Ghana Rice Policy: The Cost of Self-Sufficiency[1]

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RÉSUMÉ. Le Programme de production alimentaire du Ghana est dominé depuis des années par l'auto-suffisance alimentaire, notamment en matière de riz. Conformément à cette politique, les gouvernements successifs ont opté pour la substitution à l'importation, dans le domaine du riz, comme moyen de préserver voire générer des devises. Une étude de la production de riz révèle que, sur le plan de la vente en gros, la production de riz du Ghana ne présente pas d'avantage comparatif. Il est en résulté d'une part des prix élevés pour le riz sur le plan national (parfois dix fois plus cher que le riz vendu à la frontière) et d'autre part des prix de facteurs de production faibles. Or, le riz est la seule culture qui, dans le cadre du programme alimentaire des gouvernements successifs, ait bénéficié d'un appui important sur le plan des politiques d'irrigation et de fixation des prix des intrants. L'une des retombées de cette politique a été, entre autres, que le consommateur au Ghana a été imposé non pas au profit des revenus gouvernementaux mais comme moyen de transfert de revenus du consommateur au producteur et à l'agent de commercialisation pour financer en fin de compte une industrie de riz inefficace. Cette politique a également fait perdre des devises au Ghana. En effet, la production de riz dans ce pays a, à ce jour, fait l'objet d'une très mauvaise répartition des ressources, ce qui a nui à son économie.

Introduction

Rice has been one of the traditional and leading commercial food crops in Ghana since the seventeenth century. In terms of total production, however, rice output is low when compared to other staple food crops produced in Ghana. Maize for example has averaged about 350,000 tons per year, and yam has averaged some 700,000 tons per years; while rice production averaged only about 70,000 tons per year of paddy in the 1970s and 60,000 tons per year in the early 1980s (FAO statistics). Moreover, on the basis of per capita consumption, rice is a minor staple in Ghana (WARDA estimated per capita consumption to be 6.7 kg in 1983 and 4.9 kg in 1985), and accounts for about 10% of all cereals produced in the country (Table 1). Yet rice has

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1 This paper was based on my M. Sc thesis titled *Comparative Advantage and Rice Policy in Ghana.* I gratefully acknowledge the invaluable contributions and criticisms of Dr. J.C. Flinn, Head of Department and my major advisor, and Dr P.L. Pingali, Agricultural Economist, both of the Department of Agricultural Economics, International Rice Research Institute (IRRI), Philippines; Drs. C.T. Aragon, F.A. Lantican, and P.S. Intal Jr. all of the University of the Philippines at Los Banos (UPLB) who served on my graduate advisory committee; Drs. D.S.C. Spencer and Joyotee Smith, both Agricultural Economists at IITA; and my wife Stella, a Research officer at the University of Ghana's Agricultural Research Station, Kpong, Ghana.

been the single crop that has enjoyed a great support in the food programmes of successive governments of Ghana, particularly in terms of irrigation and input - output pricing policies.

Table 1 - Area Harvested, Yields, and Rice Production Among Other Cereals, Ghana, 1979-85

Year	Area harvested 1000 ha		Yelds kg/ha		Production 1000mt		% Rice Production
	Total cereals	Rice	Total cereals	Rice	Total cereals	Rice	
1979-81	902	107	805	837	726	89	12
1982	822	61	662	590	544	36	7
1983	835	40	369	1000	308	40	13
1984	943	57	924	1158	871	66	8
1985	964	87	809	919	780	80	10
1986	1020	90	887	889	905	80	9
1987	996	82	917	1073	913	88	10

Source: FAO Production Yearbooks, Various Issues.

Rice imports to Ghana over the years have been second only to wheat, which is not grown domestically. In 1980 for example, Ghana imported 43,000 tons of rice which represented about 60% of the total quantity of rice consumed that year; and in 1985, WARDA (1986 estimation) showed that Ghana was only 55% self-sufficient in rice production. Successive governments in Ghana therefore sought to reverse the trend whereby the country depends on rice imports to satisfy domestic needs.

The Problem

Ghana, like the other West African countries, has pursued a policy of self-sufficiency in food (particularly rice) since the mid 1960s. Even though Ghana has not attained rice self-sufficiency, cost involved in pursuing a policy of self-sufficiency in rice production has been enormous.

