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THESIS TOPIC: A STUDY ON RICE PRODUCTION IN SIERRA LEONE: INVESTIGATING CONSTRAINTS

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A Study on Rice Production in Sierra Leone: Investigating Constraints

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DECLARATION

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other University. I also declare that all sources of material utilized for this thesis have been fully acknowledged.

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LIST OF ACRONYMS

AERC	African Economic Research Consortium
BSL	Bank of Sierra Leone
DFID	Department for International Development
FAO	Food and Agriculture Organization
ha	Hectare(s) of Land
IADP	Integrated Agricultural Development Project
IFS	International Financial Statistics
IMF	International Monetary Fund
IRRI	International Rice Research Institute
LDCs	Least Developed Countries
mt	Metric Ton (s)
OIC	Organization for Islamic Countries
PEMSD	Policy Evaluation and Monitoring Sub-Division
PIP	Public Investment Programme
SLASMP	Sierra Leone Agricultural Sector Master Plan
SLPMB	Sierra Leone Produce Marketing Board
USDA	United States Department of Agriculture
UNECA	United Nations Economic Commission for Africa
WARDA	West Africa Rice Development Association

DEDICATION

To Mom and Dad

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ABSTRACT

Rice is the staple food of Sierra Leone with no close substitute. The crop accounts for the largest share of the agricultural GDP of the country. However, its production has been declining over the past two decades. Sierra Leone was once an exporter of rice until 1953; thereafter importation assumed the main source of supplying the grain for domestic consumption as production could no longer meet local demand. Decline in the domestic production of the crop has had severed sosio-economic implications ranging from hiking consumer prices to balance of payment problems and debt burden. The country is reported with huge potential for increased agricultural productivity but the situation has rather been let to degenerate to a state where she has to depend on international market and aid for the supply of her staple food. The objective of this study is therefore to investigate the constraints underlying the decline in the crop's production in Sierra Leone. The trends behind the decline are explored with the aim of explaining the factors that emerge therein. The tools employed for analyzing the problem involved a thorough descriptive statistical analysis, coefficients of protection analysis (using nominal protection coefficient), and a supply response analysis using a time series regression framework (for the period 1964-1998) within the context of the Nerlovian supply response approach. Major constraints found negatively impacting on output of the grain are such as price disincentives to farmers (though with low response); the coefficient of public investment is negative, suggesting inter alia that concentration of public expenditure on providing social infrastructure that are limited to urban areas serves to attract rural labour; there is problem of disproportionate attention on traditional upland farming system which is less productive compared to lowlands; the macroeconomic environment has not been conducive; market institutions were weak (a problem that is aggravated by infrastructural bottlenecks); modern farming implements and fertilizers were in low use; rice technological approach did not seem to be appropriate; these are some of the constraints highlighted among the lot in this study. Recommendations are made toward the findings.

CHAPTER 1

INTRODUCTION

1.1 Background

Rice has been ranked quite high among the most important food crops in the world; it is a staple food for over half the world's population, particularly in South-east Asia with rapidly growing populations (Grist, 1988). The global area under rice cultivation exceeds 200 million acres with 90% being farmed in Asia alone (Grist, 1988; Plucknett, *et al*, 1999). That makes rice a major contributor to the Asian economy. The formation of the International Rice Commission under the auspices of the UN and other international organisations was in recognition of the importance of the crop toward increasing world food production.

Rice is widely acknowledged in Africa as staple for a number of countries on the continent for which Sierra Leone is very well known in the West African sub-region (Doyle, 1966). However, the African continent has witnessed a sharp drop in per caput agricultural food production during the last three decades and effort are underway to reverse that trend by significantly increasing food supplies for its growing population. For example, while agricultural output grew at the rate of 1.9% a year in sub-Saharan Africa between 1970 and 1990, the regions population growth rate

averaged 3% (World Food Summit, Burkina Faso, 1996). Food production has been increasing faster than population in most parts of the world but sub-Saharan Africa has been falling behind with the exception of few countries like Burkina Faso, Mozambique and Zimbabwe, recorded to have made some progress toward food security (ibid). This discrepancy between production and increased population growth in Africa is having negative effects including external debt burden, which rose from $84 billion in 1980 to $289 billion in 1993 (World Bank Report as cited by FAO). According to FAO, of the 32 million people receiving relief assistance from the world food programme in 1994, about 21.5 million were Africans, with two thirds being victims of wars. The obstacles cited in the literature affecting agricultural productivity in Africa are drought, diseases, pests, lack of adequate irrigation, limited fertilizer use, armed conflicts, and inappropriate national policies.

As well as several other economies, rice occupies a centre stage in the economy of Sierra Leone; its state of production has both socio-economic and political implication. The country was an exporter of the crop until 1953, according to FAO. Since 1955, however, it has not been able to meet domestic needs; rice importation was resorted to, with imports averaging $ 2.7 million annually between 1960 and 1970 (Due and Karr, 1973).

1.2 Research Problem

Production of rice as a staple food in Sierra Leone has been declining over the last two decades. Population and demand for the grain have been on the increase while area cultivated to the crop showing negative trend. Soil fertility has decreased because of shorter fallow periods and the latter has not been compensated for by use of fertilizer or organic manure. Therefore yields have been fluctuating with an overall negative trend. The resulting food shortages have led to increased rice importation that in turn has drained the country's foreign exchange. The associated socio-

economic implications include high consumer prices, balance of payments problems, and external debt burden. The research question in then: why rice production has been declining in Sierra Leone? What factors explain this decline?

1.3 Objectives of the Study

The purpose of the study is to investigate the root constraints underlying rice production in Sierra Leone. This leads to the specific objectives as follows:

- To empirically explore the trends surrounding the decline in the crop's performance.
- To explain factors behind these trends.
- And to draw policy implications and suggestions toward a sustainable food self-sufficiency in the country.

1.4 The Hypotheses of the Study

- Rice production declines in Sierra Leone due to producer disincentives that may have emanated from unfavourable agricultural pricing and economywide policies discussed in the literature.
- Nonprice factors like infrastructural bottlenecks, poor mechanization, and inadequate irrigation schemes limit the production of the crop.
- Production declines due to shift of rural labour to the mining and urban areas.
- Increased rice importation deters domestic production of the grain.

1.5 Significance of the Study

Food insecurity could be the worst enemy to human survival. Achieving self-sufficiency in rice in Sierra Leone via boosting domestic production of the crop should be the basis for eradicating hunger and attaining a sustainable food security in the country [1]. Elegant initiatives and plans seem

[1] In the case of Ethiopia, DFID 2001 in its determination to assist the Ethiopian government in ensuring food security for the people emphasized domestic production, that sources like food aid are not reliable given costs of storage, transportation and administration associated with it; suggested thus to look into hindrances to rural output growth such as infrastructural hitches to increase local food production. For other reasons on the unreliability of food aid, see Srinivasan (1989).

to have been pursued toward this direction but results are rather disappointing--- demand for rice is in excess while its importation continues to be the main source of supply. Thus, to firmly arrest the undesirable rice situation of Sierra Leone, the first step forward, which is the concern of this research, is to discern the root constraints underlying domestic rice production in the country.

Including a supply response analysis, a tool that is rare in studying agricultural output in the literature of Sierra Leone, this research employs a joint-approach in investigating the problem under study for a meaningful policy prescription.

1.6 Limitation of the Study

The findings of this research are subject to the problems encountered along the course. Data acquisition was seriously constrained. There was intention initially to estimate a cross section regression to compare results with time series but because of extreme difficulties encountered in trying to obtain a reliable cross section data, the econometric analysis of the problem is only limited to time series estimation. Carrying a survey was infeasible because farmers in Sierra Leone were yet to come to resettlement for serious farming activities following the just ended civil war. This reason, coupled with the small time my research airticket permitted me to conduct research in Sierra Leone, and the incomprehensiveness of published agricultural surveys, makes cross section comparison with time series results impossible in this study. The limited cross section data

obtained is then only utilized under the descriptive statistical analysis. For time series regression estimation, this paper is prone to the inconsistency of the secondary data used, a common phenomenon with developing economies studies. Different Data Tables hardly present the same data series and it is almost impossible to get all data from the same Table. Data on some variables are not exactly obtainable as their measurements pose some difficulties; therefore proxy variables are used in this direction. For extreme quantifiability problems those relevant variables concerned are limited to simple theoretical discussion.

1.7 Organization of Report

The next chapter is the literature review. Chapter 3 discusses background situation to the economy of Sierra Leone with emphasis on agriculture; here, development plans and initiatives are reviewed generally, then ad hoc arrangements for increased rice production examined. Chapter 4 shows the methodology used by this study, while 5 is the descriptive statistical analysis of the constraints facing rice production. Chapter 6 presents and discusses empirical results from coefficient of protection calculations and regression estimation of the supply response model. Chapter 7 is the conclusion of the study; it summarizes the findings and draws up recommendations.

CHAPTER 2

LITERATURE REVIEW

The objective of this chapter is to explore the literature on the constraints limiting food and agricultural production in general, and Sierra Leone in particular.

2.1 Theoretical Literature

In investigating agricultural potential of Mid-Africa, Seckler *et al* (1991) argued that the low agricultural productivity of the region is a result of technological deficiency than changes in institutions and polices. They stated: " Agriculture is fundamentally biological process of production that ultimately can only be improved by changes in biochemical inputs. Changed institutions are effective only in so far as they affect biochemical process ". Looking into the dominating subsistence type of farming in Africa, the authors ascribed this nature of farming to the use by farmers of negligible amounts of fertilizers, pesticides, machinery, and other purchased inputs, while land and human labour representing the main factors of production. They found in Mid Africa that nearly all crop production takes place under rainfed conditions while irrigated area falls below satisfactory proportions. Discussed alongside these constraints are infrastructural bottlenecks; poor roads tend to discourage economic activity by making it unprofitable for farmers to buy input or sell their produce. It is argued for many coastal African cities that, it is less costly to import food from Europe and North America than to transport food produced in domestic rural areas, making the region rely on both commercial and concessional imports for a significant proportion of their food supply, suppressing the market for domestic agricultural output and hence lowering production and increasing import needs.

Policies pursued by African governments have had their own share of the blame for the poor state of agricultural growth in Africa. There is strong advocacy that for agriculture to progress farmers must receive price incentives and government must make investments that will complement private sector initiatives. Major parts of Africa are reported to have experienced inappropriate policy structures affecting agriculture. Overvalued exchange rates, cheap food prices, and low investment in agricultural research are instruments of such policies discovered impeding agriculture (Amin, 1996). Nor had Structural adjustment policies implemented in many African countries been reported with much success in alleviating growth problems in the region (see empirical review below). International policies pursued are thought to have buttressed the poor performance of agriculture in developing countries. Distortions in world markets caused by farm support programmes in the United States and Europe have harmed farmers in Africa (Srinivasan, 1989; Seckler *et al*, 1991). Untold international debt burden (FAO 1996) is a serious constraint facing farm production in Africa, with its servicing causing public investment to cease and living standards to fall in several countries.

Replacing soil fertility in agriculture is another issue, in respect of fertilizer procurement, its proper management, farming system cultures, land use management, etc. The role of chemical fertilizers is seen central in meeting agricultural needs of Africa, but this has been bottlenecked by a number of factors reflected in the low rate of fertilizer use of the continent. The productive capacity of this input is reportedly very low or virtually nil in African countries owing to the limited potential for the exploitation of the raw material (FAO 1986). In 1983, of the world chemical fertilizer produced, the percentage of tons produced by Africa as reported by FAO is 0.1 (197,000 nutrient tons). The low use rate is promoted by the restricted cash flows faced by farmers due to receipts of poor price incentives and scarce foreign exchange exacerbated by devaluation policies implemented in African countries. This makes importation of fertilizer difficult. The

literature brings to light, however, that chemical fertilizers alone cannot solve the problem of soil fertility declines in Africa. Crucial alongside chemical fertilizer application is awareness of the implication of loss of natural soil fertility. Many authors agitate for more concentration on organic matter content of the soil than the application of manufactured chemicals (Plucknett, *et al*., 1999). Excessive application of chemical fertilizer (even intensive irrigation) is proved to cause soil degradation--- it increases soil acid content, weakens the natural control system of crops, natural enemies of pests proved in many cases to be more effective in crop protection are destroyed as a result (ibid; Srivastava, *et al* 1999).

Inadequate fallow periods that emanate from inefficient farming practices are mentioned as a setback to the process of recycling soil micronutrients; this is often the outcome following population pressure on farmlands. Srivastava *et al* (1999) emphasized the feedback ecological effect of mismanaged agricultural activity. They stated in the case of Punjab, India, that, "Indiscriminate application of chemical inputs, improper management of water for irrigation and continuous cropping with rice and wheat have damaged soil health and structure, and depleted the water table. Neglect of the significance of biodiversity in carrying agricultural intensification would lead to erosion of micronutrients, and biological agents useful for reducing pest damage." They recommended thus for mainstreaming biodiversity in agriculture and that this could only be successful if those considered as ultimate managers---farmers and livestock raisers---are involved in the design and implementation of research and development projects, for they are deemed major stakeholders that can provide valuable insight on sustainable ways to use and manage those organic resources. It is argued however that, sound practices could only be implemented at community and farm level if the necessary policy environment and incentive structures are fetched so that farmers could follow programmes of sustainable land use and management systems.

In light of the foregoing, we would next look at specific areas affecting agriculture that have bean of exclusive and prominent focus in the theory.

2.1.1 Price Policy

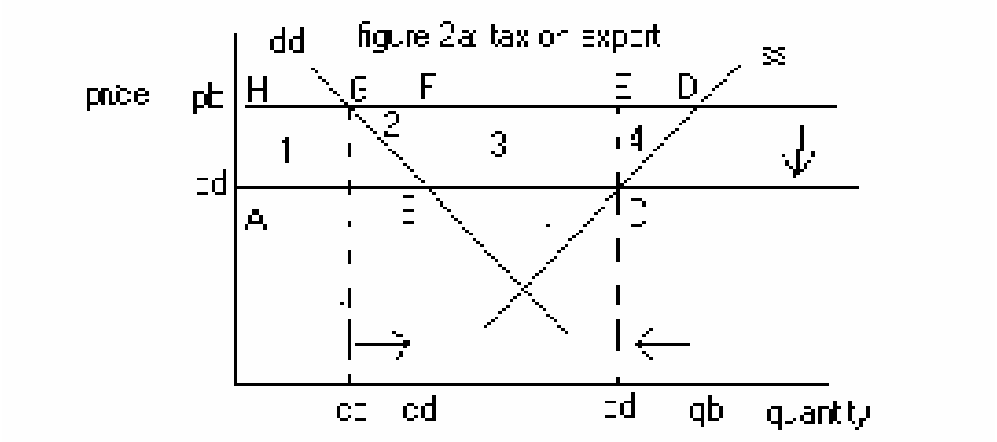
Price policy analysis has been found pivotal in agricultural production studies, price being fundamental in determining farm output. In theory, following the neoclassical economic perspective regarding optimization behaviour of the farm, price is seen as most relevant factor that influences production levels, in that *ceteris paribus* an increase in price level of output increases returns to factors of production thereby giving producers incentives to employ more input and produce more output. While for different goods, a relative change in price brings a shift in production from one output to the other via resource reallocation, as adjustment is made in response to changing relative profitability of different outputs. The latter could explain why cross-border activities sometimes arise including smuggling in a situation where decline in producer prices relative to those in neighbouring countries induces domestic movement of resource between crops, sometimes from staple to cash crop, taking advantage of price incentives in nearby nations (Ellis, 1992; and Fosu, 1992; Srivastava*, et al*, 1999).

To achieve farm output price policy objectives is a conflicting thing from socio-economic and political standpoints. Primarily (Ellis, 1992), these objectives are: to influence agricultural output, to achieve desired changes in income distribution, and to influence the role and contribution of the agricultural sector to the overall process of economic development; but they conflict themselves. Reaching desirable changes in income distribution by, say, lowering food prices increases income status of the nonfarm rural and urban poor against increasing farm output. Attaining economic growth and development may induce advocacy for policies that favour industrialization against

agriculture [2] . Simplification of this gamut of policy complexities is largely a matter of prioritisation and direction of objectives in the best interest of society. In developing nations today policies are highly dictated by socio-political objectives, and it is for this food policy is given special review in the next section. Agriculture is affected whichever of these objectives pursued. The following is an analysis of the effects of selected price policy instruments on agricultural crop.

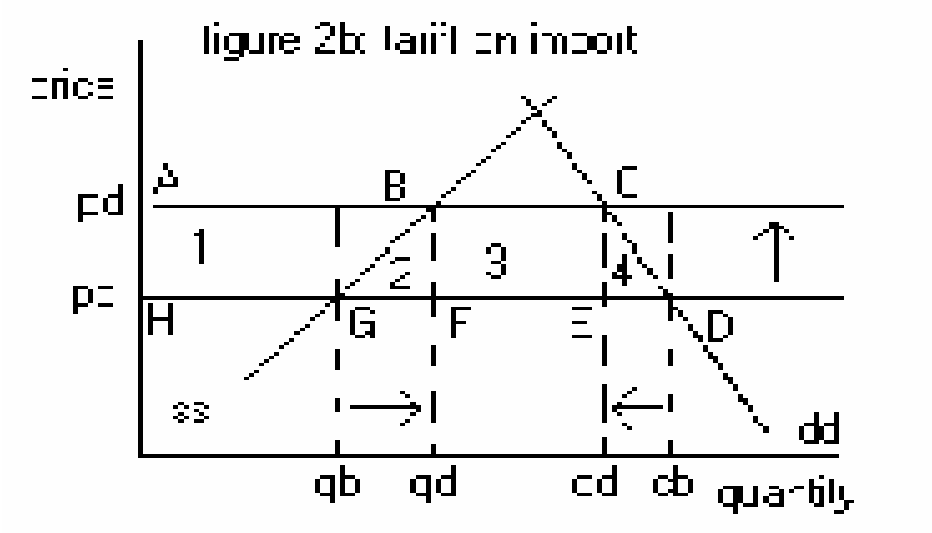
EFFECT OF EXPORT TAX: A tax on export crop is expected to lower the domestic price below the border price [3] as illustrated in Figure 2a, and bring about an increase in consumer welfare as represented by the change in consumer surplus of area 1 of this Figure. Export tax has the effect of transforming a tradable into nontradable with lower price. The consumers gain because receive lower domestic price as the commodity's supply increases domestically due to the tax on its exporters. Government budget increases, as area 3 reflects. Gains to consumers and government come as transfer of revenues from the producers. The loss to the producers is more than the gains to government and consumers as the Figure depicts. That is, the producers also lose area 2 and 4, but since no one gets these benefits, they represent social loss referred to as total efficiency loss to the country. Area 2 is the net social loss in consumption while 4 in production (Sadoulet and de Janvry 1995; Tsakok, 1990; for detail). Balance of payment deteriorates because export reduces while import increases. The total producer loss is represented by area 1, 2, 3, and 4.

[2] Earlier development strategies including import substitution initiatives in favour of industrialization are accused to have undermined agricultural growth in developing countries (Timmer, 1988; Todaro, 1995).
[3] Border price is world price converted into domestic currency using appropriate exchange rate. It is considered as efficient price with which domestic producer price is compared. See Appendix B for more explanation regarding it.



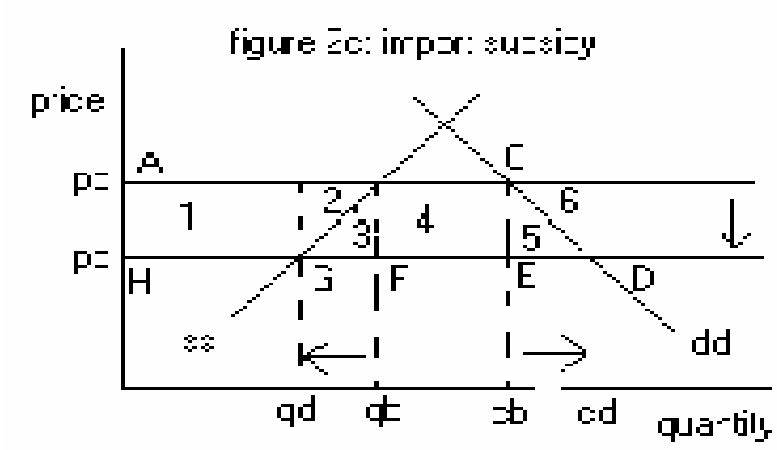
dd = demand curve, ss = supply curve

TARIFF ON IMPORT: Figure 2b illustrates this effect. Consumers lose here because the domestic price they pay is above the border price when tariff is imposed on imports, which would have competed with domestic produce. Producers gain because they are protected from foreign competition. Government still gains, but society loses following the same logic as Figure 2a. Balance of payment improves in this case.



