corporation

IG = Imperial Gallon

MT = Metric Ton

bbl = barrel

ton = MT

gallon = IG

44 IG = one barrel

268.1 IG = one MT of gasoil

gasoil = fuel used in diesel engines; sometimes called gasoline.