Granted that such factors as adverse weather conditions and an unstable political atmosphere, *inter alia*, might have contributed to the bad performance of the rice economy, the question still remains as to whether the government's continuing policy of self-sufficiency in rice production is economically sound. Moreover, the policy of rice self-sufficiency implies that the option of import substitution for rice has been adopted by successive governments of Ghana as a means of conserving or even generating foreign exchange.

How would domestically produced rice benefit the economy? That is, will benefits accruing from import substitution in rice outweigh the cost to the economy? Do rice policies in Ghana lend support to domestic rice production? Who is/are the target clientele of the import substitution approach?

Have consumers in Ghana benefited or been penalized by the import substitution drive for rice? These are some of the basic economic issues that arise from the policy of import substitution for rice in Ghana, and this paper attempts to address some of these issues.

Comparative Advantage of Rice Production in Ghana

Food policies of both past and present governments of Ghana have favoured increased food production, particularly rice. The crucial question then is whether benefits accruing from import substitution for rice outweigh the cost to the economy. This question was addressed using the Domestic Resource Cost (DRC) measure.

Intuitively, the DRC criterion is an expression of the comparative cost principle in international trade. Ghana has a comparative advantage in rice vis-à-vis the rest of the world if domestic cost per unit of rice is less than the shadow exchange rate. This analysis has employed the DRC as an "ex-post" measure of the cost of a restrictive trade system, using input - output analysis. It evaluates the opportunity cost incurred by the economy in sustaining its existing import substitution policy in rice.

When the opportunity cost of all domestic factors of production (expressed in domestic currency units, i.e. cedis) are evaluated as a ratio of the net foreign exchange earned or saved (expressed in foreign currency units, say dollars), and the ratio deflated by the Shadow Exchange Rate (SER) of the cedi, the coefficient thus obtained represents the DRC.

For a more vivid picture of Ghana's rice economy, the Nominal Protection Rate (NPR) which measures the rate at which the domestic price of a final output (rice) deviates from the world market price (or border price); the implicit Tariff (IT) rate which shows the deviation of the domestic prices of inputs from their border prices; and the Effective Protection Coefficient (EPC) which is the ratio of domestic value added (obtainable as a result of the application of protection measures) to value added in world market prices were estimated. Unlike the IT, the EPC considers protective measure relating to both inputs and outputs (see Appendix I for an outline of the methodology.

A summary of the economic efficiency indicators for rice production in Ghana (based on 1986 data) has been given in Table 2. These were obtained by applying the models outlined in the appendix to empirical data (ie data on cost of production and processing).

The computed DRC figures which were 1.2 for the traditional system, and negative for both the improved and irrigated systems (see Appendix 2 for explanation of these systems) indicate that Ghana has no comparative advantage in rice for all the three systems of rice production considered. Even more important is the fact that both the improved and irrigated systems result in negative value added to the economy, in spite of the tremendous protection afforded by government pricing policies. Also, all the three sys-

tems showed negative economic profitability, indicating that rice production in Ghana resulted in a loss to the economy (see Table 2).

Table 2 - Summary of Economic Indicators by Production Systems, Ghana, 1986.

Item	Units	Financial (a)	Financial (b)	Financial (c)	Economic (a)	Economic (b)	Economic (c)
1. **OER = c90.00 per US$1.00; SER = C135.00 per US$1.00**							
2. **Gross revenue**							
Yield (paddy rice)	t/ha	1,0	1,6	3,5	1,0	1,6	3,5
Milled (white rice)	t/ha	0,7	1,0	2,3	0,7	1,0	2,3
Gross revenue	t/ha	41600	66560	145600	18395	29432	64383
NPR rice	%				126	126	126
3. **Production costs**							
Traded inputs	t/ha	2,634	10,737	12,730	172	27,058	87,109
Domestic factors	t/ha	25,743	59,632	71,298	25,743	59,632	712,298
Total	t/ha	28,377	70,369	84,028	25,915	86,690	158,407
IT Production	%				10	-19	-47
4. **Milling/marketing**							
Traded inputs	t/ha	1,314	2,103	4,600	2,836	4,538	9,926
Domestic factors	t/ha	2,657	4,252	9,300	2,657	4,252	9,300
Total	t/ha	3,972	6,354	13,900	5,493	8,789	19,226
IT Milling/marketing	%				-28	-28	-28
5. **Total costs**							
Total cost	t/ha	32,349	76,723	97,928	31,408	95,479	177,633
6. **Value added**							
Value Added	t/ha	37,652	53,720	128,270	15,387	-2,164	-32,652
7. **Profit**							
Net Profit	t/ha	9,252	-10,163	47,672	-13,013	-66,047	-113,251
8. **Net foreign exchange earning**							
Net foreign exchange earning (NFEE)	t/ha				171	-24	-363
9. **Domestic resource cost DRC**	t/ha				1,2	-ve	-ve
10. **Effect protection rate EPR**	%				145	-ve	-ve