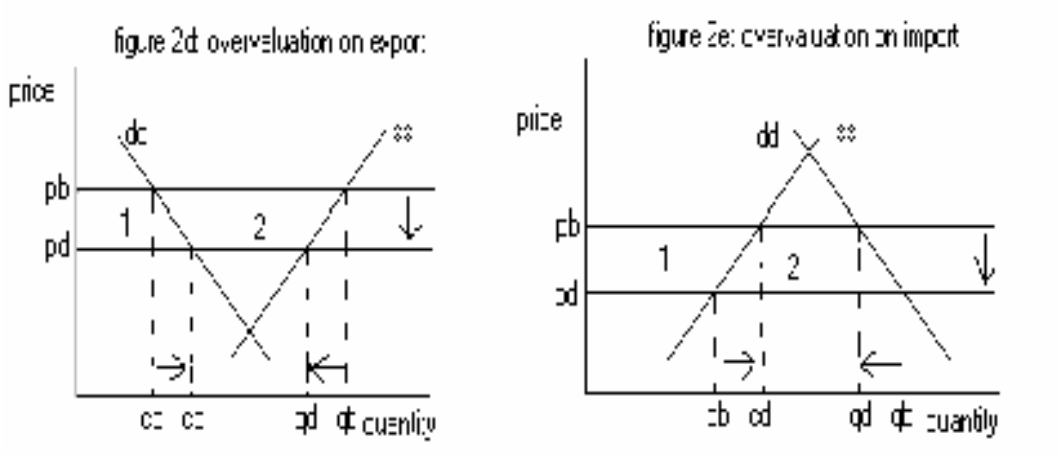
dd = demand curve, ss = supply curve

SUBSIDY ON IMPORT: See Figure 2c. Here producers lose because imports are encouraged with the effects of pulling down domestic price below the border. Producer surplus falls by the amount of area 1 & 2. Consumers gain by area 1, 2, 3, 4, & 5, a gain due to the loss to producers (1 & 2) and to the government (2, 3, 4 & 5). Efficiency loss is 2 & 6, 2 in production and 6 in consumption, noting that the social loss in domestic production in this case is a gain to consumers because government subsidizes its supply by importation; but is an efficiency loss because it could have been produced cheaply domestically in the absence of the distortion (subsidy). Balance of payment deteriorates as in export tax situation. The overall government budget expenses are represented by the sum of areas 2, 3, 4, 5 & 6.



dd = demand curve, ss = supply curve

OVERVALUATION OF EXCHANGE RATE: This effect is explained in Figure 2d and 2e where a country is net exporter and net importer respectively of the crop is question. In either case this policy steps down the domestic price of the good below its border in favour of consumers as against producers. In Figure 2d, the revenue transfer from the producers to the consumers is represented by area 1 (consumer surplus) while the social loss by 2. The budget change is positive



dd = demand curve, ss = supply curve

because overvalued currency is regarded as implicit tax on exporters; the social loss to the country goes to foreign importers as gain. In Figure 2e, area 1 denotes gain to consumers as in 2d, but they gain an additional subsidy denoted by area 2 in the form of a tax on foreign exporters, if foreign exporters continue to export, as they will receive lower prices for their sales given overvalued domestic currency. In both Figures balance of payment is deteriorated. Table 2 summarises the effects of these policy instruments.

Table 2: Summary of effects of price policies demonstrated above

Policy	Effect				
	ΔPS	ΔCS	Δ BoP	ΔB	ΔNSL
Export tax	-	+	-	+	-
Tariff on import	+	-	+	+	-
Subsidy on import	-	+	-	-	-
Overvaluation	-	+	-	+	-

Δ is change, PS, producer surplus, CS, consumer surplus, NSL, net social loss, B, government budget, BoP, balance of payment.

From table 2, with the exception of tariff on import, the rest of the policies appear to discourage domestic producers of the crop with BoP affected in the same direction. These policies depict trade-offs-----i.e, protecting consumers means discouraging domestic production of the food crop and a decline in the balance of payment. Throughout, the policies signal negative effect on society because they are distortionary. In that, they do not reflect relative scarcity of the resources by producing the right prices.

2.1.2 Food Policy

Serious dilemmas are encountered in pursuit of food policy objectives, trying to ensure sufficient food and making sure that all people have access to the food for eradicating poverty and associated risks through reducing undernutrition and starvation in different groups of the population. While efforts are being made in many developing countries to increase domestic food production, food prices are at the same time deliberately brought down to a considerable low to meet food needs for all (FAO 1996). Such policy approach may not yield desired results. In most developing countries, sub-Saharan Africa in particular, the greater proportion of food produced comes from private small-scale rural households who sell and consume part of their produce, selling to earn cash to meet other basic needs like education for their children, clothing, shelter, etc. Thus the farm household sector would need incentives in the form of increased prices for their product if more is to be produced as opposed to the need for lower prices for the welfare of nonfarm sector and urban poor. Otherwise farmers may have to weigh between on-farm and off-farm wage incomes, going for the latter if it maximizes their welfare (Singh, I, *et al*, 1986). Let us see some details about food policy implications for domestic food production.

2.1.3 Food Policy Implications

Two main objectives are derived from the definitions of "food policy" and "food security" used in the text by Ellis (1992). Appendix B features these definitions. The first objective is to ensure sufficient availability of food at all times, emphasizing the supply side of the policy. Second is to ensure that all people acquire food at all times, the demand side emphasis. The first objective encompasses not only domestic production but also importation of food and food aid to fill out supply gap in event domestic food output falls short of food requirements, a World Bank standpoint. But these alternative sources of food supply/augmentation have the effect of lowering domestic food prices thereby discouraging local production. On efficiency ground one could assert that imports are necessary where domestic cost of production outweighs border import cost, but advocated in many food strategies for predicating self-sufficiency in staple food on domestic production is the lesson that world markets are unreliable and unpredictable (Srinivasan, 1989; Ellis, 1992). From the macroeconomic front, importation of food would mean depletion of foreign exchange reserves, and for foreign exchange deficient countries this may consequently lead to incurring huge external debt. High-level debt financing implies drastic reduction of both public and private investment funds, thereby undermining economic activities with agriculture most affected in many countries. Hence a vicious circle of policy approach----from 'low-level food supply' to 'low-level food supply'.

The second identified objective of food policy (demand side) advocates food distribution to and access of food by all people. It examines the nutritional status of the population by identifying those individuals whose nutritional value is below the minimum required for healthy survival; purchasing power of different groups is ascertained and policy to improve their access to food

devised [4]. What is detested on this side, though, is that instruments commonly used in developing countries to make food accessible to consumers tend to discourage producers of the food (recall the price policy instruments discussed above), another vicious circle of policy approach---- lowering food prices implies discouraging farmers, falling output, and hence decreasing consumers' access to food than it is contemplated. Pursuing food security is paramount as an ongoing world concern for poverty alleviation and ensuring social stability in poor countries. But for this to be sustainable the policy framework has to be such that an already resented food situation would not be worsened. Many recommend incentives for food producers as top priority while other instruments to increase consumers' command over food are utilized than low food prices. To protect both sides, one way suggested by Timmer *et al (*1983) is to keep farm prices high and consumer prices low by minimising the marketing margins, so that costs incurred by farmers during production and processing of food are reduced. Other instruments suggested, in favour of the consumers in particular, are dual price system, food stamps, and a special attention to poor people's food (ibid). Noted however is the serious fiscal implication that the implementation of such dilemma-resolving policies would bring about as it requires heavy subsidization while the incidence will rest on the tax payers. Some of them have only been experimented by developed and few developing countries. Thus other thoughts recommend income generating programmes for consumers; creating employment, initiating food-for-work programmes, etc.

We move next to other crucial issues facing agricultural productivity.

[4] In Frank Ellis, a comprehensive food policy tries to keep in balance "food availability" to "food requirement" equation or "food supply" to "food demand" given that food self-sufficiency could be achieved but not food security until entitlements are made available to all people in terms of providing them with the ability/purchasing power to access food and at all times, for only then we can talk about an accomplished food policy objective.

2.1.4 Rural Finance

In Africa, agricultural deterioration is largely a failure of effective integration of formal credit institutions into the rural sector albeit the rural areas disproportionately constitute the greater part of agricultural activities, and revenues of a number of these economies come from agriculture. The growing existence of informal credit arrangements is no surprise as a result. Credits in most developing countries are characterized by banking operations in urban centres, high collateral and minimum loan requirement; favoured in these circumstances are big businesses while discouraged are small-scale ones and poor peasant farmers making up Africa's agricultural sector (Aredo, 1993). In the case of Ethiopia, as cited by Aredo, lending interests were discriminated in favour of state farms against private and individual farms; this limited the rural capacity to procure inputs. It is however worth discussing that credit lending activity is a complex one, more complicated than transactions involving trading in other goods and services, noting that a commercial creditor is a profit maximizer. Creditors face a host of problems that limit their lending to borrowers. Amongst these problems are imperfect information (notably adverse selection and moral hazards) and enforcement of loan repayments. It is difficult to know by the creditor who the borrower is (good or bad), whether the borrower would ensure efficient utilization of the loan to maximize the likelihood of its repayment; the creditor may face Herculean task enforcing repayment in event there is default, particularly owing to lack of sober legal systems, a case prevalent in many African societies. Screening and monitoring precipitated by these problems are not carried out without unbearable cost to the lender. For this reason creditors consequently reduce the amount disbursed to borrowers resulting in too little investment in the economy with rural sector most affected (Besley, 1994). The rural poor are deemed to be associated with high risk of default regarding, say, possible income shocks due to weather fluctuations that may affect a whole region, especially where farmers in such a place produce only one particular crop; the shocks could also result from changes in commodity prices that affect producers' incomes (ibid; Ellis, 1988). Being risk averse,

creditors are dissuaded to penetrate deep in these areas, denying potential farmers and small-scale investors access to credit. The inability of the poor to provide asset that could be collateralised and poorly developed property rights exacerbate the situation. As a remedy to bailout the rural sector, many governments in developing nations had intervened in the financial systems. However, politicisation of credit with governments' interventions could make the remedy worse than the disease. It is put out strongly that beneficiaries following public involvement in credit allocation for agriculture are the big farmers with political influence, and governments often fail to foreclose on assets of these influential defaulting figures; while reports at the same time showing up that many loans are not geared toward productive activities following public involvement [5]. Informal lending perpetuated in rural areas, as cure for rural credit shortage does not go without its own problems. Credit markets in rural areas are segmented. Loans only flow in a limited ranges. Their sources of funds are mostly moneylenders (accused usurious), friends and relatives, rotating savings, and credit associations. Loans are virtually made to members within a group forming the financial association; funds fail to flow across regions or other groups of individuals with potential farming opportunities (Besley, 1994).

2.1.5 Migration

Rural-urban migration is a highly celebrated factor deteriorating the agricultural sector in the LDCs. Understanding the causes, determinants and consequences of internal rural-urban movement is central to understanding the problems arresting agricultural progress and economic development of a poor country (Yap, 1977, Todaro, 1969, 1976, & 1995). The predominant development thoughts in the 1950s and 60s era were of the firm conviction that the way out to achieve growth and development in the developing nations lay in promoting the industrial sectors.

[5] An exception though is the case of East Asian public intervention in the financial system that left that region with great economic success due to prudent and a well-guided public policy involvement (Stiglitz and Uy, 1996).

In short, *inter alia,* resources were being transferred from the rural sector toward urban industrialization. Arthur Lewis, in his surplus labour theory, and followers were of this view (Timmer, 1988; Todaro, 1995;). They saw the withdrawal of " surplus labour" from the rural sector as economically and socially beneficial because human resources were being removed from locations where their marginal product was assumed zero to places where marginal product was positive and which grew rapidly due to capital accumulation and technological progress (ibid). The inward looking policies (import substitution) pursued in most developing countries after gaining independence from colonial rules (Sierra Leone inclusive) are held culpable, in addition, for nurturing rural-urban shifts. Evolving and present thinking has however countered these earlier development paradigms, that they were rather inimical to growth when currently reflecting on the indispensability of agricultural contribution for a sustained progress of the developing economies (Timmer, 1988). Another factor that has been fanning labour movement from the farms is the attractiveness of wage work compared to farm incomes in the LDCs. Relative to retail price index, labourers in LDCs see it economically more beneficial to go for off-farm employment than on-farm. In mineral rich countries people migrate from farming to mining in search of improved living conditions. The Low Farm Household Model (Ellis, 1992) demonstrates these scenarios in the case of Southern Africa where food deficit farm households abandoned their farms in taking advantage of higher returns in other sectors including mining, because it put them in better economic position to meet food needs given food retail price levels. This, as the Low Model signals, brought agriculture in that subregion to stagnation before.

2.1.6 Risk and Uncertainty

A number of propositions in peasant economic analysis have been such that peasants are risk-averse and such attitude negatively impacts on farm efficiency and agricultural growth (Ellis, 1993). Peasant farmers are commonly found vulnerable to uncertain events like natural hazards,

social uncertainties [6] , and unpredictable policy actions and wars. Peasants, insuring themselves against these odds by adapting some farming practices like mixed cropping and other situation measures has made them be dubbed as operating sub-optimally; that they fail to allocate resources efficiently and thus do not maximise profit in the circumstance [7]. In the face of growing uncertainties, farmers, the low-income, are described as striving to reach minimum livelihood security rather than output efficiency. Risk aversion is reported as restricting farmers to adopt innovations, a situation exacerbated by lack of information and effective extension service, and due to associated high cost and lack of credit (Bangura MAT, 1999, for more factors affecting farmers' adoption of technologies).

2.1.7 Land Tenure Systems

Views appear dissenting as to the need for intervention into the indigenous land rights systems. While Dorner (1972), World Bank (1974), and Harrison (1987) see the indigenous land tenure system static in Africa and limiting investment on the land and constraining agricultural development, a counter view comes from Cohen (1980), Boserup (1981), Noronha (1985), and Bruce (1988). The latter argue that indigenous tenure arrangements are dynamic in nature and evolve in response to changes in factor prices, that as population pressure is exerted and agricultural commercialisation progresses there will be spontaneous individualization of land right over time, which does not necessarily necessitate state intervention. Migot-Adholla *et al* (1991) in support of the latter view suggest that the state role should be ensuring the transformation of individual farming systems and providing enabling environment such as improving rural infrastructure, promoting marketing efficiency, and disseminating information on production

[6] Refers to social uncertainties such as insecurity facing farmers over control of resources in the peasant economy that subject them to the weapon of crop sharing or usury; the unequal ownership of land in the communities.
[7] Ellis, 1993, has a counter analysis to this view arguing that inefficiency does not necessarily mean unoptimization of profit since profit maximization is subject to a range of constraints for which risk is an integral part in rural farming.

technology, which are argued to be the main constraints limiting agricultural productivity than concentrating on land right reforms. Further supporting non-interventionism, other authors advance that even where land reforms are called for, to alter land titles for instance, accompanying policies (e.g., credit provision) should be in place to realize the benefit of the reforms so that new land holders who may be cash-poor would be able to prevent land from being idle resources; otherwise reforms are untenable (Ellis, 1992). Some successful land reforms mentioned are the cases of Iran, Japan, china, India, Philippines, and Kenya, by Binswanger and Elgin (1988).

2.2 Empirical Literature

Using protection coefficients analysis (nominal protection coefficients), Krueger *et al* (1988) investigated agricultural incentive structures in 18 developing countries for two periods (1975-79 and 1980-84); and they found that, of the 18 countries (from Africa, Asia and Latin America) covered, only Chile for the first period and Portugal for both periods could accord positive incentives to their producers of selected export crops (including rice), amidst direct and indirect policy intervention in agricultural pricing. The rest of the countries studied accorded their producers negative incentives, which could have discouraged them from producing more. The disincentive impact of the indirect policy (economywide policies such as exchange rates) was found to dominate the direct policy interventions (like agricultural price fixing by governments via marketing boards). Using the same analytical tool, Jaeger and Humphreys (1988) affirmed such disincentive impact on farmers in selected sub-Sahara African countries including Sierra Leone, studying the effects of policy reforms on agricultural incentives. As a result, leaving market forces to determine the path of agricultural pricing was recommended. Krueger, *et al* pointed out the lack of comprehensiveness about the implications of macroeconomic policy for agriculture as potent contributing factor for farmers' increasing disincentives. A study conducted on adjustment

programmes and agricultural incentives for Sudan by Hag Elamin and El Mak (1997) reached the same conclusion as the latter, using protection coefficient analysis.

Further addressing agricultural problems, authors have delved into agricultural supply response analysis—aggregate and single crop-wise— estimating supply elasticities to dig more into the constraints that limit the sector's productivity. The conventional wisdom upheld by many in concomitance with the traditional beliefs of the World Bank and IMF that " once prices are right " farmers will increase their output has been strongly criticized in respect of African economies (Ogbu and Gbetibouo, 1990; *a critical review of the literature on agricultural supply response in Sub-Saharan Africa*). Meeting the necessary price incentives for increased agricultural output is a key factor to reckon with but there are a lot of other factors affecting agriculture in developing nations that equally (if not most) need proper attention. Cited by Ogbu and Gbetibouo, Peterson (1988) using cross-country analysis argued in favour of increased producer prices to stimulate agricultural supply based on a- greater-than-one elasticity of supply estimates he obtained. However, Chhibber (1988) opposed Peterson on this finding. He outlined factors such as land constraints, availability of credits, ecological characteristics, and legal status of production he thought can't be removed simply by increasing prices. And upon including these factors in agricultural supply estimation, Chibber came up with price elasticity estimate of less than 1(opposed to Peterson's) using the same model for a set of developing countries with similar structures. Binswanger, *et al* (1987) analyzing the role of price and nonprice factors in agricultural supply captured in their model the effect of extension services, irrigation, physical infrastructure, research, agroclimatic potential, rural population, human capital and life expectancy. They found that the nonprice (shifter) factors accounted for most of the variations in supply; the country-specific time series own-price elasticity estimate they obtained was less than 1, in support of Chhibber. There seems to be growing convergence amongst researchers that nonprice factors are

the main snags that deter progress in agricultural production in most developing economies. Structural adjustment policies pursued under the faith "getting the price right" could not yield desired fruits in agriculture for many developing countries. For more thoughts that highlight nonprice factors as major determinants of supply response in poor countries, see Fosu (1992); Elamin and El Mak (1997); Adubi and Okunmadewa (1999); Kwanashie *et al* (1997); Binswanger (1990); Hattink *et al* (1998)

2.3 Studies on Sierra Leone

Factors mentioned by past studies as affecting crop production in Sierra Leone include weeds, pests, diseases, poor road networks, continued use of traditional farming methods, low yielding varieties, inadequate provision of seed rice, fertilizer shortage, inadequate cash for labour, high export taxation, non-enforcement of official prices and inefficiency of state marketing operations (WARDA, 1993; Kreul, 1983; Massaquoi, 1988; Millington, 1988; Donhauser, 1985). A lot of papers advanced the reluctance of farmers to adopt recommended technologies toward rice cultivation as one of the main factors limiting output performance of the crop in Sierra Leone. However, it is argued from the other side that, farmers were reluctant due to the "top-down" technological approach followed before via research-extension-farmer chain, which is proved inappropriate in addressing technological problems facing rice farmers in the country (Richards 1986; Zinnah and Adesina 1993; Millington 1988; Dreis 1991). Negligible success in the top-down attempts to increase rice production in Sierra Leone was surfaced by the latter, thus recommended the reverse, "bottom-top", to reflect in the research and development the poor-farmers major interest and priorities. Moreover, according to Knickel (1988), the technologies that were being offered were too labour demanding, and labour deficient farmers faced difficulties in adopting them. The issue of infrequent contacts amongst rice researchers, extension staff and farmers is raised as a problem; researchers depended on extension staff for delivery of

technologies to and feedbacks from the farmers, which was not efficacious. Zinnah and Adesina (1993) recommended that researchers come down to the grassroots (farmers) to receive first-hand information than just sitting in the research centre rooms while extension staff only reaching the field. This is thought necessary so that researchers could unravel themselves the limits to farmers' adoption of technologies for necessary action and suggestions to the government. A number of farmers failed to adopt innovations because they lacked the necessary accompanying inputs. Age and literacy level are other reasons found limiting farmers adoption of technologies[8].

What seem scarce in the literature on rice in Sierra Leone are empirical analyses regarding the crop's production. Thus, in an attempt to narrow this gap, this study carries out detailed descriptive statistical analysis of the problem under study, supplemented by protection coefficients and regression analyses.

[8] Bangura, MAT (1999), studying the impact of improved rice technologies on the income levels of upland-lowland continuum rice farmers in the Kambia District, Sierra Leone, concluded using a Probit model that high likelihood for adopting modern rice technologies is only associated with young and educated farmers with access to credit.