Source: Computed from Cost and Return Field Data.
(a) Traditional - (b) Intermediate - (c) Irrigated

In order to investigate the effect of relative changes in assumptions regarding the parameters used in the analysis with respect to the DRCs for the different rice production systems, sensitivity analysis was done within an elasticity framework. The assumption here was that the DRCs are likely to be sensitive to the c.i.f. price of rice, yield, labour costs, irrigation/pumping cost, and capital services. Only the parameters for the production systems were considered since post-production activities may not be confined to only one method, and, therefore, have little influence on elasticity values. In this respect, the elasticities are functions of the size of the domestic resource cost and the respective parameter, or the share of the particular factor in the initial total cost of production.

The sensitivity analysis indicates that all the production systems are sensitive to yield and border prices of rice. This means that policies that ensure higher yields on the farmers' fields when matched by higher world market prices for rice will substantially improve Ghana's comparative advantage position in rice production. The traditional system shows high sensitivity to unskilled labour cost, but not to capital services. This is not surprising, since unskilled labour is the most important factor of production in the system; and implies that innovations that save labour in the traditional system will improve its comparative advantage. On the other hand, the improved and irrigated systems are highly sensitive to capital services, indicating that the cost of inputs like machinery and their respective quantities/numbers employed in the production processes significantly effect the county's comparative advantage in rice by these systems.

The sensitivity analysis brings into sharp focus the issue of whether Ghana should continue to promote large-scale rice farming and so use scarce resources to import the necessary machinery and make further investments in irrigation development, or turn to the traditional small-scale rice farmer and improve the prospects of comparative advantage there by means of yield increasing innovations.

Protection of Ghana's Rice Industry through Input-output Prices

Ghana's rice industry continued to enjoy substantial protection from government policies in the mid-1980s. This is demonstrated by the Nominal Protection Rate (NPR) estimates which show the extent of deviation of the domestic price from the border price (see Table 3). The NPR for the period 1970-1986 shows that government pricing policies generated enormous protection for the rice industry. The NPR ranged between 300% in 1976 and 1700% in 1982. This means that between 1976 and 1982, rice consumers in Ghana paid between 3 times and 17 times higher for each kilogram of rice than they could have obtained it at free trade prices (i.e. if there were no restrictions on imports). The implication here is that consumers in Ghana have been taxed (in terms of rice) over the years, not for government revenue (since quantitative restriction through import licensing were used), but as transfer of income from consumers to producers and marketing agents to finance an inefficient rice industry.

The excessive protection given the rice industry could be attributed to (a) an overvaluation of the Ghanaian cedi, and (b) government market intervention policies. Lutz and Scandizzo[2] observe that NPR measures are directly related to foreign exchange shadow rates. Thus the NPR (when a currency is overvalued or under-valued) will be a measure of the equivalent tariff (or

2 Lutz, E. and P. L. Scandizzo (1980): Distortions in Developing Countries: A Bias Against Agriculture. *European Review of Agricultural Economics*. Vol. 7, No.1.

subsidy) implicitly levied against the commodity as a consequence of the overvaluation (or under-valuation), and of the direct intervention.

Table 3 - Estimates of Nominal Protection Rate (NPR) for the Rice Industry, Ghana 1970-86

Year	Border price c.i.f. Tema (cedis/mt)	Domestic price wholesale	NPR %
1970	191.50	269.30	41
1971	171.20	277.93	62
1972	252.60	376.43	49
1973	194.36	451.14	132
1974	466.69	496.22	6
1975	452.76	680.32	90
1976	349.58	1,394.70	299
1977	358.82	1,973.41	350
1978	421.96	2,680.54	535
1979	381.92	3,051.68	699
1980	1,128.00	9,330.00	727
1981	1,271.00	12,440.00	879
1982	748.70	13,330.00	1,680
1983	4,754.00	48,700.00	924
1984	9,266.15	50,000.00	440
1985	12,009.91	64,000.00	433
1986	19,998.00	64,000.00	220

Source : Ministry of Trade, Accra, Ghana.