CHAPTER 3

BACKGROUND TO THE SIERRA LEONE ECONOMY:

AGRICULTURE EMPHASIZED

3.1 An Overview of the Economy

Sierra Leone, located in the South-western part of West Africa, sharing borders with Guinea, Liberia and the Atlantic Ocean, with an area of 72000 square km, has an economy that is based on agriculture and mining. Agriculture is the largest sector of the economy, representing in 1990 (a year before the civil war) 40% of the GDP, employing 65% of the labour force, and accounting for about 30% of the export (FAO reports). The principal export of the country comes from mining, the second largest sector. Contribution from these sectors has however been declining over the years; in the mining sector, gems and diamonds, once the leading mineral products of Sierra Leone, have fallen in production at levels far below those of the past. The low output is reported to have resulted from near extinction of mining fields, smuggling and the civil war (ENCARTA 97 Encyclopaedia). Rutile (a mineral), a titanium ore of which Sierra Leone has one of the world's largest deposits, is said to have assumed the role of leading export, producing half of all earnings; other minerals are: gold, platinum, iron ore, chromium, and bauxite (ibid). Manufacturing is poorly developed in the country with processing activities virtually limited to palm kernels and rice; amongst the small-scale industries developed are furniture, textile, cigarette, and cement factory, while a refinery is run for imported petroleum. The country once operated a railway system, closed down due to certain constraints; it runs four main seaports: in Freetown (the capital city), and the rest in three respective provincial towns. Communication facilities, though better than before, are still largely restricted to the city. Most economic activities are frustrated by a

staggering energy sector whose electricity services are being rationed. Electricity is currently only available in two provincial towns, after the capital city; that is Bo and Kenema towns. The backward performance of the economy was reflected in poor macroeconomic indicators: GDP has been declining with remarkable downturns in per capita income given rising population rates; balance of payment deteriorating, debt burden heightening, and inflation reaching a considerable high [9]. Policies pursued including structural adjustment programmes to arrest the situation were not with expected outcomes. The situation became worse during the bloody civil war of the 1990s.

3.2 Agriculture

Other crops grown for domestic consumption in Sierra Leone after rice (the staple food) are such as cassava, millet, sorghum, peanuts and sugar. Rice has not got close substitute in the country making it prestigious and highly income elastic (Karr and Due, 1973). Crops grown for exports are cocoa, coffee, kalanuts, piassava (palm fibres), palm oil, palm kernel and ginger. In the livestock subsector, cattle, sheep and goats are raised *inter alia*; and the fishery industry is of increasing importance. Rice is reported the most contributive crop toward Agricultural GDP in Sierra Leone. The SLASMP (1993, vol., II) reports that of the 31% total gross domestic product provided by the agricultural sector, 1993, 85 % came from rice cultivation; with area cultivated to the grain mounting up to 67% of the total area cropped either in pure or mixed stands. Agriculture has not however been doing well in the past few decades. Its poor performance had even gained eminence before the civil war. The downturn of the sector started showing up after the country's independence decade, the 1960s; recording stagnation on average in the 1970s while displaying pronounced retrogression throughout the 1980s (SLASMP, vol. I). The war episode of the 1990s that wreaked the entire economic activities of the country would only be regarded as an

[9] BSL (1994) asserts that inflation in Sierra Leone is highly traceable in the cost of rice importation, while Coker (1997) highlights rice importation as a cause for debt burden in the country.

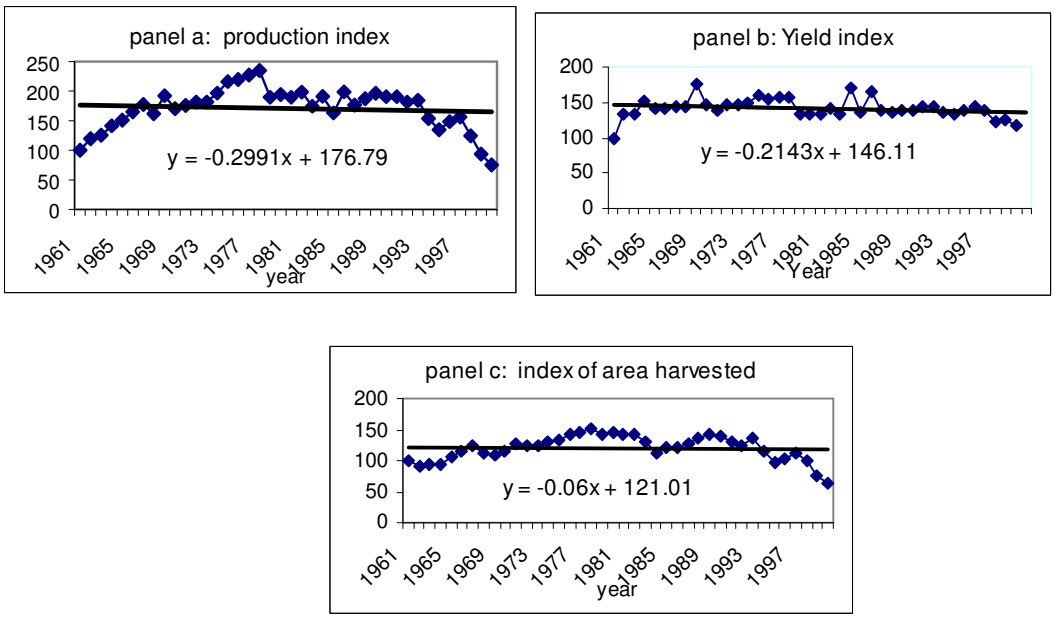
exacerbation of agricultural growth problem in that period. The disappointing trend had persisted before the war, and despite the endowment of large potential reported for agricultural progress in the country. The rich agricultural base should be able to enhance the nation's capacity to provide sustained increase in employment, rural incomes and food for its growing population, and immensely contribute toward foreign exchange earnings (FAO Reports; SLASMP, 1992 and 1993). The climate is reported favourable with abundant rainfall; vast suitable area of land remains uncultivated, and there is abundant water with great irrigation potential. The poor performance of the sector suggests minimal utilization of these resources. As forwarded by World Bank (1992), yet to be exploited, by rice ecology, is a 65% of upland rice, 85% of inland valley swamps, over 90% of riverain grasslands, over 90% of mangrove swamps and about 97% of bolilands; while less than 50% of the area suitable for cocoa and coffee (the principal export crops) has only been cultivated (more light on rice ecologies below). As well, there exists potential in the other subsectors like fishery, but with rather dwindling performance. A lot is blamed on week macroeconomic environment and inappropriate domestic and sectoral policies for the dismal state of Sierra Leone's agriculture. Concerns are also raised about degrading soil conditions resulting from population pressure and unsustainable use of land.

3.3 Overview of Sierra Leone Rice Situation

Agriculture is the main economic activity in Sierra Leone with rice, grown by more than 95% of rural families, as the main staple food. Sierra Leone ranked fourth in rice production at one time in Africa, with a total production of 315,000 metric tons and national average yield of 1,236 kg/ha in 1963 (Doyle, 1966). In West Africa, Sierra Leone was the second largest producer while next to Liberia as second largest consumer of the crop (Due and Karr, 1973). However, production trends in Appendix C for selected West African countries show that Sierra Leone has the lowest rice

production today in the group[10]. FAO rice production data show negative trends for Sierra Leone for the period 1961-2000 (Figure 3). Taking 1961 as base year [11] , the early period of 1962-1967 recorded continual increases in production by 19%, 25%, 41%, 51%, 64% and 77% in the respective years from 1962 to 1967. This was followed by a brief fluctuation between 1967 and 1970, then a continuous increase from 1970 to 1978, the year 1978 being the peak with 135% increase. Thereafter a downward trend in production started showing up, from 1979 to the year 2000, with slight fluctuation in-between. The breakdown of production trend for the entire 1961-

Figure 3: Trends in production of and area harvested to rice, 1961-2000



Source: obtained from Appendix 1

2000 period in Appendix D suggests that the negative trend of 1979-2000 dominates the positive trend of 1961-1978, leaving the overall production trend downward sloping as panel a of Figure 3

[10]The selected West African countries for comparison are Sierra Leone, Liberia, Guinea, Côte d'Ivoire, Senegal, Ghana, Nigeria, and The Gambia, with Sierra Leone producing the least production trend gradient, -142, followed by Liberia, -98.

[11] 1961 in the year Sierra Leone gained independence.

shows. The negative production trend is associated with negative average yield indices (panel b) summarized in the gradients, –0.3 for production and –0.21 for yield.

3.4 Problems Associated with Agriculture

L A N D . The issue of land and the sector's poor performance is mainly ascribed to problems of underutilization and mode of use of the resource than its availability. As reported in the SLASMPs, agricultural censuses conducted in 1970/71 and 1984/85 depict a decline in farm holdings between these survey periods. From table 3 farms with smaller acreage were only found increasing in proportion; that is, farms smaller than 2 hectares in size increased by 19% between the censal periods. Change in population distribution of the country was seen as the major cause for the decline in the number of farms cultivated. While the population of the country grew at the rate of 2.3% per annum within the said census periods, according to SLASMP, the rural population stayed in no more than 1% growth rate, with the rate of growth of urban population increasing from 18 to 20 % of total population. Moreover, 40% of the total population was reported less than 15 years (unproductive class). The discovery of diamonds in the 1950s that lured the attention of rural population is an outlined reason for the drastic reduction in farming activities in Sierra Leone; rice farmers were shifting to the mining areas, the activities of which were deemed more rewarding than farming. It does not, thus, seem a problem of land shortage; rather a good proportion of arable land appears to be left lying idle while some areas converted into mining.

Table 3: Land Distribution

Farm size	1970/75	%	1984/85	%
Under 2 ha	178,259	62.3	165,665	74.2
2-4 ha	69,324	24.2	40,803	18.3
4-6 ha	19,087	6.7	9,965	4.5
6 ha and over	8,459	3.0	6,834	3.1
(Unreported)	11,010	3.8		
Total	286,137	100.0	223,267	100.0

Source: SLASMP, 1992, vol., I,
Note: ha is a unit of hectare

Land tenure system is a policy issue that demands serious watch to the extent that it can affect access by economic agents to land, especially where potential farm investors are thwarted from acquiring adequate land. However, land ownership in Sierra Leone, though communal in fashion with freehold rights in the western area and other urban centres, has not been viewed as being serious a problem inhibiting agricultural production in the country. The traditional form of land tenure was tied to a low-input and low-output bush fallow cropping system with very large land margin; significant attention was not paid to other farming ecologies like swamps allowing vast land areas to remain unexploited. Concerns about land use rights came about due to pressure on the resource following increasing population growth, changing market condition, and crop diversification in the rural upland economy (SLASMP). Nonetheless, efforts by the government to develop swamp farming, being wasted earlier on, would have eased any tension on upland traditional farming system. Existing though is the need for proper codification of property rights given changing circumstance so that there will be well defined individual use rights deemed more compatible with increased output than continuing with the old clannish form of ownership.

LABOUR. Of the three main production factors, the role of labour is seen most central in rural production. Its level of contribution to rural output has had both age and sex implications in the developing countries. In rural Sierra Leone, work gangs or companies used to be formed as strategy for increasing acreage cultivation and hence output. Some nonmembers of such village associations did have social skills necessary to negotiate farm-work deals with the existing gangs for rice production, negotiations that pose considerable difficulty for female-headed households. But as mentioned shortly, farm labour started being a big snag to rural output since the 1950s, the diamond-mining inception in Sierra Leone, when young and energetic rural folks began moving to

the mining districts (SLASMP). The migratory patterns of rural labour then involved movement from the Northern Province of the country (with more potential for rice production) to Freetown (the capital city, in the Western Area), and the urban and rural areas of the East and Southern Provinces; the last two provinces being the regions diamonds were first discovered in. There were relatively high incomes in the urban and mining centres that significantly engendered negative skewness in the level of labour needed for increased rice production. This scenario is discussed to have left greater numbers of females and children than males in agriculture, consequentially ending into food shortage, undernutrition, maternal and child health problems. These occasions can limit the adoption of improved production technologies that require the use of high level of labour. Absence of basic rural amenities is a practical contributing disincentive causing rural-urban labour movement in Sierra Leone. Did the war in the 1990s bring a reversal of this trend? Indeed, the civil war, surfacing first in the rich mining areas, instigated the return of many people to their villages. But the situation was nevertheless compounded as the entire economic activities were brought to a standstill.

CAPITAL. Most farmers in Sierra Leone are low-income earners. Thus there physical capital is commonly limited to fixed hand-tool equipments like hoes, cutlasses, sickles and harvesting knives. Mechanized farming is not well developed. The efficiency of the few tractors that were available was being reduced by lack of good road networks leading to farming areas; many remained without spare parts. The use of draught farming (oxen power) is limited; oxen operations were being hampered by lack of cleared and flat lands in many places, lack of finance and poor animal health service (Allagnat, 1985; Corbel, 1988).

CREDIT. Credit markets are poorly developed in the country, a cause strengthening farmers' inability to procure a more productive capital. There is little or no integration of formal credit

institutions into the rural regions, leaving subsistence farmers with virtually no access to cash; this is made worse by the lack of collateral. Given most people are low-income earners, savings become low, and hence poor capital formation and low supply of loanable funds. In addition, negative interest rates are reported to have limited the mobilization of savings, hence scarce loanable funds. Before, giving lack of cash, rice farmers acquired fertilizers at some point by trading some bags of paddy; it used to be, in 1987, a bag of fertilizer for a bushel of paddy rice; the ratio changed by 1993, with the same bag of fertilizer requiring two bushels of paddy; this discouraged farmers (SLASMP, 1993).

MARKETING CONSTRAINTS. Poor road networks have seriously hampered agriculture in Sierra Leone. Many producing areas are not linked by motorable roads to market centres; most farmers would have to carry their produce on heads to points of vehicular access. With storage facilities lacking this compounds the frustration of farmers efforts. With inflation increasing at rates faster than prices of crops, farmers were further discouraged as their purchasing power over other requirements was falling. While consumer price index had been increasing at a rate of 2% annually over the period 1969-1998, producer price of rice increasing at a rate of 1%. This is indicative to some extent of unfavourable commodity terms of trade against farmers. These trends are thoroughly explored in chapter five. It is reported that the Sierra Leone Produce Marketing Board (which is no more existing) had been taxing rice farmers in the form of according them with low gate prices. And such taxes became stark when world prices for the country's main export crops (cocoa and coffee) were declining, leaving the Marketing Board with less foreign exchange. Low foreign exchange earnings were being partly transmitted into lower farm gate prices for rice producers (ibid; Landell Mills Associates and Rokel Consultants, 1982). The thin market for local rice experienced by farmers is substantially blamed on past governments' continued large-scale importation of the grain, for which one of their driving forces is to curry

political favour. (See Appendix E for a response received from one agricultural official interviewed during my research trip in Sierra Leone regarding the decline in local rice production).

MANAGEMENT AND INSTITUTIONAL ORGANIZATION OF THE AGRICULTURAL SECTOR

Management of public service operations in the agricultural sector carries its share of the blame for the poor performance of agriculture in Sierra Leone. Overstaffing of the unskilled in the ministry was, reportedly, institutionalized at the lower echelons of management that brought about unwarranted government expenditure at the expense of skilled staff and development projects. "Expenditure patterns were marked by disproportionate allocation for unskilled labour to the extent that allocations for operating costs have become insufficient to maintain basic services ", SLASMP reposts. Political compensations and favouratisms had turned out rules into exceptions while the reverse is also true. The *sine qua non* of restructuring public sector management advanced by the World Bank and IMF in their SAP packages for Sierra Leone as in other developing nations was premised upon such unprecedented resource-wasteful management practices unraveled in the agricultural department. Radically forestalling economic progress are such factors like mismanagement, corruption, organizational inefficiencies and lack of public transparency and accountability, discovered inherent in the structures of many poor nations. Misappropriation of funds to shadowy, low priority and low potential projects in much talked about in Sierra Leone. A number of projects in the country were reportedly executed on baseless political guidelines thereby uneconomically draining the meagre resources of the nation. In an effort to streamline the public sector agricultural institutions in light of the above, negotiations were initiated with the World Bank in the first half of 1980s for an agricultural sector support project aimed at strengthening the planning and policy formulating capability of the ministry of agriculture and related departments (SLASMP). In this direction, some retrenchments of unskilled workers are pronounced to have taken effects to downsize unnecessary expenditure.

POLITICAL INSTABILITY. The frequent change of governments Sierra Leone has experienced due to coups d'état is a remarkable factor that has been devastating the agricultural sector hence rice output performance. The brutal civil war of the 1990s plunged the political and economic situation of the country into total disarray, hence reducing all national activities into complete disruption.

THE EXTENT OF STRUCTURAL ADJUSTMENT POLICIES. Sierra Leone has tried adjustment policies on a number of counts, by itself and as directed by the World Bank and IMF. Regarding IMF/World Bank interventions, the impact of these policies on Sierra Leone's agriculture would be somewhat indeterminate given the fact that the policies started going into effective implementation in the wake of the civil war of the country—kicking off in 1989 while the war breaking out in 1991. No reliable assessment result would be tenable about the effects of these polices during the two years that elapsed before the war began when they were implemented. The Leone fell in value by 67.33%, 188.68%, and 130.43% in 1989, 1990, and 1991 respectively following IMF/World Bank prescription (OIC Database, 2000), and subsidies were lifted on many items including agricultural inputs. However, *ceteris paribus,* it would be extremely doubtful whether these adjustment policies would have thrived in the economy of sierra Leone, being typical of any poor country that is highly dependent on foreign capital for its production activities, and whose export is based on primary commodities. Success of devaluation and subsidy elimination is questionable in a circumstance where farmers' exports are primary with low foreign demand elasticities, and commodity prices are falling in the international markets; elimination of subsidy would only aggravate an already low farm income situation. Assuming there wasn't any war, these policies may have succeeded only in the absence of structural rigidities characterizing the country as reflected in the lack of strong capital base, poor roads networks, and primary mode of production.

3.5 A Review of Development Policies and Agriculture in Sierra Leone

This review borrows a lot from the reports of the Sierra Leone Agricultural Sector Master Plans (SLASMPs). The government adopted the first national development plan in 1974, a five-year plan for the period 1974/75-1978/79. Before this plan's adoption, economic growth of the country was largely dependent on exports of minerals after gaining independence [12]. Growth pictures were nonetheless disappointing as low rates of economic performance were recorded. In this light, coupled with risking vulnerability of national revenues over such export concentration and the realization of the neglect of other important sectors like agriculture, the initiation was then born to restructure and diversify the economy that gave rise to the formulation of the first development plan. The public sector was to provide the main policy thrust while the top priority of the plan was to ensure increased agricultural productivity. The paramount aims for the crop subsector as contained in the plan were the achievement of self-sufficiency in rice, encouraging transition from a subsistence to commercial type of production and improve the trade position through export crop promotion and import substitution (SLASMP). The dreams of this development plan were frustrated amidst a bundle of factors ranging from consequences of the first oil shock from an external wing, to the collapse of the country's iron ore mining and unfavourable domestic policies that squeezed resources for plan implementation (ibid). Thus due to ad hoc arrangements, the Integrated Agricultural Development Projects (IADPs) programme was launched under the aegis of the World Bank after the demise of the first development plan to pursue the objectives for the agricultural sector aforementioned. The IADPs were a smallholder-based strategy geared at providing and accelerating the adoption of new farm technologies for smallholders in order to increase their productivity and achieve sustained increase in output and incomes. The programme's success relied also on the state's leading role since market forces were not believed

[12] Dependence on import substitution industrial strategies was also pronounced after the country's independence.

to be able to ensure that available technologies were harnessed to the farmers. Efforts were to make sure that grassroots farmers obtain certain inputs and credits. But as the former, the activities of the IADPs encountered their own problems that made the programme fall short of expectation. Amongst the failures, including inefficient project co-ordinations, is the inapplicability of some of the technologies to the farming environment. Then come a draft of the second national development plan of 1983/84-1985/86, a three-year plan, placing emphasis again on agriculture within structural adjustment frameworks with the following objectives:

- To increase production and reduce import of staple foods, so as to achieve self- sufficiency in the medium and long term
- To increase productivity, output, rural incomes and employment
- To ensure balanced regional and equitable income distribution
- To maximize foreign exchange earnings

Source: SLASMP, vol. I, pp. 60-61

Nor was this second plan successful as balance of payment difficulties persisted with slow growth; foreign debt arrears built up, intensifying economic and political crisis in the country. Other development strategies that ensued thereafter are discussed next under the following headings.

THE 1986 GREEN REVOLUTION PROGRAMME (GRP)

This programme emanated in cognizance of the shortcomings of the preceding strategies, some of its objectives though being largely an emphasis of those of the programmes discussed hitherto. GRP put more premiums on rice self-sufficiency. The programme is summarized in the following objectives.