The implicit tariff (IT) rate estimates which quantity the impact of government policies on tradeable inputs such as fertilizers, show further that the rice industry in Ghana has enjoyed a high level of protection. A positive IT means a disincentive to the use of the input because its price is higher than would be the case without government intervention. Alternatively, a negative IT means incentive is provided to encourage the use of the input.

In terms of production costs, the IT rates were 10% for the traditional system, -19% for the improved system, and -47% for the irrigated system. These figures suggest that while government policies created disincentives for the use of traded inputs in the traditional system, strong incentives were offered for the use of these inputs (i.e. fertilizers and machinery) in the improved and irrigated systems.

The Effective Protection Coefficient (EPC), also expressed as the ratio of the excess in domestic value added over freetrade value added, measures the combined impact of price policies on output and tradeable inputs on producers' incentives, and, therefore, reflects the incentives afforded for invest-

ment in an industry[3]. The EPC for the traditional system was positive, 1.45, which means that on the aggregate, pricing policies offered strong incentives for rice production by this method.

On the other hand, the EPC values were negative for both the improved and irrigated systems. This implies that the returns to domestic primary factors (domestic value added) were much lower economically for the improved and irrigated system than what these factors could earn in a free trade situation.

Thus, returns to factors of production were penalized by the protection system, so that removal of the protection would allow these factors to be employed in more efficient productive activities than the rice industry.

Also, the negative EPC indicates that rice production by the improved and irrigated systems led to an absolute loss of foreign exchange to the economy. This could be attributed to the high cost of traded inputs used in these systems. Since both systems use fertilizer and machinery which are traded, and whose prices have substantially increased as a result of the cedi devaluation (for example, a 65 hp tractor cost ¢35,000.00 and combine harvester cost ¢100,000.00 in 1979/80; and in 1986 (which is the study period) their prices increased to ¢3.5 million and ¢6.9 million, respectively) the overall value added was negative in both cases. Again, this implies that government input price policy resulted in the diversion of factors of production from more efficient activities to a less efficient activity.

As has already been discussed, the comparative advantage analysis of rice production in Ghana indicates that Ghana has no comparative advantage in rice production at the wholesale level. This means that it costs higher to produce rice in Ghana than obtaining it through imports, and therefore an import substitution drive for rice could be detrimental to Ghana's economy. More significant is the fact that both the improved and irrigated systems of rice production show negative DRC estimates, and therefore result in loss in foreign exchange to the economy. In other words, these two system of rice production conclusively lead to social welfare loss.

For example, the figures for Economic Value (EV) added, Net Economic Profit (NEP), and Net Foreign Exchange Earnings (NFEE) were all negative for both the improved and irrigated systems. The irrigated system, however, showed the highest negative figure as shown in Table 2 (EV = ¢32,652/ha; NEP = ¢113.151/ha; and NFEE = US$ 363/ha), indicating that the irrigated system has the highest economic loss or social welfare cost and therefore higher loss of foreign exchange.

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3 Corden, W. M. (1966). The Structure of a Tariff System and the Effective Protection Rate, *Journal of Political Economy* Vol.74.

It could the deduced then that even though government policies have favoured and protected the domestic rice industry, rice production in Ghana has so far been detrimental to the country's economy. It is therefore necessary that government takes a critical look at her policies related to rice vis-à-vis the country's rice production potentials.