- To increase rice production to self-sufficiency levels, and hence eliminate imports
- To increase agricultural production in other food crop
- To provide adequate producer price incentives and appropriate market structure
- To provide improved seed and other key inputs; provide tractor and work oxen services
- To encourage improved cultural practices through extension services
- To minimize or prevent post-harvest losses
- To embark on medium to large scale irrigation programme to minimize dependence

on rainfed agriculture
- To review and reorientate the IADP programme
- To focus on adaptive research in order to develop improved cropping systems in all ecologies on a sustainable basis

Source: an excerpt from the GRP objectives reported in the SLASMP, vol. I, pp. 65.

THE 1987 ECONOMIC EMERGENCY PROGRAMMES

These were reformist measures taken by the government of Sierra Leone after falling apart with IMF in the mid 1980s over the non-adherence of government to prescribed programmes (*sine qua non*) and the suspension of IMF disbursement. The government in 1987 thus reintroduced exchange rate controls, trade controls and administered prices for staple food. But it did not augur well.

THE ECONOMIC AND FINANCIAL POLICY FRAMEWORK

The Sierra Leone government then succumbed again to IMF policies in 1989, which accorded them some credibility with both IMF and the World Bank. Trade liberalization policies where then dramatically implemented; monopoly of the Sierra Leone Produce Marketing Board (SLPMB) in cash crop transactions and importation of rice was ended, permitting private traders to import rice; the currency was first devalued then followed by the adoption of free market exchange rate in April 1990. Agricultural development was again given the top priority under this framework, especially toward increasing market surplus of food crops, rice the main concern. Launched in the realm of these policies was the Public Investment Programme (PIP), a three-year instrument, 1992/93-1994/95, deemed highly complementary to the targeted objectives. While fancying the private sector as the main engine of growth from the IMF/World Bank standpoint, recognized along side this belief is the unflinching complementing role of the public sector investments in social and economic infrastructure like health, education and roads. Of the resources allocated to

the productive sectors under this PIP programme, the greater portion went to agriculture [13] . However, pre- and post-reform performance comparison may not be taken with a grain of salt because the reform policies came to prominence at a time of devastating war that denied all policies in effect the conducive atmosphere necessary for reaping expected benefits. Thus it is hard to say about whether reforms succeeded or not.

3.6 Rice Farming Systems and Policies

ECOLOGIES. In Sierra Leone, rice is grown under the following land conditions.

Upland--- involving land clearing (brushing and burning), ploughing and direct seeding, using heavy labour input annually; the land is then turned over to other crops after a year and subsequently abandoned for a long period as natural fertility declines; the activity here is rain fed.

Lowland--- largely wetland and sub-classified into four situations:

- *Inland valley swamps*: stream valleys receiving water from stream overflows or runoff from surrounding hills; such land is believed to contain good soil (e.g., via erosion on the immediate uplands washing top soil into the swamps); this area may remain partially flooded for the major part of the growing season.
- *Boliland*: areas of low swamp grasslands, also described as drainage depressions flooded to considerable depths from surrounding higher lands, making cropping not as suitable because of lack of natural water outlets.
- *Mangrove*: these are swamplands found in the coastal tidal zone experiencing saline flooding; there are also nontidal fresh water sedge swamps under this condition.
- *Riverine Grasslands*: these areas found along riversides are deeply flooded during the rainy season; often requires floating rice varieties that sometimes elongate to considerable feet in length;

[13] For details on the PIP spending see SLASMP, vol. I; and World Bank document, 1994, on Sierra Leone public expenditure policies for sustained economic growth and poverty alleviation

it makes harvest of rice under this condition labour-consuming.

The commonest and traditionally practised of the above systems outlined is upland production system. According to Due and Karr (1973), upland cultivation covered 80% of the acres in rice production in Sierra Leone; 12% went for inland swamps, 4% on bolilands and 4% on riverine and mangrove swamps. But paradoxically, yield estimates of 1965/66 (ibid) showed that upland yields averaged about 1000 pounds whereas swampland yields averaged about 1900 pounds per acre. Ecological degradation following inadequate bush fallow period on upland is mentioned as major factor for the poor yield under upland system. We will take a look next into some rice policies pursued before.

RICE POLICY

Given the unparallel and strategic position of rice in Sierra Leone, exclusive development strategies have been geared toward the crop's production. A semi-autonomous rice research station had long been established in 1934 with the main aim of providing better farming technologies, the research activities of which are coordinated by the National Agricultural Research Council of the country. Yet Sierra Leone is still struggling; is still importing rice. Following the severe rice shortage of 1978/79, a crash rice programme was launched for 1980. The Sierra Leone Marketing Board was an instrumental in this vein, providing the ministry of agriculture with tractors and other equipments for distribution to farmers. The low- or swamplands, deemed more productive, were targeted in this programme, than uplands. Disappointing yields were however reported, explained partly as a result of mechanical breakdowns on the part of the power tillers; the tillers sank in mangrove soils.

Other projects undertaken, also geared toward lowland cultivation, are: the Torma Bum Rice Development Project (cost US$8.5 million), with main objective to cultivate 5,060 ha of riverain grassland annually in the project region (Torma Bum), to produce 5,320 tons of milled rice, between the period 1979 and 1986 (SLASMP, 1993, vol. II). Owing to problems, notably inefficient management, only 2,430 ha were cultivated annually. The region is reported to have about 8,100 ha of which 62 % was targeted but only 30 % achieved. Another is a Japanese supported project called Gbundapi Rice Development Project, developed in 1988 toward grassland cultivation with the aim of cultivating 9000 ha involving 2,500 farmers in the Gbundapi region (cost US$1.6 million); but logistic problems were however reported for the low output of the project, which was brought to a complete stop as a result of the war. Aimed at irrigated rice cultivation was another project "Rhombe Swamp Agricultural Development Project", (cost US$11.2 million). More rice production projects are found in the Integrated Agricultural Development Programme mentioned earlier on as instrument for increased agricultural productivity. The World Bank Agricultural Mission Aide-Memoire of 1992 aimed at increasing food security also underscored inland valley swamps as the best potential for increasing rice production in Sierra Leone (ibid).

One may deduce from above that Plans and Policies devised for agriculture in Sierra Leone were a mere display of conceptual elegance than results given the subsequent output levels. The available voluminous policy documents seem to suggest to us that problems facing rice production in Sierra Leone had long been diagnosed and the right policy approach recommended. Yet the output is a paradox. Where then was and is the problem? The next chapter describes the methodology used to address the issue under study.

CHAPTER 4
THE METHODOLOGY

The following techniques are used for empirical investigation of the problem under study. A thorough descriptive statistical analysis is carried out using averages, percentages, tables, graphs, etc; a detailed trend examination is done under this tool. Next, a coefficient of protection analysis is employed. Then, aiming at establishing the extent and significance of effects of constraints on rice production, a supply response analysis using time series regression estimates is carried out.

4.1 Coefficients of Protection Analysis

This is a technique used to investigate the incentive structures underlying price policy interventions, and how efficient such policies are. For the purpose of this study, this tool is used in the context of policies affecting agriculture, to establish whether rice farmers in Sierra Leone are accorded with incentives or not. There is wide range of coefficient measures used in the literature for such analysis, comparing border price and domestic price (see Sadoulet and de' Janvry, 1995; Tsakok, 1990). Because of paucity of data a simple but widely used coefficient of protection is employed in my study: the Nominal Protection Coefficient (NPC). Among the studies that have used this tool of analysis in determining farmers incentives are Krueger *et al* (1988); Jaeger and Humphreys (1988); Fosu (1992); Amin (1996); and Elamin and El Mak (1997). The coefficient is Symbolically expressed as

$$NPC_{i\,t} = \frac{\text{domestic price}}{\text{foreign price times exchange rate}}$$

or $NPC_{i\,t} = P_i^d \big/ P_i^b$

Where

P_i^d = domestic price of the i^{th} commodity; t represents time period.

P_i^b = border price of the i^{th} commodity, i.e., foreign price times exchange rate.

United States commodity price is used as proxy for the world or foreign price, which is converted into domestic currency to obtain what is referred to as the border price using appropriate exchange rate.

The NPC becomes real/effective protection coefficient called the nominal rate of protection (NPR) if the exchange rate reflects its opportunity cost to the economy, taking policy distortions into consideration. This is expressed as $NPR = (P_i^d - P_i^b) / P_i^b = NPC-1$

Producers of the crop are said to be protected or accorded incentives if NPC > 1; that is receiving higher prices at the expense of consumers than would be the case in the absence of policy intervention. The reverse is true. The policy produces neutral effect on producers and consumers (neither subsidy nor tax) if NPC = 1. The NPCs estimate should however be interpreted with caution because they only consider one side of production activities that affects incentives, that is the revenue aspect, they do not take into account the cost aspect to reflect profitability to an extent which should better state whether farmers are accorded with incentives or not; there are more informative coefficients than the latter in this regard (ibid) but because of data acquisition difficulties, especially on domestic inputs, NPCs are only used. It should be mentioned as a shortcoming of protection coefficients analysis in general that it might not be understandable from

estimates as to which particular policy component has caused incentives or disincentives---- is it due to direct (sectoral) policy or indirect (economy-wide) policy? If is the latter, is it due to distorted exchange rate policy or inflation or other macroeconomic policy? These questions demand answer for a comprehensive policy prescription. But because of difficulty of disentangling policy effects, results of the NPCs obtained can only establish whether rice farmers were being accorded price incentives, then appropriate recommendations are provided.

4.2 Supply Response Analysis

It is widely agreed in theory that supply response elasticities are generally higher for individual crops than aggregate. While individual crops theoretically respond to price factors in the short-run by a considerable magnitude aggregate supply response is believed to be very low. This is because a crop's output response can be increased in the short run by easily shifting resources from others toward its production. It is not the case with overall sector response since the primary factors (land, labour and capital) are fixed; shifting resources in favour of one crop implies depriving the output response of the rest, so that all crops response becomes almost impossible right away. It is in the long run that the feasibility exists for aggregate output to respond as well as individual crops, since fixed factors would become adjustable and variable; as more resources are devoted to agriculture, or if technology changes; or if there is investment in infrastructure, roads, market, irrigation, education, health, etc. (Binswanger, 1989; Sadoulet and de Janvry, 1995). It is in the same logic that individual crop supply elasticity is expected to be higher in the long run than short run. The estimation of crops' response can be in terms of yield, area, or output.

4.2.1 The Regression Model

The time series model adopted is based on ad hoc specifications within the framework of the Nerlovian supply response models used widely in the literature. The specified model borrows from

El Amin and El Mak (1997), Kwanashie et al (1997) and Hattink *et al* (1998). See Appendix F for some detailed description of the adopted Nerlovian model. A shortcoming of the Nerlovian supply response approach is that it is highly dependent on the price factor as the major determinant of output response. Given the structures of the Sierra Leone economy, like any other poor nation, the model is modified to incorporate nonprice factors, seen most influential on output supply in the literature for the developing world (Ogbu and Gbetibouo, 1990). The working model is thus specified as follows:

$$Q_t = \theta_1 + \theta_2 Q_t + \theta_3 P_t + \theta_4 PUI_t + \theta_5 RACR_t + \theta_6 CSCRE_t + \theta_7 RMP + \theta_8 F + \theta_9 RUP_t + \theta_{10} DUM + \varepsilon_t$$
$$(+) \quad (+) \quad (?) \quad (-) \quad (-) \quad (-) \quad (+) \quad (-) \quad (-)$$

t = current year time subscript, and t-1 is previous year time subscript
Q = quantity of rice produced (dependent variable)
P = producer price of rice
PUI = public investment
RACR= Area under rice cultivation
CSCR = area under cassava crop production
RMP = quantity of rice imported
F= fertilizer consumption
RUP = rural population
DUM = dummy for the civil war in Sierra Leone
ε = error term, assuming to have zero expected value
θ_i = a vector of the parameters

P is ratio of rice producer price to consumer price index expected to positively influence output of rice. A fall in producer price relative to retail price index (reflecting the effect of inflation) is expected to discourage farmers; the reverse holds. Q_{t-1} is the previous year's output level (making the model autoregressive) the coefficient of which enables us determine the speed with which actual output adjusts to the desired output. PUI is public investment, used as proxy of infrastructure and/or research expenditure. The PUI coefficient cannot be signed with certainty in the case of Sierra Leone. Where the desired impact of public expenditure is felt by farmers in terms of construction of feeder roads, provision of social amenities in the rural areas, and ensuring that agricultural plans and programmes reach the farmers (target groups), it should be expected that PUI

will positively affect rice production; but where the opposite is the case, i.e. public investment is just limited to the provision of roads and social infrastructures for the urban centres, one will definitely expect PUI to adversely affect rice production of the country; the negative impact would result where disproportionate public infrastructural investment in the urban areas serves as a strong ground for the attraction of rural labour. Skewed public expenditure is a characteristic of Sierra Leone public budget, making PUI an indirect proxy to capture effects of rural-urban migration on rice performance in case it comes out negative [14]. RACR is acreage under rice production, expected to positively impact on rice production. CSCRE represents acreage under cassava crop production, and is expected to affect rice production negatively. Cassava, a composite tuber crop, is the next staple after rice, and is produced all over the country. Cassava price could have served a better variable to account for effect of other crops on rice but data on it are unavailable that is why its acreage is used. Cassava is assumed to compete with rice production over land. Other crops (cocoa and coffee, the main exports) are too region specific, thus the former is preferred; effect of the latter crops are analysed descriptively. Quantity of rice imported, RMP, should negatively affect domestic rice production. This is a crowding out hypothesis because, high quality imported rice, coupled with subsidization of its price by government and ease of cooking, would negatively affect demand for the domestic grain, hence its production. The variable F is quantity of fertilizer used expected with positive effect on rice production. RUP is rural population expected to carry positive coefficient. DUM1 is a dummy for the effect of the 1990s civil war in Sierra Leone. The model is estimated in log form to enable us interpret results as elasticities.

[14] In an effort to capture the effect of rural-urban migration on agriculture in Nigeria, Kwanashie *et al* (1997) used government expenditure on social infrastructure (which is limited to urban areas) as proxy to capture movement from rural areas to urban settlement; the variable was found significant with the expected negative sign that public investment on social infrastructure localized in urban centres attracted rural labour hence a reduction in farming and agricultural output.

4.2.2 Model Estimation Techniques

The model estimated is an autoregressive distributed lag (ADL) model using OLS technique. In an effort to capture the dynamic behaviour of rice production in Sierra Leone, the model is estimated several rounds using different lag lengths to reach a more parsimonious estimates. PcGive module in GiveWin econometric package is used for the estimation. Different econometric tests are performed to establish the reliability of estimates. The tracking power of the estimated model over actual values is examined. A sample size of 35 is used (1964-1998)

4.3 Data Source

Data were obtained from FAO database, Organization for Islamic Countries database, World tables, International Financial Statistics Year Books, African Development Indicators Tables, Central Statistic Office of Sierra Leone, etc.

CHAPTER 5

DESCRIPTIVE STATISTICAL ANALYSIS OF RICE PRODUCTION CONSTRAINTS

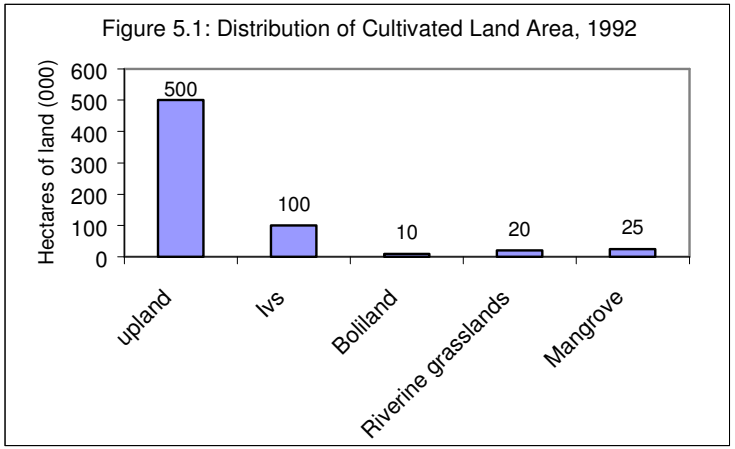
Of the 72,000 square km area covered by Sierra Leone, 74% (5,360,000 hectares) is suitable for crop cultivation on a sustainable basis (FAO Report). But disappointingly only a very small proportion of the cultivable land is harvested. 600,000 (11.2%) hectares of this suitable land was cultivated in 1990 as reported by FAO, implying efficiency loss in Agricultural crop production of about 65.6%. And out of the 600,000 hectares utilized, 392,600 (65.4%) were devoted to rice production, continuing to explain that rice farming principally constitutes the agricultural crop activity in Sierra Leone. Therefore, where crop acreage is expanded, more will be devoted to rice production to minimize food shortage.

5.1 Rice Farming Systems

Table 5.1 and figure 5.1 describe the available land resource opportunity, and the distribution and level of utilization of this resource for rice production by ecology in Sierra Leone. As column 4 of table 5.1 accounts, the largest fraction of the suitable land resource (87.8%=100%-12.2%) was left uncultivated in 1992 for all ecologies with more hectares of the cultivated land falling under upland rice farming than lowlands. Though more hectares are devoted to upland than lowlands, table 5.2 depicts lesser yields on the former than the latter. The comparative distribution of yields over the ecologies in this table tells us that average rice yield for the period 1970/71-1990/91 is least under upland cultivation compared to the rest (lowlands). This farming structure may have seriously contributed to the low rice production in Sierra Leone. Output could have increased if the structure was in favour of swamp/lowland rice harvesting than upland. The latter is reported with less natural nutrients than the former. It should however be noted that, because of the ease with

Table 5.1: Distribution and level of utilization of cultivable land by ecology

Ecology	uitable for Cultivation (ha)	Cultivated in 1992 (ha)	Cultivated as % of suitable
Upland	4,200,000	500,000	11.9
Lowland:			
--Ivs*	690,000	100,000	14.5
--Boliland	145,000	10,000	6.9
--Riverine grasslands	130,000	20,000	15.4
--Mangrove	200,000	25,000	12.5
Lowland subtotal	1,165,000	155,000	13.3
Total	5,365,000	655,000	12.2



Source: obtained from FAO website, www.fao.org, on Sierra Leone agriculture

* Ivs stands for inland valley swamps.

Table 5.2: Distribution of area cultivated (000 ha) and yield (mt/ha) of rice by ecology, 1970/71-1990/91

	Total		Upland		IVS		Riverine		**Boliland**		Mangrove	
Year	Area	Yield	Area	Area	Yield	Area	Area	Yield	Area	Yield	Area	Yield
1970/71	327	1.36	243	1.31	89	1.39	-	-	-	-	-	-
1984/85	319	1.58	224	0.92	80	2.95	12	3.42	3	2.67	-	-
1985/86	302	1.42	197	1.02	92	2.25		-	6	0.83	7	2.29
1986/87	340	1.54	241	1.27	75	2.47	14	1.57	7	1.00	3	1.00
1987/88	357	1.31	212	1.07	88	1.90	24	1.25	12	1.42	20	1.30
1988/89	388	1.27	260	1.04	93	2.12	16	0.63	8	1.50	12	2.80
1989/90	403	1.28	270	0.97	97	2.06	16	1.50	8	1.25	13	1.54
1990/91	384	1.38	263	1.03	94	2.23	8	1.50	7	2.00	12	3.17
Period e ave. Yield	1.39		1.07		2.17		1.65		1.52		2.02	

Source: Agricultural sector master plan, 1993, vol., II, pp., 220.

which farmers in Sierra Leone find upland cropping compared to swamplands, majority of farm households cling to the upland system than the latter; labour shortage fans this custom since swampland is more labour requiring than upland.

Table 5.3 gives a break down of acreage distribution by ecology and Districts, supporting the information in table 5.2, for the periods 1970/71 and 1984/85. With the exception of Kambia and

Table 5.3: Distribution of Area (rice) by District and Ecology, 1970/71 and 1983/84

District	1970/71 Agricultural Census			
	Area of upland rice	Area to swamp Rice (ha)	% area of swamp rice	Cultivation Per person (ha)
Moyamba	40,300	4,800	10.6	0.24
Port Loko	26,100	17,400	40.2	0.15
Bo	36,600	6,700	15.5	0.21
Kenema	29,000	10,000	25.6	0.15
Tonkolili	26,700	28,000	9.5	0.14
Kambia	7,600	17,900	70.2	0.16
Bombali	18,900	2,800	12.9	0.09
Koinadugu	11,600	7,300	38.6	0.12
Kono	12,100	4,800	28.4	0.05
Pujehun	13,400	1,800	11.8	0.14
Kailahun	16,000	5,500	25.6	0.12
Bonthe	4,300	1,400	24.6	0.07
			Mean	0.14
			Variance	0.003
			S. Deviation	0.05

…continued from previous

District	1983/84 Census			
	Area to upland rice	Area to swamp rice	% of swamp Rice	Cultivation Per person
Mayamba	23,951	7,804	24.6	0.13
Port Loko	18,182	10,515	36.6	0.09
Bo	27,338	3,664	11.8	0.12
Kenema	40,398	10,216	20.2	0.15
Tonkolili	22,389	6,920	23.6	0.12
Kambia	11,374	5,059	30.8	0.09
Bombali	21,581	7,889	26.8	0.09
Koinadugu	7,308	13,872	65.5	0.12
Kono	23,400	6,020	20.5	0.08
Pujehun	8,770	3,116	26.3	0.11
Kailahun	11,837	7,652	39.3	0.08
Bonth	6,892	11,889	63.3	0.19
			Mean	0.11
			Variance	0.001
			S. Deviation	0.03

Source: ASMP 1993 vol., I, pp., 144.