Ghana's Domestic Rice Prices and World Market Prices

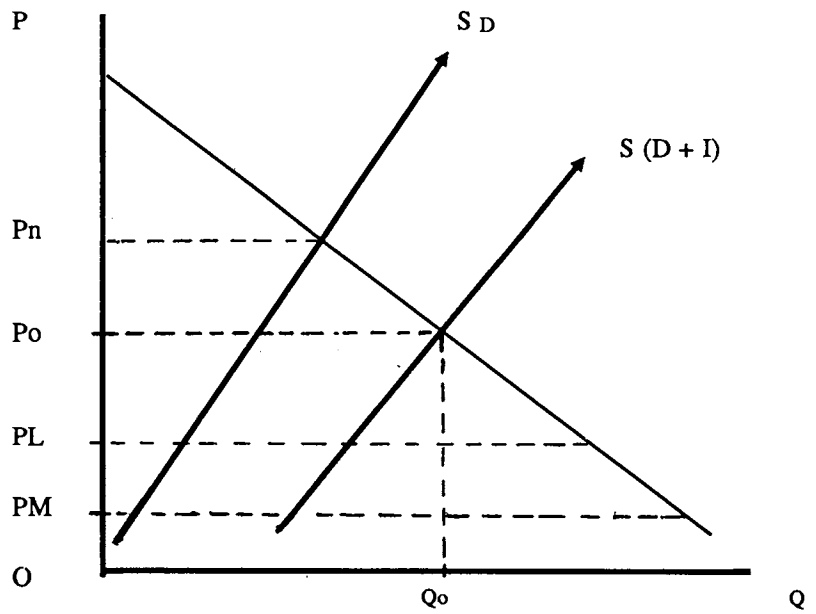
Government policies which have affected rice marketing in independent Ghana have been:

(a) Trade restrictions for imported rice through an import licensing system;

(b) Floor (support) and ceiling prices for domestically produced rice.

Even though government was able to control the prices of imported rice at the official distribution centres, there has been no effective machinery to control the prices of locally produced rice. Subsequently, there has existed three price regime for rice in Ghana, namely: (1) official prices for imported rice (which have been lowest), (2) official prices for locally produced rice, and (3) open market prices for both local and imported rice which tend to equalize. This is explained in Figure 1. The resultant effect is that the actual market prices faced by consumers in Ghana have always been higher than the government official prices which have been the same throughout the country (regardless of distribution costs).

Fig. 1 : Rice Price Regimes in Ghana, 1980-87



D = Demand Curve for rice (which is relatively elastic)
Sd = Supply Curve for rice if there were no imports
S (D+I) = Supply Curve for rice (local rice plus imports)
Pn = Price of rice if there were no imports
Po = Open market price for both local and imported rice
PL = Official price for locally produced rice
PM = Official price for imported rice.

For example, in 1981 when the border price was ¢1.27/kg for imported rice, the official retail price was ¢4.00/kg which was more than 3 time higher. But the open market price for the same period for both local and imported rice was ¢29.90/kg; about 7 times higher than the official retail price, and 24 times higher than the border price.

The divergence in rice prices in Ghana reached a peak in 1984. The 1984 official retail price for imported rice was ¢11.40/kg, and that for local rice was ¢50.00/kg, which was more than 4 times higher. But the open market price for both local and imported rice was ¢171.61/Kg about 15 times higher than the official price, and 18 times higher than the actual border price (c.i.f. Tema price was ¢9.27/Kg). Thus consumers in Ghana have paid very high prices for rice as compared to the prevailing world market prices. Table 4 and Fig 1. show these three price regimes.

Table 4 - Official Retail Price versus Open Market Price* for Rice (cedis/kg), Ghana, 1980-87

Year	Official Price		Open Market Pric	
	Local	Imported	Local	Imported
1980	9.33	9.33	-	-
1981	12.57	4.00	29.90	29.90
1982	17.76	4.60	42.32	42.30
1983	48.70	11.40	115.98	115.98
1984	50.00	11.40	171.61	171.61
1985	64.00	36.00	96.00	96.00
1986	64.00	36.00	96.00	96.00
1987	96.00	50.00	100.00	1000.00

* Some of these figures have not been officially documented.
Source: Ministry of Agriculture, Accra.

Conclusion

This paper has attempted to analyze the misallocation of scarce resources in favour of rice production in Ghana in an effort to increase domestic rice output and attain rice self-sufficiency, using the DRC criterion as a measure of comparative advantage. The analysis has shown that even though Ghana has no comparative advantage in rice production at the wholesale level, government policies have highly favoured domestic rice production. This resulted in high domestic rice prices as compared to border prices (sometimes

sulted in high domestic rice prices as compared to border prices (sometimes more than 10 times higher) and subsequently high consumer welfare losses. High subsidies on inputs like fertilizer and machinery resulted in gross misallocation of resources as large area expansion and large-scale rice farming, as well as expensive irrigation projects were under-taken; such that the minimal increases in rice production over the years could not compensate for the huge investment costs incurred by government in pursuing a programme for self-sufficiency in rice.