Koinadugu Districts for 1970/71 and 1983/84 respectively, the rest of the Districts Showed far less swamp rice farming (which has more potential for rice production) than upland farming. It can also be deduced from table 5.3 that the per capita area cultivated in both periods for all Districts is less than 1hectare and virtually the same for the individual Districts as the variance and standard deviation measures depict---- the variance and standard deviation for 1970/71 are 0.003 and 0.05 while for 1983/84 are 0.001 and 0.03 respectively; the mean is 0.14 hectares in 1970/71 and 0.11 in 1983/84. The decline in mean per capita area cultivated measure from 1970/71 to 1983/84 signifies a continued poor situation in rice production.

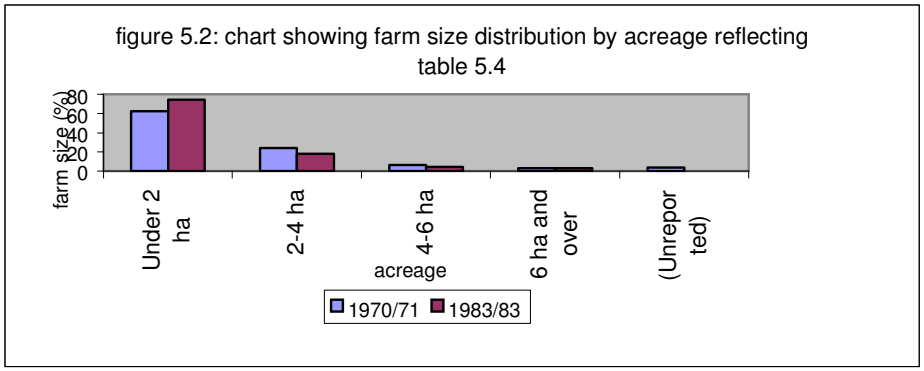
5.2 Distribution of Farm Size

Reports have been mounting about the continual decline in area cultivated in Sierra Leone, either due to rural urban migration, movement to the mining areas, or otherwise. The main suspect for the decline as it is abundantly clear in the country is the shift from farming to mining in search of better incomes. The tables and graphs below visualize this situation. Table 5.4 shows, for both periods, 1970/71 and 1983/84, that Sierra Leone farming is immensely dominated by smallholdings; 62.3% of the farms in 1970/71 and 74.2 % in 1983/84 were of size less than 2 hectares; it is also reflected in the negative skewness displayed on the bar chart, figure 5.2. The table further depicts that the number of farms in the country reduced from 1970/73 to 1983/84 in absolute terms for all size categories. Demographic reasons are partly suggested for this scenario that there was serious shift from farming activities to other sectors, mining in particular. Though decreased in absolute terms, there is a percentage increase in smallholdings which may have come about owing to the intuition that previous large farms reduced to small sizes as farmers sometimes share their time, engaging in other non-farming activities to supplement incomes instead of depending on just farming with low returns. Most farmers in Sierra Leone produce mainly for their consumption, but they need money income to meet other needs; they have to educate their children and meet medical bills among other things. The ability to foot these expenses arises only out of

Table 5.4: Comparing farm distribution between 1970/71 and 1984/85

Farm size	1970/71		1984/85	
	No. of farms	%	No. of farms	%
Under 2 ha	178,259	62.3	165,665	74.2
2-4 ha	69,324	24.2	40,803	18.3
4-6 ha	19087	6.7	9,965	4.5
6 ha and over	8,459	3.0	6,834	3.1
(Unreported)	11,010	3.8	-	-
Total	286,137	100.0	223,267	100.0

Source: SLAMP



the market surplus they make from their farm produce. Moreover, not only on household produced food that household members depend, they need cash to purchase other food items they don't produce, especially where barter economy is absent; even where it is present exchange could pose unbearable cost. Therefore, a number of people would instead prefer to purchase the food they can produce (in the absence of farming incentives) by engaging in non-farm activities with more returns that could enable them acquire their basic needs. That is why it is agitated for the provision of rural incentives and amenities for preventing those folks from leaving their farms; they should be given price incentives to earn surplus to be able to meet other needs.

Table 5.5 shows that the national average farm size cultivated in Sierra Leone as of 1983/84 is 1.63 hectares, an insignificant figure for attaining food selfsufficiency. Dependency on crude farming implements due to lack of capital and credit sources are serious factors borne in mind for the reduction of farm operations to small-scale.

Table 5.5: National Average Farm Size Cultivated in 1983/84

Farm size	Number of farms	%	Area (ha)	%	Average area (ha)
Under 0.5 ha	48,338	21.6	14,151	3.9	0.29
0.5-1.0ha	58,618	26.3	43,153	11.9	0.74
1.0-2.0 ha	58,709	26.3	82,320	22.6	1.40
2.0-4.0 ha	40,803	18.3	112,534	30.9	2.76
4.0-6.0 ha	9,965	4.5	48,545	13.3	4.87
6 ha and over	6,834	3.1	63,326	17.4	9.27
Total	223,267	100	364,029	100	1.63

Source: SLASMP

5.3 Farm Population Distribution by Sex and Age

The sex and age distribution of farm population has its effect on farm production. Though table 5.6 implies more male population than female in farming, the ratio is however negligible; the percentage difference is very small. While male population is roughly 51% the female is 49%. Telling us that the most active sex, male, which should be incomparably more involved in farming to realize bumper harvest (to the extent that farming in the country is preponderantly labour dependent), occupied a proportion almost equaling the female (less active). It in fact shows from most active age group, 25-44, that there were more females

Table 5.6: Farm Population Distribution by Age and Sex, 1970/1971.

	Sex			%	
Age group	Male	Female	Group total	Male	Female
< 10 yrs	248,701	225,537	474,238	52.44	47.56
10-24	260,908	254,008	514,916	50.67	49.33
25-44*	240,115	300,120	540,235	44.44	55.55
45-54	89,539	65,660	155,199	57.69	42.31
55>	128,082	75,451	203,533	62.93	37.07
Total	967,345	920,776	1,888,121	51.23	48.77
Ratio	1.05 : 1				

Source: Agricultural Statistical survey of Sierra Leone, 1970/71

*Most active farm population age class.

(56%) involved in farming than males (44%) in this group. Thus strengthening the claims that energetic male population did move to nonagricultural sectors leaving the total farming population in this class dominated by females. Age 55 > is suggesting that the male number becomes significantly greater in agriculture at old age when they are less active, when people decide to return to farming from non-farm engagements, when they are no more energetic. This population structure also shows a significant number of persons (474,238) falling under another less active age class, <10.

5.4 Forms of Land Acquisition and Types of Land Operation in Sierra Leone

Table 5.7 describes the manner of land acquisition. People were acquiring land by being chiefdom and family members, individual inheritance, payment of a fee, and others. The greater portion of the land was communally owned as reflected in the 51.3% of the land acquired under family ownership. Chiefdom membership added to this dominant form of land tenure (8.8%). Such tenure system is one of the premises upon which some schools of thought have characterized the low agricultural productivity of many poor countries as being incompatible with land investment incentives, though a controversial view (Migot-Adholla *et al* 1991). Inheritance is the major source of land acquisition at both family and individual levels. Individually alone, inheritance accounted for 27.2 % of total acquired fields. Looking at land purchased/rented and loaned/pledged/leased, it is discernible that land market in Sierra Leone is poorly developed, with 3.6% acquired under the former and 3.1 % the latter. The overall tenure structure is argued as an inefficient way of resource allocation. Unlawful acquisition (under squatter) is virtually nil in proportion, accounting for just 0.5% of the total land acquired. However, in support of earlier analysis, additional information emerges regarding migration and land under squatter, in that the largest land acquired unlawfully came from the Eastern Province, the richest Diamond-Mining base in the country. That, in view of the Diamond lure, some acres in this region were unlawfully/forcefully acquired in thirst for the mineral by strangers coming in from other regions in Sierra Leone (who may have been farmers before), and perhaps from neighbouring countries. Next to mining areas in terms of

Table 5.7: Forms of Acquisition of Fields (Land Tenure) and Size of Fields, by Province, 1970/71

Province	Forms of Acquisition and Size of Fields (acreage)						
	Chiefdom ownership[a]	Under squatter	Family ownership[b]	Individual ownership		Loaned/pledged/ leased	Others
				Inherited	Purchased/rented		
South	22666.19	0	137084.8	116226.99	16021.14	17348.46	23328.19
East	37124.99	3183.22	331707.8	98414.71	2653	1519.73	24881.65
North	52895.76	715.62	189755.5	132570.01	25493.53	12048.8	23170.66
Western Area	260.6	2272.47	1454.53	2190.99	1885.16	37.9	5.5
Sub total	112947.5	6171.31	660002.6	349402.7	46052.83	40384.95	71386
Grand total	1286348						
%	8.8	0.5	51.3	27.2	3.6	3.1	5.5

Note: [a] communal form of ownership based on chiefdom membership, special permission (acquired from chief to strangers) and special allocation (from chief to clansman)

[b] two types constitute this: group inheritance, and being family member, (communal as well).

Source: Agricultural statistical survey, CSO, 1970/71.

Table 5.8: Size of Fields by type of operation, by District, 1970/71

Type of operation	District and Size of Fields/Farms											
	Bo	Bonthe	Moyamba	Pujehun	Kailahun	Kenema	Kono	Bombali	Kambia	Koina-dugu	Port Loko	Tonko-lili
Large scale operators	1336	101	188	1110	1430	501	920	706	3444	322	0	2020
Small scale operators	120114.7	18291.1	144847.8	49422.2	163930	276796.7	58758.3	85513	73480.40	68602.3	137159.5	81324.7
Government	0	1968	2030	0	0	0	190	0	0	0	1063	0

Source: Agricultural statistical survey, CSO, 1970/71.

land squatter is the Western Area where the capital city, Freetown, is situated, accounting for the second largest land under this manner of acquisition (the rural-urban shift insignia of poor countries). Table 5.8 beside 5.7 describes land size by type of operation (i.e., large-scale, small-scale, and government). It shows without working out percentages that land cultivation in Sierra Leone was extremely dominated by small-scale operations (as table 5.4 had reflected), with government operating nothing in eight Districts, as per 1970/71 CSO survey. Large-scale operation was comparatively very small. Given the limited access to credit facilities and other inputs for small scale-operators in Sierra Leone, such an unparallel distribution of land toward small-scale exercises is certain to have significantly contributed to low crop productivity.

5.5 Transportation of Farm Produce to Market Centres

Table 5.9 displays the various modes of transporting produce from the farm to the market places by farm holders following 1970/71 surveys. The row % of the table shows that majority of farm holders were transporting farm produce to market by foot (62.6%), a medium that should reduce farmer's incentives to produce more. Lorry is the next frequently used, incomparable to foot medium though; access to train (railway) haulage by farmers was almost zero, 0.1% (a railway system was then existing, during this survey period). Other modes of transportation, bicycle and canoe/boat/launch, were not effective as well. The table, by and large, summarizes some of the infrastructural problems faced by farmers. In the rural areas (South-, East-, and Northern Provinces), modern transportation method (lorry and train) was more witnessed in the Southern Province than the rest; the Western Area (where the Capital City is) cannot be counted much in this description because it carries insignificant farming activities.

Table 5.9: Number of holders transporting goods for sale by method of transport

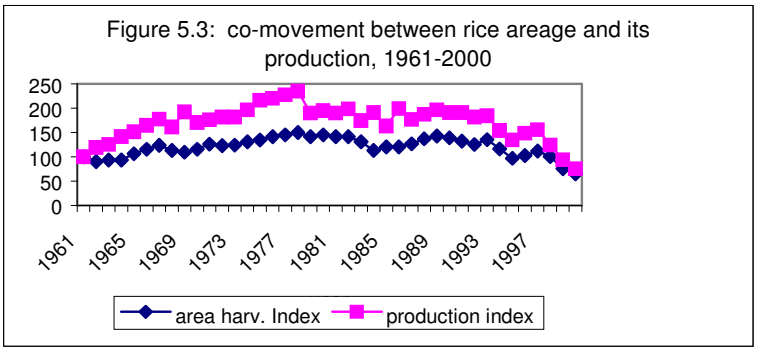
Province	Foot	Canoe/Boat/	Lorry	Bicycle	Train	Row	%

		Launch				Total	
South	18,073	223	10,352	0	0	28,648	32.1
East	16,269	106	16,659	96	96	33,226	37.2
North	19,287	308	5,284	0	0	24,879	27.8
Western Area	2,296	0	290	0	0	2,586	2.9
Column total	55,925	637	32,585	96	96	89,339*	100
%	62.6	0.7	36.5	0.1	0.1	100	

* This is the grand total
Source: Agricultural statistical survey, CSO, 1970/71.

5.6 Time Series Trend Analysis

Figure 5.3 depicts a co-movement between area cultivated to rice and level of production of the crop suggesting that increases or decreases in production of the crop follow acreage expansion or contraction. The fall in the crop's performance over the years can in part be explained by the contraction in acreage. The negative trend of acreage under rice had already been established in the introductory chapter. Figure 5.3 reinforces the message table 5.1 above tries to deliver that the level of underutilization of suitable land reported in 1992 (only 12.2% cultivated) is a crucial factor to take into consideration for the weak performance of rice crop. The correlation coefficient between these two variables is 0.85 (very strong).

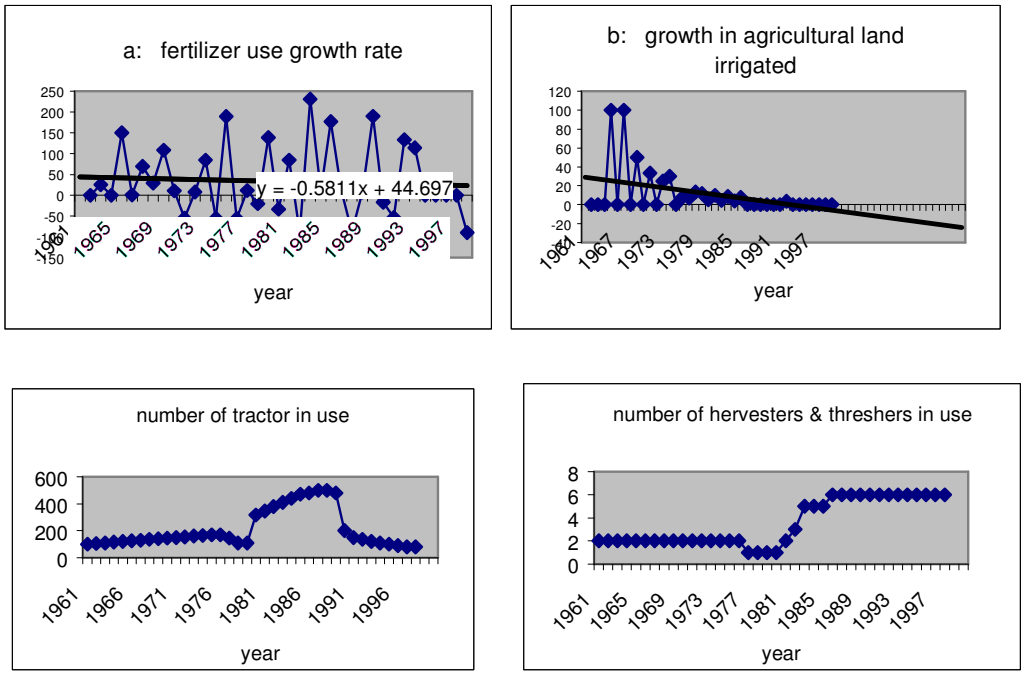


Source: Appendix A

Next are trends of factors that may have given rise to the deterioration in rice production. Figure 5.4 shows movement in the level of fertilizer use, irrigated land area, number of tractors employed on the land, and the use of combined

harvester/threshers. These trends indicate low use of modern farming technology in Sierra Leone. Panel a. and b. respectively show fluctuating and declining rates of fertilizer use and land irrigation. Low fertilizer consumption might be a result of high cost of the input, the acquisition of which is dependent on importation, and given hiking rates of currency exchange, this may have posed serious constraints. Appendix H shows a rising exchange rate trend for the period 1966-1998, implying on average the Leone has been annually falling in value against the US dollar in this period, which poses high costs for the importation of capital items. Poor irrigation may have emanated from high costs associated with water supply and management. Increased tractor use was witnessed from 1961 to 1987, from 100 machines to 500, increase of 400 (though at a decreasing rate with a trough between 1975 and 1981); there was however a continuous and dramatic decline in use by 419 machines from 1988 to 1998. Use of harvesters/threshers was stagnant at low levels for most of the range between 1961 and 1982 with a slight deterioration between 1976 and 1981; it improved from 1982 to 1987, and then remained unchanged onward to the end period 1998.

Figure 5.4: trends in land irrigation, use of fertilizer, tractors and harvesters/threshers, 1961-1999

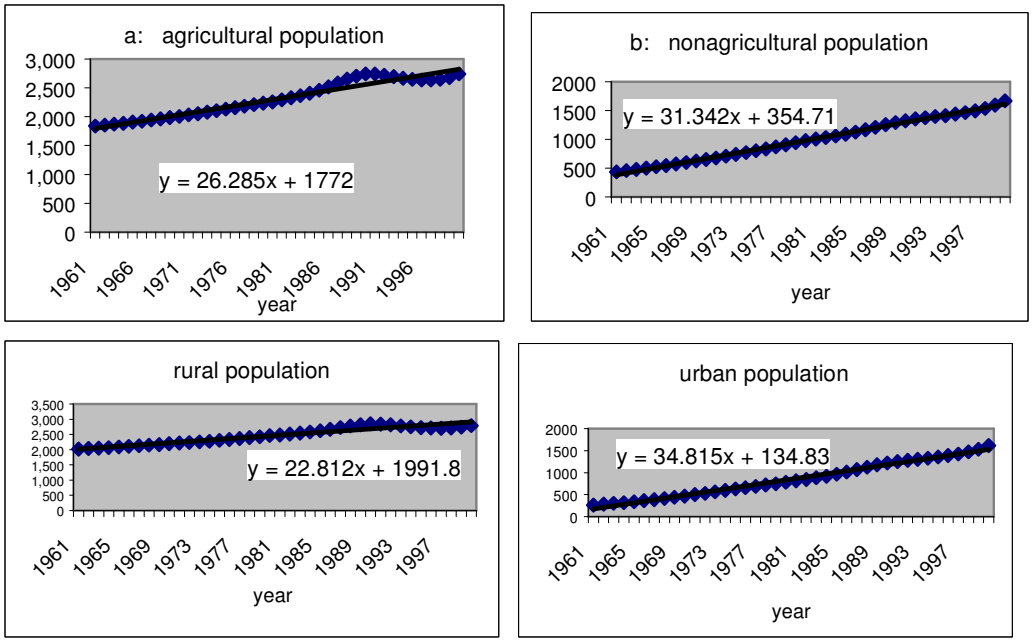


Source: derived from Appendix A

5.6.1 Population and other Trends

In panel a. and b. of figure 5.5, the increase in nonagricultural population (31,000 persons every year) outweighed the increase in agricultural population (26,000 persons the same year) for the period 1961-2000. This would have severe implications since population-lead of nonagricultural sector in developing countries often implies a reduction in young and energetic male folks from the rural areas toward urban and other sectors in search of better income pots. Moreover, the increase in population of those who remained in agriculture (panel a) without expansion in acreage is another problem causing unwarranted pressure on land and hence soil health problems. Panel c. and d. are more or less exact replica of a. and b. The former (c. and d.) signify that changes in agricultural population and nonagricultural respectively match changes in rural and urban population as they present the same trend behaviour though different gradients. Figure 5.6 visualizes share of labour force in agriculture as compared to industry and service sectors put together. While labour force of the latter has been showing positive movement over the period 1977-1999 the labour force in agriculture

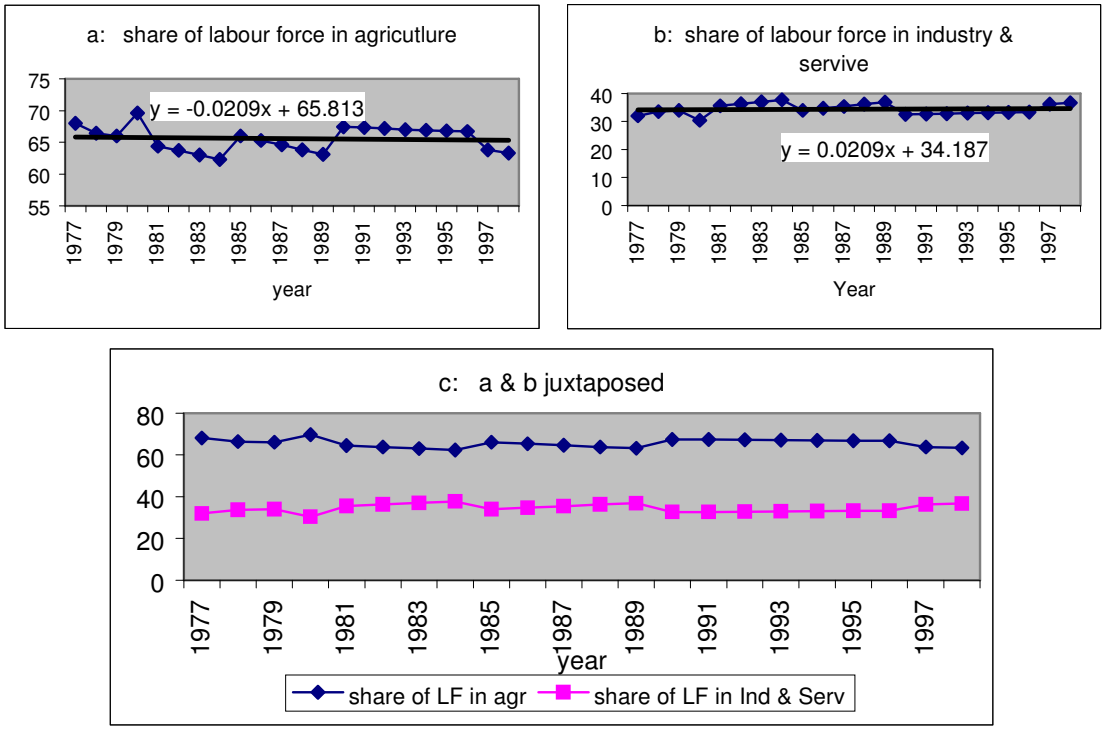
Figure 5.5: Sectoral Population Trends in Sierra Leone, 1961-2000



Source: derived from Appendix A

has been shrinking on average. This just again supports the suspicion of having active labour force transferred to other sectors of the economy from agriculture. Unlike agriculture, one can hardly find children, many females, and old age in the industrial, service and mining sectors of Sierra Leone, meaning increased labour force or population in general in the nonagricultural sector of the country highly likely constitutes more of the energetic male individuals leaving agriculture or rural areas in search of better economic opportunities. Panel c (showing juxtaposition of a & b of figure 5.6) communicates that increased labour force in industry and service sector implies a reduction in agricultural labour force.

Figure 5.6: share of labour force in agriculture compared with that in industry & service sector put together, 1977-1998

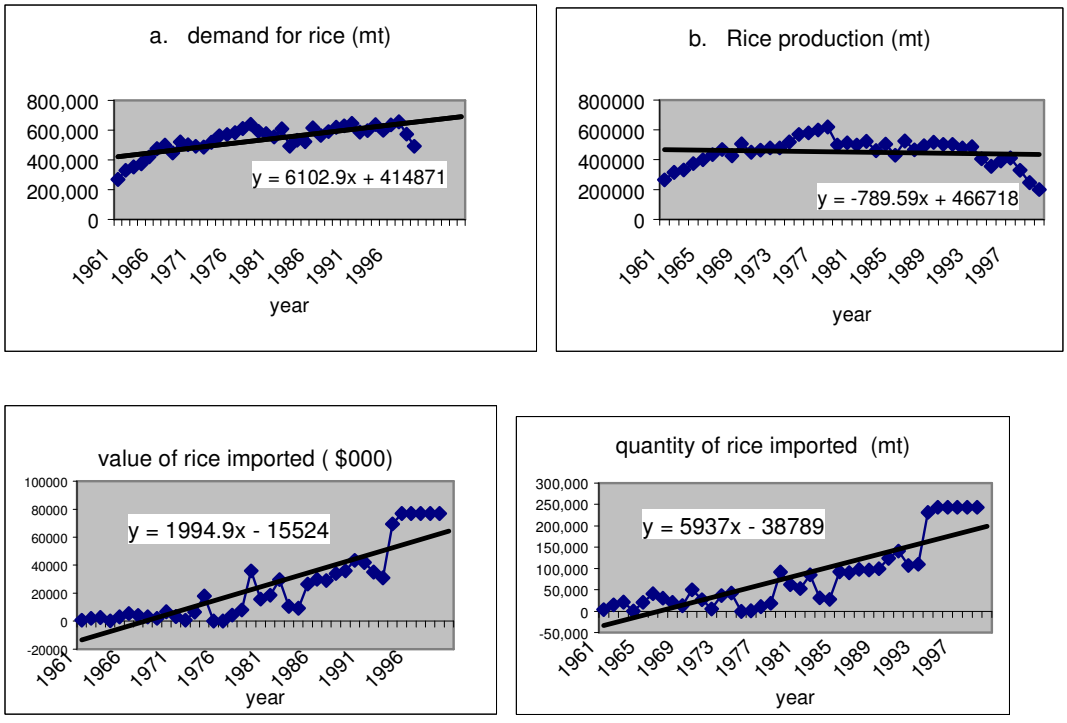


OIC data base: website www.sesrtcic.org

While population and demand for rice are on the increase in Sierra Leone without a matching domestic production of the crop (in fact with a decline in

production), importation of the grain becomes indispensable nonetheless the possible plummeting macroeconomic implications seen in shortage of foreign exchange, balance of payment problems, debt crisis, etc. Panel a and b of Figure 5.7 show that while demand for rice in Sierra Leone has been increasing by 6103 metric tons annually from the year 1961 to 2000 on average, domestic production declining by 790 metric tons. This implies the difference should be met by importation. And as panel c and d of this figure signal, the country has been remarkably embarking on importation of the crop; both quantity and value (in US dollars) show positive trends. Given importation in hard currency, of which the country is deficient, this may have badly affected the balance of payment position of the country and left it in debt troubles. A soaring exchange rate (Appendix H) can exacerbate the situation as import and debt servicing costs increase, with their adverse effects on domestic production, since more public resources would be directed away from local investment to settling foreign debt.

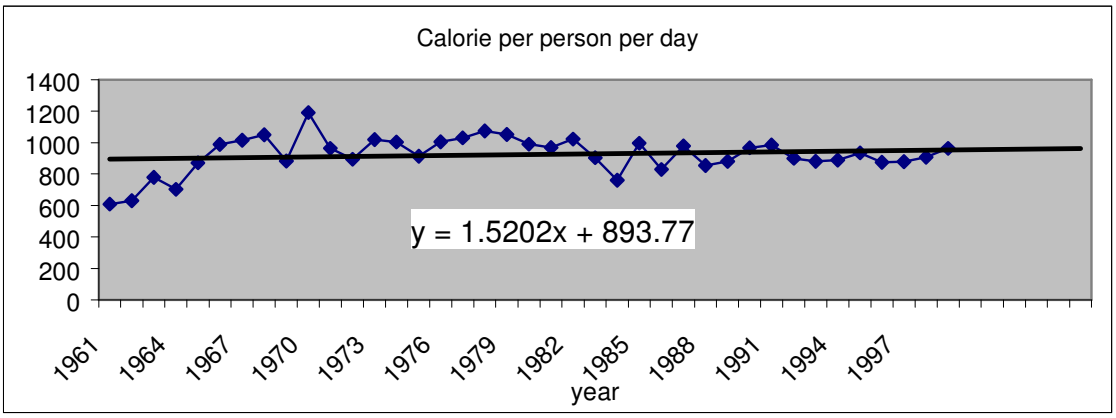
Figure 5.7: Trends in Rice Production, Its Demand and Importation, 1961-2000



Source: derived from Appendix A

Food importation with high cost could hardly be seen effective in solving problems of nutritional needs since increased border costs (c.i.f) would be transmitted to higher domestic retailing prices of the grain. The following figure (5.8) on calorie intake per person per day, with respect to rice consumption, shows little annual increase in calorie intake of Sierra Leone for the period 1961-2000, despite increased importation of the grain as source of augmenting domestic supply. The negligible increase in calorie intake may be due to the rise in price per "buttercup" (usual unit measure for the least quantity of milled rice purchased by consumers in Sierra Leone). At least 1½ buttercups should make a man survive for the day but currently majority can't even afford up to a cup/day. The price/cup of milled rice rose from about 30 cents in the first half of the 1980s to about 200 Leones (imported), 250 Leones (domestically produced "rough rice"), and 300 Leones (domestically produced parboil rice) in the year 2001 (PEMSD, 2001). Rough rice refers to the milled that does not go through boiling after harvesting while parboil is first boiled for proper retention of nutrients, dried up, then milled.

Figure 5.8 Trends in Rice Calorie Intake Per Person Per Day, 1961-2000



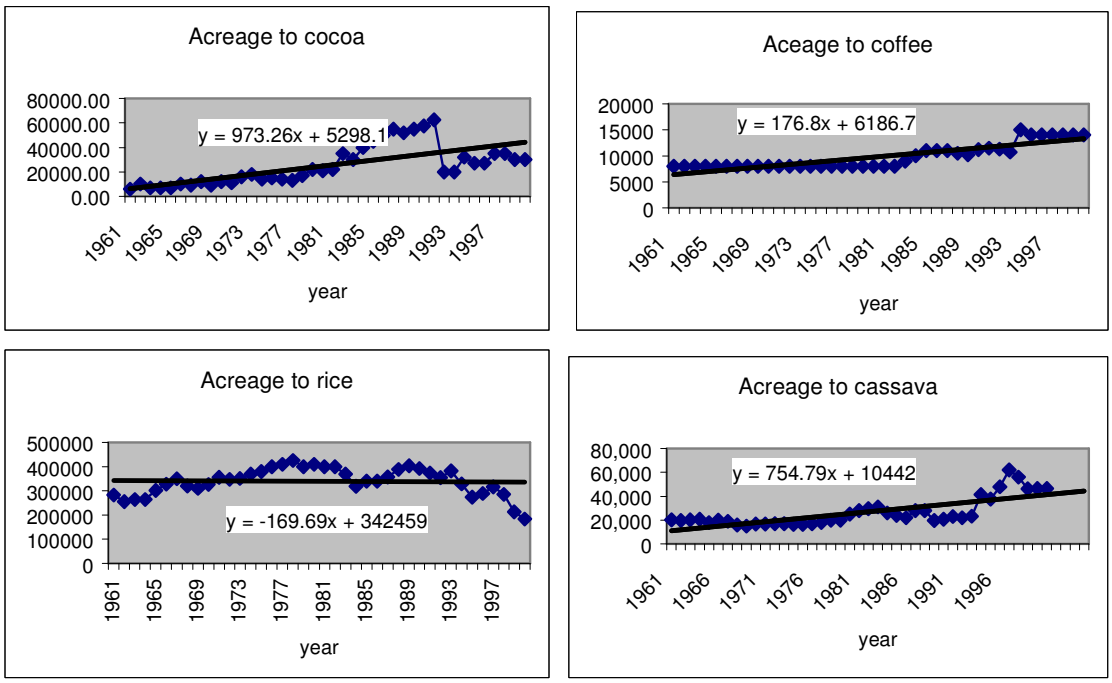
Source: derived from Appendix A

5.6.2 Changes in relative acreage and price of crops

Figure 5.9 shows trends regarding land resource competition amongst rice and other crops---- cassava (the second staple food reported), and cocoa and coffee (the major export crops). The acreage for the latter three crops has been expanding while that for rice contracting. Perhaps farmers may have seen it profitable to divert resources from rice farming to other crops, even

if it cost them to buy rice later on. This would be in affirmation of the drive by farmers to scout out for alternative sources of improving their income earnings. Figure 5.10 compares producer price trends among rice and the main export crops, cocoa and coffee; data on cassava price unavailable. Producer prices of all three crops (rice, cocoa and coffee) have been swinging upward. The difference in price increase is not significant, with rice in fact ranking second, while cocoa first and coffee the least over the period 1966-1999; producer price of cocoa increased annually by 16,682 Leones/ton; rice by 16,662 Leones/ton; coffee 16,135 Leones/ton. This does not signal much incentive difference. However, given the marked

Figure 5.9 Acreage Trends among Crops, 1961-2000

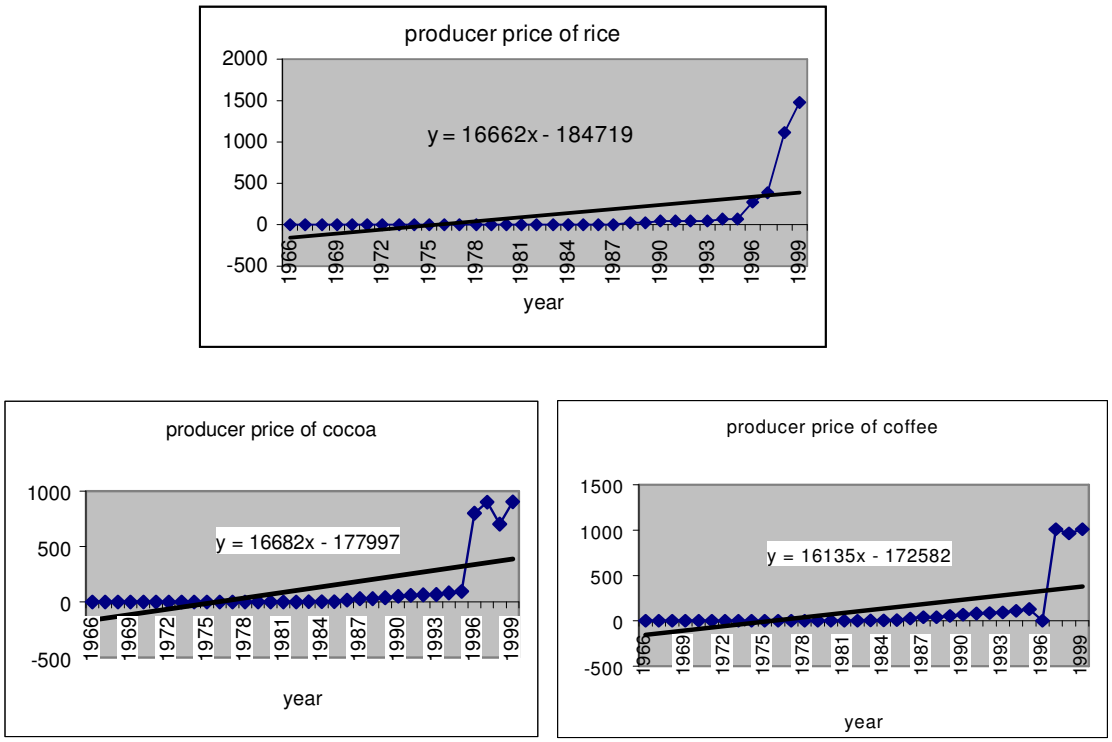


Source: derived from Appendix A

acreage trend difference in figure 5.9, with rice acreage diminishing while that of the other crops increasing, it suggests that projects and programmes may have been concentrating more on the other crops than rice, especially for earning foreign exchange (with respect to cocoa and coffee). For cassava, many people in Sierra Leone are substituting foods from this crop such as cassava flakes (*gari*) and *foo foo* for rice, not because they are close substitutes to rice but because people can afford them more than rice given the low-income levels of the majority. Thus shift in diet caused by low-income circumstances can bring about a decline in the production of the main staple. Many people during the civil war lived exclusively on

cassava, more so because it is easier to cultivate than rice. Export crops like cocoa and coffee are region specific, mainly based in parts of East and Southern Provinces of the country. But the fact remains that, where more project attention is given to them in terms of their foreign exchange earning potential, some farmers in other regions would transfer to their farming locations at the expense of rice production.

Figure 5.10: Comparing relative prices of rice, cocoa and coffee, 1966-1999



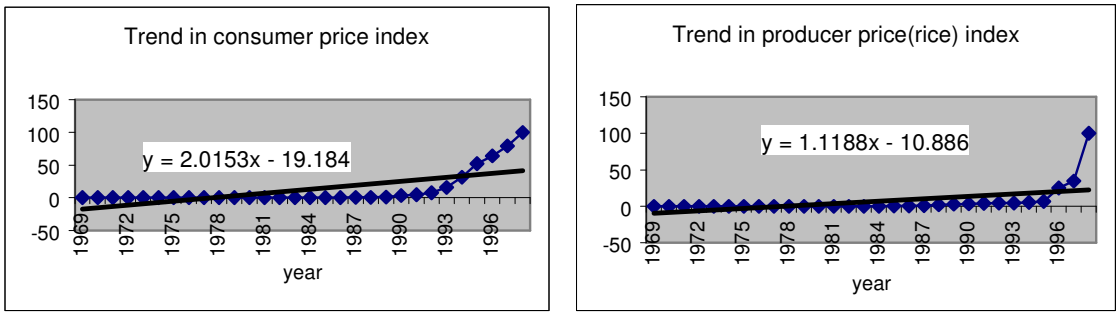
Source: Appendix A

5.6.3 Comparing Producer Price (Rice) with Consumer Price Index

The producer price index of rice has been assuming positive trend but the consumer price index (CPI) has been increasing faster, implying a negative net purchasing power to the farmers, which will tend to discourage their production. Figure 5.11 reflects this fact. While the consumer price index has been increasing by 2% annually, rice producer price index increasing by 1% (see trend equations). This supports reports on Sierra Leone by Landell Mills

Associates and Rokel Consultants (1982) that rice farmers were in part discouraged due to increased rates of inflation that their grain prices cannot match.

Figure 5.11: Producer price (rice) comparing with CPI, 1969-1998



Source: derived from Appendix 1

In summary, the visual inspection done in this chapter reveals that suitable land resource for agriculture is far from being efficiently exploited in Sierra Leone; most land cultivation that takes place is under upland ecology, which is less productive than lowlands; active labour has been shifting from farmlands to other sectors; the structure of land acquisition depicts deprivation of potential farm investors from securing the resource; the transportation system has not been efficient to enable farmer effectively transport their produce to market places; there has been minimal use of fertilizers and low employment of mechanized farming methods. It is also visualized that farmers have not been accorded with adequate price incentives; inflation rates appear to have been rising faster that rice producer prices; quantities of rice imported have been steeply increasing at the expense of local production. Put together, these factors may have immensely contributed to the decline in rice production in Sierra Leone. However, the extent to which factors explored here are significant in affecting rice production in the country is what the ensuing chapter tries to further establish.