On the basis of the foregoing analyses, it seems appropriate to discourage rice production in Ghana for reasons of economic inefficiency. For example, if one looks at the Net Economic Profit (NEP) which is negative for all these systems (see Table 2), but least for the traditional system (NEP = -¢13,013/ha), and with a conservative estimate that each of the three systems considered resulted in a loss of ¢13,013/ha to the economy, one could conclude that for the 1986 crop season alone, the total loss to the economy through rice production (area harvested conservatively put at 60,000 ha) amounted to at least ¢781 million (or US$8.7 million). This is a huge loss to a developing economy like that of Ghana saddled with balance of payment problems and foreign exchange constraints.

However, if the government's decision takes into account other issues such as food security and income distribution, then it will be more economical and socially beneficial for the government to direct attention towards the traditional small-scale rice farmers where a relative comparative advantage in rice lies. This will allow only large-scale farms which are relatively efficient to survive while marginal farms phase out gradually. Moreover, these small-scale farmers will gradually acquire the techniques and management skills for modern rice cultivation practices, and thereby improve rice yields on their farms which are rather low at present.

It is envisaged that favourable government policies such as adequate and effective support prices, adequate and timely provision of credit facilities, and an improved input delivery system will not only help small-scale (traditional) rice farmers to increase rice production, but also facilitate the movement of income towards the rural sector. And higher rural incomes mean higher nutritional status and higher level of welfare for the farmers.

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Appendix 1

The Methodology

Scandizzo and Bruce (1980) have outlined methodologies for analyzing government market intervention effects and the social/economic cost of productive activities. These methodologies have been adopted and modified for the Ghanaian situation in this analysis.

Inn order to ascertain the comparative advantage of rice production in Ghana, the Domestic Resource Cost (DRC) criterion was used.

Estimates were made also for the Nominal Protection Rate (NPR), Effective Protection Coefficient (EPC), and Implicit Tariff (IT) rate as a means of assessing the impact of government input-output pricing policies.

Since the estimation of the DRC is based on certain assumption, a sensitivity analysis was also done to reflect the effect of changed assumptions on comparative advantage.

Nominal Protection Rate (NPR)

The NPR measures the rate at which the domestic price of a final output (rice) deviates from the world or border price.

In formula:

$$NPR = \left(\frac{P_jd}{P_jb} - 1 \right) \times 100$$

NPR > 0 means protection to domestic producers
NPR < 0 means penalty on domestic producers

A related measure is the Implicit Tariff (IT) rate which helps to quantity the impact of government policies on tradeable inputs.

$$IT = \left(\frac{P_id}{P_ib} - 1 \right) \times 100$$

IT > 0 means disincentive to the use of the input.
IT < 0 means incentive for the use of the input.

where

P_jd = domestic price of output
P_id = domestic price of input
P_jb = border price of output
P_ib = border price of input.

Effective Protection Coefficient (EPC)

Balassa (1975) defines the EPC as the ratio of the domestic value added, obtained as a result of the application of protective measures, to value added in world market prices.

This ratio of excess in domestic value added over free trade value added indicates the combined impact of price policies on output and tradeable in-

puts on producers' incentive, and therefore reflects the incentive afforded for investment in the rice industry (Corden, 1966). Thus the EPC could give an indication of the direction of movement of resources in terms of the rice industry.

In expression:

$$EPC_j = \frac{Va^d_j}{Va^b_j} = \frac{\text{Value added (financial)}}{\text{Value added (economic)}}$$

By decomposing it into input and out components,

$$EPC = \frac{P^d_j - \sum_{i=1}^{k} aij\ p^d_i}{P^b_j - \sum_{i=1}^{k} aij\ p^b_i}$$

where

aij = quantity of the ith input used to produce one unit of the jth output
P^d_j = domestic price of the jth commodity
P^b_j = border price of the jth commodity
Pi^d = domestic price of the ith input
Pi^b = border price of the ith input.

By way of interpretation:

EPC > 1 means protective measures provide positive incentive
EPC < 1 means protective measures discriminate against rice.
EPC < 0 signifies an absolute lose of foreign exchange.