CHAPTER 6

ANALYSIS OF NOMINAL PROTECTION COEFFICIENT AND REGRESSION RESULTS

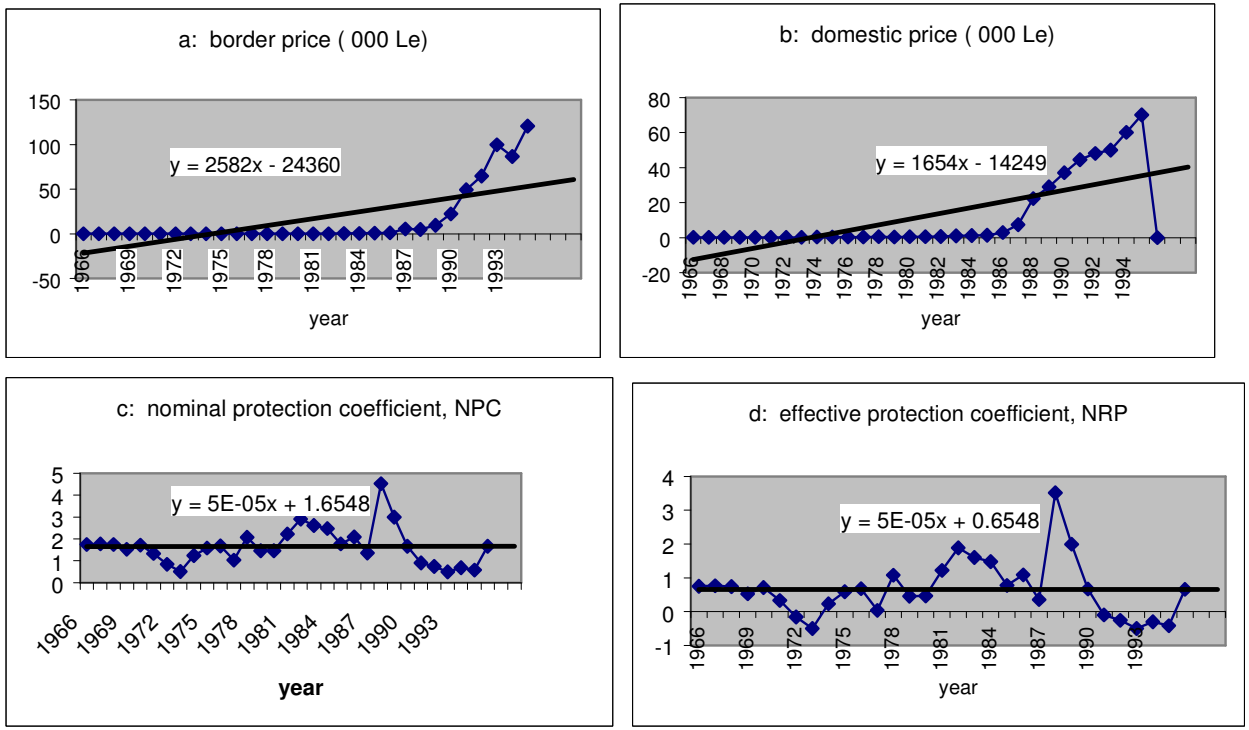
6.1 Nominal Protection Coefficient Results

It appears from the estimated nominal protection coefficient, NPC, in table 6.1 that rice farmers where being protected or accorded incentives on average. The average NPC over the period 1966-1995 shows an incentive of about 66% accorded to farmers of the grain due to policy intervention. This seems obscure because rice output has been declining as the trends before explained. However, accounting for exchange rates distortion, the nominal rate of protection, NRP, which is a correction of NPC to reflect true resource use, shows disincentives to farmers of the crop of about 66%. Based on this latter measure deemed more effective, one could infer that policy intervention into the market accorded farmers negative incentives, and this may have partly contributed to the decline in rice production over the years. Figure 6.1 graphs the border price, domestic price, NPC, and NRP, regarding rice. It shows that the border price has been increasing at a rate faster than the domestic price of the crop as the trend equations depict (the former by 2,592 Leones while the latter by 1,654 Leones per ton annually, panels a & b), leaving both NPC and NRP with negative trends (panels c & d). This confirms a reduction in farmers' incentives over the period 1966-1995. The results should however be interpreted with caution since such protection measure considers only one side of farmers crop activities (the revenue side), it does not capture the cost side to enable us better understand the incentive structure in terms of farmers' profitability. It is thus a limitation of the study since comprehensive data on inputs (domestic in particular) are hard to acquire. Nevertheless, the measure used is indicative of incentive

Table 6.1: Nominal Protection Coefficients

Year	Border	Domestic	NPC	NRP
1966	77.39	135	1.74	0.74
1967	78.1	138	1.77	0.77
1968	79.2	138	1.74	0.74
1969	90.47	138	1.53	0.52
1970	94.62	162	1.71	0.71
1971	97.94	130	1.33	0.33
1972	118.4	99	0.84	-0.16
1973	249.28	125	0.50	-0.50
1974	212.42	262	1.23	0.23
1975	165.6	262	1.58	0.58
1976	172.05	288	1.67	0.67
1977	240.35	248	1.03	0.03
1978	189	393	2.08	1.08
1979	244.86	356	1.45	0.45
1980	296.1	432	1.46	0.46
1981	232	515	2.22	1.22
1982	215.76	624	2.89	1.89
1983	357.21	930	2.60	1.60
1984	444.27	1100	2.48	1.48
1985	732.96	1300	1.77	0.77
1986	1335.47	2780	2.08	1.08
1987	5446.4	7400	1.36	0.36
1988	4909.01	22200	4.53	3.53
1989	9689.22	29040	3.00	2.00
1990	22263.15	37040	1.66	0.66
1991	49321.78	44400	0.90	-0.100
1992	64927.2	48000	0.74	-0.26
1993	99872.96	50000	0.50	-0.500
1994	86837.52	60000	0.69	-0.31
1995	120835.2	70000	0.58	-0.42
		Ave	1.66	0.66

Figure 6.1: border price, domestic price, and protection coefficients



NPC = nominal protection coefficient; NRP = real protection coefficient

Source: FAO database, using US rice producer price as proxy for world price

reduction following price intervention into agricultural marketing and distorted economywide policies, which may have in part discouraged farmers to produced more rice.

6.2 Regression Results

These results are autoregressive distributed lag (ADL) model output using OLS technique, with each variable lagged thrice in an effort to capture the dynamic behaviour of rice production in Sierra Leone. PcGive module in GiveWin econometric package was used for the estimation. From table 6.2, output of rice in Sierra Leone positively responds to last year and the year before prices and both are significant at 10%, but with very low elasticities (0.01 and 0.19 respectively). Implies a 10% increase in last year and the year before producer prices relative to consumer price index only brings about a 0.1% and1.9% increase in output. These low price elasticities for the Sierra Leone case are not however surprising as the country is one of the poor nations whose farmers' response to price is deterred by a lot of structural rigidities, ranging from poor infrastructural network to imperfect institutions. The current year price and its third lag are not significant. None of the public investment variables (current and lagged) is found significant in affecting rice production in the country. Its insignificance may not be doubtful for a country where public expenditure is not properly directed. Expenditure on agriculture could be tremendous but if this is just restricted to putting up office buildings, employing agricultural experts, spending on unskilled workers, etc, it will be difficult to realize the expected fruits of the budget. Without reaching the constrained farmers through provision of basic and necessary farm implements, fertilizers, rural amenities, better feeder roads, effective extension service, etc, a major part of the expenditure toward agriculture could only be a waste of resources, and this would not have the expected impact on agricultural production. Last year increase in cassava acreage (CSCRE_1) negatively and significantly affected current production of rice as expected, reflecting land resource

Table 6.2: The general modelling of rice output (Q) using OLS, 1964-1998

Variable	Coefficient	Std.Error	t-value	t-prob	partial r^2
Constant	18.306	7.7049	2.376	0.0980***	0.6530
LQ_1	-0.86083	0.30190	-2.851	0.0650***	0.7305
LQ_2	-0.28881	0.30558	-0.945	0.4143	0.2294
LQ_3	-0.32715	0.24651	-1.327	0.2764	0.3699
LP	0.098217	0.062028	-1.583	0.2115	0.4553
LP_1	0.010721	0.075304	-0.142	0.0958***	0.0067

LP_2	0.18642	0.072946	-2.556	0.0835***	0.6852
LP_3	-0.12066	0.10676	-1.130	0.3406	0.2987
LPUI	0.026347	0.030592	0.861	0.4524	0.1982
LPUI_1	0.016063	0.051818	0.310	0.7769	0.0310
LPUI_2	0.11264	0.065676	1.715	0.1848	0.4951
LPUI_3	-0.049587	0.043212	-1.148	0.3344	0.3050
LCScre	-0.060207	0.18765	-0.321	0.7694	0.0332
LCScre_1	-0.23733	0.090881	-2.611	0.0796***	0.6945
LCScre_2	-0.13394	0.14350	-0.933	0.4195	0.2250
LCScre_3	0.28762	0.18137	1.586	0.2110	0.4560
LRmp	-0.014377	0.013698	-1.050	0.3710	0.2686
LRmp_1	-0.029493	0.012862	-2.293	0.0057*	0.6367
LRmp_2	-0.037964	0.011176	-3.397	0.0426**	0.7937
LRmp_3	-0.038867	0.010263	-3.787	0.0323**	0.8270
LRACR	-0.41952	0.36549	-1.148	0.3343	0.3052
LRACR_1	0.64973	0.29386	2.211	0.1140	0.6197
LRACR_2	0.24225	0.31233	0.776	0.4945	0.1670
LRACR_3	0.82381	0.36208	2.275	0.0074*	0.6331
F	0.02333	0.04000	0.845	0.4555	0.1922
F_1	0.12384	0.14251	-0.893	0.3995	0.1990
F_2	-0.09066	0.10576	-1.099	0.3406	0.2787
F_3	0.59973	0.28386	2.211	0.1150	0.7197
LRUP	16.527	16.309	1.013	0.3855	0.2550
LRUP_1	-44.567	39.264	-1.135	0.3388	0.3004
LRUP_2	84.764	42.813	1.980	0.1421	0.5665
LRUP_3	-56.934	23.550	-2.418	0.0944***	0.6608
DUM	-0.24263	0.15510	1.564	0.0157**	0.4493

R^2 = 0.993698 F(28,3) = 16.894 [0.0193] DW = 2.42

Short-run price elasticity = 0.01
Long-run price elasticity = 0.005

Diagnostic Test

AR 1- 1 F(1, 2) = 0.94828 [0.4329] SC = -4.45
ARCH 1 F(1, 8) = 0.0018378 [0.9669]
Normality Chi^2(2)= 0.88147 [0.6436]
RESET F(1, 2) = 0.000615 [0.9825]

SC = Schwarz information criterion
* significant at 1%, 5% & 10%; ** significant at 5% & 10%; *** 10%
ln = natural logarithm
Q = quantity of rice produced (dependent variable)
P = producer price of rice
PUI = public investment
CSCR = area under cassava crop production
RMP = quantity of rice imported
RACR= Land area under rice cultivation
RUP = rural population
DUM = dummy for the civil war in Sierra Leone

competition effect. Cassava is the second staple food of Sierra Leone; it is not, normally, a close substitute to rice crop, but produces a considerable response from rice cropping following increase in its acreage. Table 6.2 shows that rice output drops by 2.3% for a 10% increase in cassava acreage the previous year (the resource switching effect, that may follow from an increase in demand for this tuber crop, which may earn better economic returns than rice in some situation, especially when rice price is considerably high). A good might not be a close substitute to another *ceteris paribus* but could circumstantially be when the price of the other item skyrockets. Sierra Leone could be an example. Due to people's low income, cassava, a composite tuber crop, often supplements rice. In many parts of the country majority consume more cassava than rice; this fact became eminent during the decade long civil war, when rice was a luxury for most people. Current increase in the area under this crop and its second and third lags do not appear with significant effects on rice production.

All lagged RMP variables (representing quantity of rice imported) significantly and negatively affect rice production in Sierra Leone, though with low elasticity response. The low negative response might be a result of the fact that the full negative multiplier effect of import is partly offset by the positive effect it produces in that, during planting or production process, farmers would need food for work which in many parts of Sierra Leone comes from acquiring imported rice grain from the market, and this will help them work hard and boost local production of the grain. However, given the superior quality of the imported rice, its subsidized price, and perhaps ease of cooking, local grain is often crowded out of the market, the reason for the negative net impact suggested in this study. The current RMP variable has the expected sign but is not significant, suggesting rice importation affects local production of the grain with a lag.

For area under rice cropping, both current acreage expansion and that of the last two years do not seem to have significant effects on current rice production. However, its increase three years back (RACR_3) appears with a positive and significant effect. The insignificant rice response to current as well as the last two years increase in acreage may result from the fact that area cultivated may have increased but if there were not improved rice varieties or sufficient application of fertilizers the output would not be significant; more so with upland farming system with low natural nutrients. The crop might have only significantly responded to increased acreage after a considerable lapse of time when complementing factors, like

those just mentioned, are acquired. However, under no situation, current or lag, has fertilizer consumption (the F variable) proved significant in affecting rice production from table 6.2. It may not also be surprising since fertilizer is not procured costlessly. Given the low-income bracket of most farmers in Sierra Leone as reflected in the dominance of small-scale farming in the country, the application of fertilizer on farms would be on a very small-scale, while the cost of the input is on the increase with increase in exchange rate levels. Hattink *et al* (1998) studying cocoa supply response for Ghana also found insignificant result for fertilizer use partly due to the reason given shortly and because the input was being acquired by farmers in that country from the black market.

Rural population (RUP) positively affects rice production but with the farthest lag considered (the third lag). The first two lags and the current value of RUP are not significant. Nonetheless, given the positive and significant impact produced by the third lag of the RUP, it suggests that reduced labour movement from rural areas would significantly increase output of the crop with time. Just as increased acreage may not automatically increase output of the crop, rural population increase would not immediately bring about an increase in production because they would need to be equipped technically or by acquiring certain requisite inputs which could not happen a day. The dummy capturing effect of the 1990s civil war comes out significant with the expected negative effect on rice production.

R^2 and F-test statistics show significant goodness of fit of the model. From the diagnostic tests, there is no problem with the normality of the error term (this is buttressed by its normal curve in Appendix H). The model is well specified, and no case of heteroscedasticity; absence of serial correlation is affirmed. The incidence of any simultaneity or nonstationarity can be reduced by the inclusion of a number of lagged variables in the model (Banerjee, ***et al***, 1993; Gujarati, 1995).

Table 6.3 shows estimated regression after dropping the most insignificant variables, PUI (public investment) and fertilizer consumption variable (F), in the previous model. This drastically improved the results of the remaining variables; all the significant variables carried

the expected signs. All variables in this table appear to be significantly affecting rice output with a lag. For producer price of rice, the first and second lagged price variables significantly affected output. The difference between CSCRE variable here and in the previous results is that its effect becomes more significant here than before. The first, second and third lag values of Rice importation (RMP) and rural population (RUP), all significantly affected output of the crop as expected; with area under rice production impacting positively and significantly on the crop at current and lag one level.

This last estimated model shows significant goodness of fit as the previous. The diagnostic tests are all favourable. Both models in tables 6.2 and 6.3 seem to be reasonable in tracking historical records (see actual and simulated values in appendix I), which can make forecasting outcomes admissible. Schwarz information criterion (SC) reveals that the second model in table 6.2 performs better.

Table 6.3: Modelling of rice output after dropping RAP variable using OLS, 1964-1998

Variable	Coefficient	Std.Error	t-value	t-prob	Partialr^2
Constant	13.512	3.7124	3.640	0.0083*	0.6543
LQ_1	-0.91513	0.18967	-4.825	0.0019*	0.7688
LQ_2	-0.29589	0.23737	-1.247	0.2527	0.1817
LQ_3	-0.077523	0.19278	-0.402	0.6996	0.0226
LP	0.013036	0.041045	-0.318	0.7600	0.0142
LP_1	0.092312	0.050938	1.812	0.0128**	0.3193
LP_2	-0.15519	0.052917	-2.933	0.0219**	0.5513
LP_3	-0.055297	0.053387	-1.036	0.3348	0.1329
LCScre	0.11532	0.10763	1.071	0.3195	0.1409
LCScre_1	-0.29350	0.085585	-3.429	0.0110**	0.6269
LCScre_2	-0.051539	0.10324	-0.499	0.6329	0.0344
LCScre_3	0.0035137	0.097998	0.036	0.9724	0.0002
LRmp	-0.0078405	0.0066712	-1.175	0.2783	0.1648
LRmp_1	-0.032151	0.0072989	-4.405	0.0031*	0.7349
LRmp_2	-0.029084	0.0070383	-4.132	0.0044*	0.7092
LRmp_3	-0.028052	0.0070465	-3.981	0.0053*	0.6936
LRACR	0.16848	0.32451	-0.519	0.0196**	0.0371
LRACR_1	0.51788	0.23538	2.200	0.0637***	0.4088
LRACR_2	0.19755	0.25150	0.785	0.4579	0.0810

LRACR_3	0.31629	0.25782	1.227	0.2596	0.1770
LRUP	6.1079	8.1912	0.746	0.4802	0.0736
LRUP_1	26.511	22.230	−1.193	0.0719***	0.1689
LRUP_2	53.644	26.611	2.016	0.0836***	0.3673
LRUP_3	−32.158	14.612	−2.201	0.0636***	0.4090
DUM	−0.13030	0.072650	1.794	0.0160**	0.3149

R^2 = 0.984182 F(24,7) = 18.147 [0.0003] DW = 2.72

Short-run price elasticity = 0.09
Long-run price elasticity = 0.05

Diagnostic Test

AR 1- 1 F(1, 6) =	2.1192 [0.1957]	Sc = −5.234
ARCH 1 F(1, 5) =	0.0035156 [0.9550]	
Normality Chi^2(2)=	3.0649 [0.2160]	
RESET F(1, 5) =	0.31354 [0.5892]	

SC = Schwarz information criterion
significant at 1%, 5% & 10%; ** significant at 5% & 10%.

It is calculated from both estimated regressions that, the long run price elasticity is positive but unexpectedly lower than the short-run elasticity (see tables 6.2 and 6.3). The expectation of the theory is that long run price response for both individual crop and aggregate should be higher as factors become more flexible to adjust in taking advantage of incentives. The opposite is nonetheless suggested in the case of Sierra Leone in this study, meaning the ability of farmers to respond to prices in the country becomes more affected in the long run, indicating that the structures (such as infrastructural problems, institutional bottlenecks, etc) that limit farmers response in the short-run in fact become more deterring in the long run. The structures seem to become more rigid over time in Sierra Leone. This might not be far from being true, for a country where corruption and mismanagement of resources have been reaching a crescendo. It would not be surprising if farmers' response to price incentives becomes narrower in the long run for an economy where resources are not directed toward meaningful investments that should directly or indirectly facilitate agricultural production adjustment.

CHAPTER 7

CONCLUSION

7.1 Summary of Findings

The foregoing analyses indicate that low producer prices create disincentives to rice farmers, hence a decline in the grain's production in Sierra Leone. A fall in producer price relative to consumer price index stands to have a downward pressure on farmers' purchasing power, which would eventually discourage cropping as farm labour time might be curtailed toward off-farm employment to supplement incomes. However, given the minimal response of rice output to price as reflected in the regression results, scaling up prices farmers receive would not seem to be the only way out of the food's shortage. There appears to be strong determinants (non-price factors) that influence the grain's output response to price, and this suggests among other things problems of poor infrastructural base, limited and poor roads to link farming areas to market centres; lack of credit facilities promoted by non-integration of formal credit institutions into the rural areas. There is the problem of limited mechanized farming, leaving farmers relying on the hand-power and crude farming implements. Poor road

network in rural villages had inhibited the operations of the few available tractors in the country while most were without spare parts. Though not found significant from the regression results, the trend description in chapter 5 shows that fertilizer use rates have been negligible and this would contribute to arresting farmers response to price of the grain; this could be a consequence of the low-income band farmers are trapped in while the input's consumption is exclusively dependent on importation. With exchange rate towering as it has been, many farmers may have gone without any use of the input, as its consequent local cost would be unaffordable to many.

Cassava crop is discovered a substitute to rice in this study in terms of competition over land resource, that expansion of acreage under the former contracts area cultivated under the latter, more so when both crops are farmed under the same farming systems and in many circumstances mixed cropped. Increased demand for cassava would attract the attention of farmers toward its production so that its acreage and proportion in mixed stands may be increased.

Rice importation is discovered negatively and significantly affecting local production of the grain. The economic strategy of inordinate dependence on rice imports to reduce the food gap in Sierra Leone is seen by this research as a vicious circle of policy approach, apart from the international markets being unreliable and imports competing with domestic produce. Embarking on excessive importation when foreign exchange reserves are low would only bring the nation to square one as incurring huge external debt in this situation is inevitable for which both public and private funds will be squeezed toward its servicing, thereby suppressing domestic investment activities including rice projects. The policy of importing the staple food may thrive in the short-run, but could worsen an already acute food shortage

situation in the medium- and long-run. For data reason, this study cannot ascertain whether it is on efficiency ground in terms cost of local rice production outweighing importation cost that the country has been depending on the latter source for the supply of the grain. But the fact remains that huge potential for local production of the grain is proved to be far from being efficiently exploited.

Increased rice production in the country is found to follow expansion of acreage under the crop, with significance at 5 and 10% at current level and 10% with a lag (RACR_1) from table 6.3. Increased rural population is also found positive and significant in affecting rice production. The implication is that rice production increases with increase in rural population (with a lag) while the reverse is also true in affirmation of the hypothesis that "shift of rural labour toward non-agricultural sector reduces rice output in Sierra Leone". The reverse implication suggests that the disproportionate concentration of government attention on the mining sector may have been a big source of wreckage in the agricultural sector toward rice production, as majority in Sierra Leone regard mining the fountain-head of money, pulling rural labour away. The "Low Farm Household Model", describing farmers time allocation between farming and off-farm employment in Southern Africa, seems to hold in the case of Sierra Leone; farmers seeing better wages in off-farm employment relative to consumer prices compared to on-farm returns tends to pull them over, leaving little or no time on farming (Ellis, 1992).

With the exception of RACR variable (acreage under rice production), affecting rice production at both current and lag levels, in table 6.3, the rest of the effects summarized above appear to have affected rice production in Sierra Leone with only a lag. This supports the premises upon which the study model is specified; that is within the Nerlovian supply

response framework. That farmers respond to incentives or disincentives with time lapse in that once planting has taken place it will take them considerable period to respond or be able to meaningfully adjust to current market and other situations. One of the other studies that found farmers responding to incentives with lags is Elamin and El Mak's (1997) in the case of Sudan. This study thus uniquely establishes toward the literature on Sierra Leone that rice farmers respond to price incentives with lags and that they do not form naïve expectations but rather adaptive. On average, the non-price factors appear with stronger effects on rice production than the price factor. Another unique finding for Sierra Leone is that short-run price elasticity is greater than the long-run price elasticity for rice response contrary to theory. This can be justified in a case where imperatives necessary for long run farming adjustment are not fulfilled.