Domestic Resources Cost (DRC)

Simply defined, the DRC is a measure of the social opportunity cost (in terms of domestic factors of production employed directly and indirectly) of earning a marginal unit of foreign exchange. Ghana has comparative advantage in rice vis-à-vis the rest of the world if domestic cost per unit of rice is less than the shadow exchange rate. This can be expressed as:

$$DRC = \frac{\text{Opportunity Cost of Domestic Resources (in domestic currency)}}{\text{Net foreign exchange earned or saved (in foreign currency)}}$$

Algebrically,

$$DRC = \frac{\sum_{s=1}^{n} Ysj \; MPP_s^b \; P_s^d}{P_j^y - \sum_{i=1}^{m} aij \; P_i^y}$$

where,

Ysj = quantity of primary traded factors used in producing a unit of the ith commodity
MPP_s^b = Marginal physical product of the sth input in its best alternative use (b)
P_s^d = domestic price of the sth input
P_j^y = foreign price of the jth output

then,

DRC < 1 means Comparative Advantage
DRC = 1 is Neutral
DRC > 1 means Comparative Disadvantage

Shadow Exchange Rate (SER)

Due to price distortions, the official exchange rate (DER) does not normally reflect the free trade equilibrium rate or the shadow exchange rate (SER). In this study the SER for Ghana was estimated, following Medalla (1979), and the World Bank's study on "Ghana: Policies and Programme for Adjustment" (1984).

In formula :

$$SER_t = OER_t (1 + b)$$

where b = premium put on foreign exchange

Considering the rather erratic movement of Ghana's exchange rate for the cedi since 1983, and the approach used by the World Bank in the 1984 study, the premium put on foreign exchange for this study was taken to be 50%.

SER 1986 = 90 (1 + 0.5) = 135

Exchange rates (cedis/US $ 1.00)

1978/82	..	..	..	¢02.75
1983	..	..	..	¢30.00
1984	..	..	..	¢35.00
1985	..	..	..	¢59.88
1986	..	..	..	¢90.00
1987 May		..	..	¢149.25

Sensitivity Analysis

In an effort to approximate the effect of dynamic changes within the system with regards to the major variables in the estimates, sensitivity analysis was done on these variables within an elasticities framework.

In expression, the elasticity E is :

$$E_i = \frac{\Delta \text{ DRC coeff. / DRC coeff.}}{\Delta \text{ i item / i item}}$$

It is to be noted that in interpreting these elasticities reference should be made to the importance of that item or factor in the total cost. This is because the relative magnitude of the elasticity of any given shadow price depends on the importance of that factor in the total cost. As a result, unimportant factors have low elasticities. Also, the estimates are point elasticities, and they are probably valid for only small changes in yield and factor costs.

Appendix 2

The analysis centered on three categories of rice production systems which are considered to embrace the major micro rice ecologies found in Ghana. These are:

(a) The traditional system which includes rice production practices in both the forest and savannah zones of Ghana which use neither mechanization nor modern inputs like high yielding varieties and fertilizers, and are totally rainfed (ie upland rice);

(b) The improved, semi-intensive system which refers to rice cultivation practices which are partially mechanized, use modern inputs, and supplement rainfall with pump irrigation from nearby rivers and ponds; and

(c) The irrigated, fully mechanized intensive system under which all farm operations are mechanized (except sowing and fertilizer application), which uses modern inputs, and depends mainly on government (large irrigation projects.

Essential features of these rice production systems are summarized below:

Major rice production systems in Ghana

	Unit	Rice system		
		Traditional	Improved partially mechanized	Irrigated fully mechanized
Nature of rice culture		less-intensive	semi-intensive	Intensive
Yield	t/ha	1,0	1,6	3,5
Labor	man-days/ha	113	209	159
Varieties (seed)		local	modern	modern
Fertilizer				
NPK (15-15-15)	Kg/ha	nil	200	400
Sulphate of ammonia	kg/ha	nil	75	150
Cultivation	-	manual	tractor	tractor
Harvest	-	manual	manual	combine
Extension contact	-	nil	yes	yes
Capital source	-	traditional	banks	banks
Water source	-	rainfed	mainly rainfed	irrigated

Source: Ministry of Agriculture, Accra; Irrigation Development Authority (IDA), Accra, and Crop Service Department, Accra.