The decade long civil war in Sierra Leone was a strong impediment to rice activity, and agriculture in general. The dummy variable slotted in to capture this catastrophe comes out significant in affirmation of the expected negative impact of the civil war on rice production.

The foregoing findings should however be taken with caution as they should be sensitive to the nature data were acquired for this exercise, a common phenomenon for developing economies studies. Data compilation activity in poor nations encounters a number of constraints making figures incomprehensive; this affects reliability of studies based on secondary information for empirical analyses.

A number of constraints unearthed in this research are extremely difficult to quantify, and this makes getting reliable proxies for them uneasy. Thus cannot be captured in the empirical estimation; they are only limited to theoretical analysis (Ogbu and Gbetibouo, 1990;

Kwanashie *et al*, 1997). Some of these are the chronic farming practices in Sierra Leone. The traditional upland farming system with which farmers are inextricably linked is a serious constraint limiting rice production in the country, given such rice ecology the least in yield compared to others (swamp ecologies). Such farmers' behaviour, however, has some defendable grounds, or rather factors to explain it. A key reason is the ease of cultivation associated with upland farming compared to the latter; labour shortage strengthens the attachment of farmers to upland culture since swamp cultivation is vastly labour requiring. Continuous cropping with shortened fallow periods characterizing upland farming in Sierra Leone further reduces the yield potential of this ecology, a situation made worse as population increases exert pressure on the land at rates faster than acreage expansion.

It follows from the literature reviewed that the technology approach (top-bottom) that was being adopted was not much successful in resolving rice food shortage in Sierra Leone. Improved rice varieties proffered by most research activities were virtually focusing on swamp cropping leaving out upland system to which the majority of the farmers are accustomed. This suggests the recommendation, "bottom-top" approach to include farmers' traditional knowledge in research and development. Besides, information does not adequately flow to farmers regarding new technologies so that farmers consider it risky to adopt new rice varieties, which they think may not do well as the traditional (a problem of poor extension service). Furthermore, the effective application of new technology is predicated upon the availability of accompanying inputs (such as credits), which are often lacking, and on high level of labour which is scarce in the rural areas.

Improper management of funds related to increasing the crop's production is another factor. Projects are not properly managed to optimal outcome to enable farmers get the estimated

impact. Lack of political will toward domestic production of the crop is a serious concern, if not the most. Importation of rice by government on political ground to curry votes (a fact surfaced) is unfortunate against domestic production. Plans and programmes implementation capacity is discerned weak in this study. There have been suitable and well-designed policies for increased rice production but results suggest undermined implementation efforts and lack of political will. In addition, some programmes were failing to reach some potential rice producing areas.

It does not seem to be a serious discussed problem affecting agriculture in the Sierra Leone literature come across, but given its structure described in this study, land tenure system being communal in fashion sends some signals as an imminent factor affecting rice production in the near future as population pressure on the land increases and marketing opportunities expand.

7.2 Recommendations

If economic and social stability should be enjoyed in Sierra Leone, shoulders should be put to the wheel to ensure sustainable provision of basic food for the people; and rice (the staple) commands the highest priority. From this vantage point and given the problems of rice highlighted in this study, the following recommendations are noteworthy.

Rice farmers should be accorded the necessary incentives to keep them effective in the cultivation of the grain. Thus the food policy approach that had for long depended on massive importation of rice should be revised in favour of domestic production. It is paramount that the policy focuses first on improving incentives for domestic rice producers by curtailing imports and according them reasonable prices, the author's conviction that it is only via

boosting domestic production that a sustainable food selfsufficiency and hence food security could be achieved. The objective of increasing consumers' access to food should not be based squarely on food price reduction; rather government should instigate income generating programmes, employments, food for work, etc, to enhance consumers command over food. Increased domestic production via a meaningful protection of farmers can by itself reduce the price of the grain to the advantage of the consumers. This is deemed by this research the way out of resolving food policy dilemmas facing governments in developing countries (Timmer, *et al*, 1983, for more details on food dilemma resolution). What it needs is a proper prioritization and sequencing of policy. This study recommends that public funds be redirected or reduced away from rice importation toward investments in its local production in Sierra Leone.

For farmers to be able to take full advantage of price incentives though, there should be such imperatives like stepped-up credit facilities and input subsidization to enable them procure the necessary requisites for their cropping activities. Output response requires full-scale dismantling of infrastructural bottlenecks; feeder roads and bridges have to be constructed and refurbished for easy access of the market by farmers in the villages and the access of these settlements by credit programmes.

The foregoing recommendations are among those needed for a reversal of the rural-urban or farm-mine shift trend that is discussed in almost every agricultural document of Sierra Leone as outstanding contributor to low agricultural productivity of the country. To emphasize it more, social infrastructural investment should be decentralized so that schools, health centres, and other relevant institutions could be effectively established in close proximity with village settlements. The improper mining policy that had existed in Sierra Leone allowing illicit and private individuals freeholds in the mining areas is a cause for the unrestrained abandonment of farms for the mines. Stringent mining policy for the benefit of all should be instituted, restricting the unwarranted entry into the fields as is happening in some Southern African countries. It is recognized however that entry restriction may pose Herculean task since minerals, diamonds in particular, are not clustered in one place in Sierra Leone. Nonetheless

effort should be made toward this direction, and let there be demonstrated policies and education that could bring people to mind that there is a steak in agriculture in Sierra Leone; potentials exist. This could be practicalized if farmers' incomes are raised.

In addition to price incentives for farmers is a healthy macroeconomic environment, seen in a stable inflationary and exchange rates levels. A stable inflation is required for an improvement in the purchasing power of farmers relative to the prices they receive of their crop. Inflation in Sierra Leone immensely depends on the level of exchange rates owing to the fact that it is supply-side driven; it is heightened significantly if costs of capital importation are increased from a depreciating value of the local currency as has been happening in the last two decades. In this regard, and with cost consequences it produces on inputs like fertilizers and fuel, all frantic efforts should be made to stabilize exchange rates in the economy. Subsidies should not be totally lifted on such indispensable inputs for Sierra Leone. Local organic manure should be exploited as substitute to reduce the cost impact of manufactured fertilizers, and this could help avert the negative effect chemical fertilizers would have on the soil health.

Petrol is an indirect and unavoidable input to poor farmers in the villages; it aids transportation of produce; thus its high costs as currently being witnessed in Sierra Leone can be translated into high transportation fares, which limit farmer's accessibility of market centres. Therefore continued subsidy on fuel importation is recommended while at the same time effort should continue to stabilize exchange rates. In the same token, government should pursue effort to start tapping the crude oil discovered in Sierra Leone so that resources could be saved from fuel importation.

Government should initiate and promote mechanized farming programmes to expand acreage. Irrigation schemes should be promoted to reduce incidence of seasonal cropping in the country. Agricultural research activities should involve both swampland and upland development than the disproportionate concentration on the former ecology, which has been limiting farmers' efforts due to its high demand for labour. Extension services should be enhanced to provide continued education to farmers on new rice technologies, to reduce the

feel of risk over the application of new rice varieties. Agreeing with other authors, agricultural researchers in Sierra Leone should themselves come down to the grassroots to receive first hand feedbacks on the progress of the technologies they proffer than solely relying on information from extension workers. This could better enable researchers revisit their approaches where necessary, and at the same time utilize farmers' traditional knowledge in further research activities.

Finally, a successful economy is the one that witnesses the utmost political will. A successful rice policy toward alleviating food shortage in Sierra Leone depends on the political imaginations. With political attention focused on domestic strategy to increase rice supply, given the agricultural potential, food shortage would surely be mitigated in Sierra Leone. Government has to back up programmes and enhance their implementation capabilities. Grateful that the civil war has come to an end; what is recommended are efforts to ensure a sustainable peace and good governance, the first prerequisites for any activity to thrive well in an economy.

7.3 Research Need for the Future

It will be necessary to carry out studies investigating root causes of rural-urban migration, analyzing these causes and their economic effects. A comprehensive study of farm-household model is worthy of undertaking to deeply analyze effects of farmers' time allocation decision on the staple food's production. A multi-crop supply response analysis is another area for future researchers to study the interaction among crops in an effort to ascertain the extent other crops affect rice production; this could be important to explore crops that are nearest substitutes to rice, for the purpose of promoting staple food diversification. Studies are necessary to investigate factors that influence farmers' adoption and non-adoption of new technologies in Sierra Leone.

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Appendix A: Data Set

YEAR	Q	RPCPI	PUI	CSCRE	RMP	RAP	RCRE	RPR	RPIND	CPI	USRPR
1961	264000										
1962	314976										
1963	331000										
1964	373000	0.62	18500	20639	551	0.27	264013	134	0.01	0.02	
1965	399000	0.60	19500	18000	21134	0.28	301000	135	0.01	0.02	
1966	434000	0.52	22184	20000	41150	0.28	327000	135	0.01	0.02	705
1967	468000	0.55	15398	19000	30481	0.29	350000	138	0.01	0.02	747
1968	426100	0.54	12925	16000	20930	0.30	320000	138	0.01	0.02	711
1969	507000	0.48	18635	15000	12833	0.31	310000	138	0.01	0.03	979
1970	450000	0.54	28730	16665	50157	0.32	326810	162	0.01	0.03	929
1971	464000	0.43	28570	16600	27361	0.33	356000	130	0.01	0.03	805
1972	479000	0.31	16012	17000	5233	0.34	348000	99	0.01	0.03	1389
1973	479000	0.37	16525	17000	37318	0.36	351000	125	0.01	0.03	1551
1974	518700	0.79	38238	16500	42325	0.37	370000	262	0.02	0.03	1277
1975	570600	0.75	46452	16500	3	0.38	380000	262	0.02	0.03	1387
1976	580000	0.78	26722	17000	854	0.39	400000	288	0.03	0.03	1658
1977	600000	0.59	35504	18000	11026	0.40	410000	248	0.02	0.04	4079
1978	620000	0.78	36500	20000	18500	0.41	425000	393	0.04	0.05	3042
1979	500000	0.60	63912	20000	91883	0.42	400000	356	0.03	0.05	2778
1980	513000	0.68	147540	25000	62119	0.43	410000	432	0.04	0.06	3527
1981	500000	0.73	99712	28000	53100	0.44	400000	515	0.05	0.06	4409
1982	523500	0.72	89810	29600	85339	0.44	400000	624	0.06	0.08	4740
1983	460200	0.96	102912	31000	31291	0.45	370000	930	0.08	0.09	4960
1984	504137	0.92	52160	26000	28000	0.45	318892	1100	0.10	0.11	6063
1985	430000	0.85	182748	24000	92193	0.46	339865	1300	0.12	0.14	6173
1986	524989	1.08	333161	22000	90146	0.46	339865	2780	0.25	0.23	6393
1987	465675	1.73	1277760	28000	97700	0.47	357381	7400	0.67	0.38	6388
1988	493000	2.94	672000	28000	96700	0.47	387800	22200	2.00	0.68	7269
1989	517800	2.13	907132	19600	99500	0.48	403200	29040	2.61	1.23	8590
1990	503700	0.97	3511153	20600	123700	0.48	392600	37040	3.33	3.42	5947
1991	503700	0.87	4670892	22852	141100	0.49	372970	44400	4.00	4.60	3858
1992	478515	0.58	22069676	22000	107200	0.51	354322	48000	4.32	7.39	3748
1993	486300	0.29	11783488	23100	110000	0.52	382000	50000	4.50	15.59	4960
1994	405200	0.17	22321849	41500	231600	0.53	328300	60000	5.40	31.60	5401
1995	355500	0.12	18670330	37500	243200	0.54	274500	70000	6.30	52.29	5780
1996	391700	0.39	15742374	48000	243200	0.55	289200	278700	25.08	63.91	
1997	411300	0.44	3752000	62000	243200	0.57	316400	383900	34.55	79.37	
1998	328310	1.00	20694000	56000	243200	0.58	284770	1111100	100.00	100.00	
1999	247235										
2000	199134										

Continued……

YEAR	EXRAT	COFP	COCP	RACRE	CFACRE	COACRE	CSACRE	FCON	AGAIRR
1961				283000	8000	6000	20234	160	1
1962				255110	8000	10000	19688	160	1
1963				263936	8000	7000	20234	200	1
1964				264013	8000	7000	20639	200	1
1965				301000	8000	7000	18000	500	2
1966	0.71	265	265	327000	8000	10000	20000	502	2
1967	0.71	264	264	350000	8000	9000	19000	850	4
1968	0.72	314	302	320000	8000	12000	16000	1100	4
1969	0.83	314	302	310000	8000	9000	15000	2287	6
1970	0.83	314	304	326810	8000	12000	16665	2522	6
1971	0.83	314	314	356000	8000	11000	16600	1136	8
1972	0.8	314	314	348000	8000	16000	17000	1226	8
1973	0.82	336	327	351000	8000	18000	17000	2262	10
1974	0.86	467	500	370000	8000	14000	16500	1010	13
1975	0.9	560	672	380000	8000	15000	16500	2918	13
1976	1.11	834	803	400000	8000	14000	17000	1275	14
1977	1.15	1553	1270	410000	8000	13000	18000	1415	15
1978	1.05	1613	1661	425000	8000	17000	20000	1124	17
1979	1.06	1680	2128	400000	8000	22000	20000	2684	19
1980	1.05	1971	2119	410000	8000	21000	25000	1792	20
1981	1.16	1811	1848	400000	8000	22000	28000	3310	22
1982	1.24	1345	1680	400000	8000	35000	29600	360	23
1983	1.89	2688	2296	370000	9000	30000	31000	1191	25
1984	2.51	4685	3976	318892	10000	40000	26000	1300	26
1985	5.09	8363	3976	339865	11000	45000	24000	3600	28
1986	16.09	25013	17770	339865	11000	50000	22000	4000	28
1987	34.04	40320	30240	357381	11000	55000	28000	500	28
1988	32.51	40300	30240	387800	10500	52000	28000	538	28
1989	59.81	53000	40000	403200	10200	55000	19600	1560	28
1990	151.45	68000	51000	392600	11200	57500	20600	1300	28
1991	295.34	81000	61000	372970	11500	62500	22852	600	28
1992	499.44	87000	66000	354322	11304	20000	22000	1400	29
1993	567.46	91000	69000	382000	10739	20000	23100	3000	29
1994	586.74	110000	83000	328300	15000	32000	41500	3000	29
1995	755.22	129000	97000	274500	14000	27000	37500	3000	29
1996	920.73	780	800,000	289200	14000	27000	48000	3000	29
1997	981.48	1007330	898,900	316400	14000	35000	62000	3000	29
1998	1563.6	961110	703,300	284770	14000	35000	56000	300	29
1999		1008400	901,400	213054	14000	30000	46224		29
2000				183214	14000	30000	46490		
							46490		

Continued…….

YEAR	CAL/C/D	RUPP	URPP	AGPP	NAGPP	LF AG	LF IN&S
1961	**610**	**2013**	**263**	**1839**	**438**		
1962	**630**	**2032**	**280**	**1854**	**458**		
1963	**779**	**2051**	**298**	**1871**	**479**		
1964	**704**	**2070**	**318**	**1887**	**501**		
1965	**871**	**2090**	**339**	**1905**	**524**		
1966	**987**	**2109**	**361**	**1923**	**547**		
1967	**1016**	**2129**	**385**	**1943**	**571**		
1968	**1049**	**2149**	**410**	**1962**	**597**		
1969	**884**	**2169**	**437**	**1983**	**623**		
1970	**1191**	**2190**	**466**	**2005**	**650**		
1971	**964**	**2210**	**497**	**2029**	**678**		
1972	**895**	**2232**	**529**	**2053**	**708**		
1973	**1019**	**2254**	**562**	**2078**	**738**		
1974	**1004**	**2278**	**595**	**2103**	**770**		
1975	**914**	**2303**	**627**	**2129**	**802**		
1976	**1005**	**2332**	**658**	**2154**	**835**		
1977	1030	2362	688	2180	870	68	32
1978	1075	2394	717	2206	905	66.4	33.6
1979	1051	2425	747	2232	941	66	34
1980	990	2457	779	2257	979	69.6	30.4
1981	970	2486	812	2293	1005	64.4	35.6
1982	1024	2514	845	2328	1031	63.7	36.3
1983	904	2543	881	2365	1059	63	37
1984	761	2577	921	2407	1090	62.3	37.7
1985	996	2617	965	2458	1125	66	34
1986	829	2668	1014	2517	1165	65.3	34.7
1987	978	2725	1069	2585	1209	64.6	35.4
1988	853	2780	1124	2651	1253	63.8	36.2
1989	882	2822	1175	2705	1292	63.1	36.9
1990	968	2843	1218	2739	1322	67.4	32.6
1991	985	2840	1252	2739	1353	67.3	32.7
1992	899	2817	1280	2721	1376	67.2	32.8
1993	880	2783	1304	2693	1394	67	33
1994	889	2749	1328	2665	1412	66.9	33.1
1995	934	2723	1357	2646	1435	66.8	33.2
1996	876	2707	1390	2635	1462	66.7	33.3
1997	878	2700	1427	2633	1495	63.8	36.2
1998	908	2708	1474	2645	1537	63.3	36.7
1999	964	2737	1535	2679	1593		
2000		2791	1614	2738	1667		
year							

Source: FAO database, website www.fao.org; OIC database, website www.sesrtcic.org;

IFS Yearbooks.

See variable definition below

Q = quantity of rice produced in metric tons

RPCPI =ratio of rice producer price to consumer price index

PUI =public investment (million Leones)

CSCRE =acreage under cassava crop (hectares)

RMP = quantity of rice imported in metric tons

RAP =ratio of nonagricultural population to that of agriculture

RPR = rice producer price (Leones/metric ton)

RPIND = rice producer price index

CPI =consumer price index

USRPR =United States rice producer price ($/metric ton)

EXRAT =nominal exchange rate (Leone/US$)

COFP =coffee producer price in metric tons

COCP =cocoa producer price in metric tons

RACRE =acreage under rice production (hectares)

CFACRE =acreage under coffee production (hectares)

COACRE =acreage under cocoa production (hectares)

FCON =fertilizer consumption (metric tons)

AGAIRR =agricultural area irrigated (000 of hectares)

CAL/C/D =calorie per capita per day

RUPP =rural population (000)

URPP =urban population (000)

AGPP =agricultural population (000)

NAGPP =nonagricultural population (000)

LF AG =share of labour force in agriculture (%)

LF IN&S = share of labour force in industry and service sector (%)

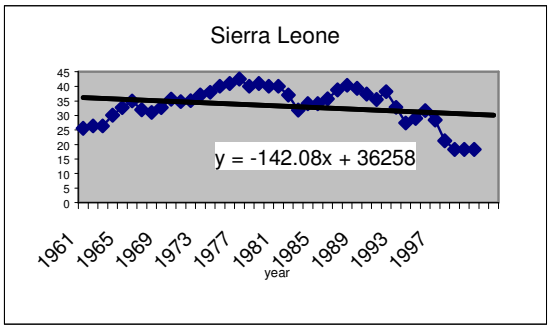
Appendix B. Some Definitions of Concepts

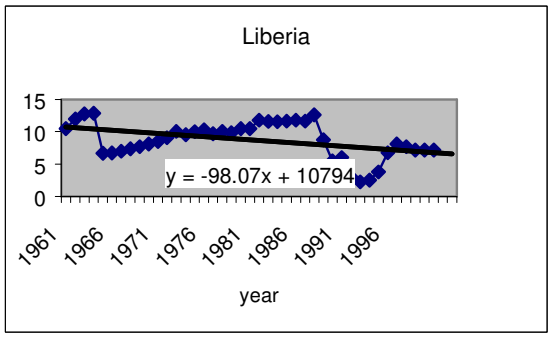
Food policy: "Food policy concerns the integration of state actions affecting the supply, distribution and consumption of food in order to ensure continuity of access to enough food for all the people in a country." (Ellis, 1992, ch. 13, pp. 303).

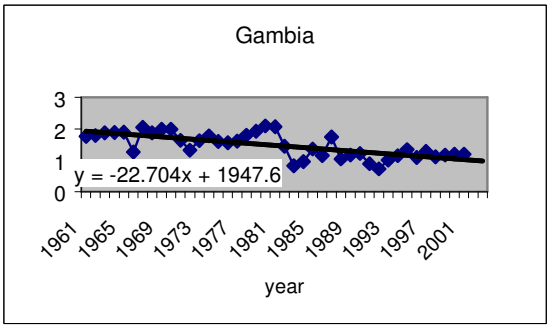
Food security: " Food security is the access by all people at all times to enough food for an active, healthy life. Its essential elements are the availability of food and the ability to acquire it. Food insecurity, in turn, is the lack of access to enough food." (A World Bank definition cited by Ellis, 1992, ch. 13, pp. 310).

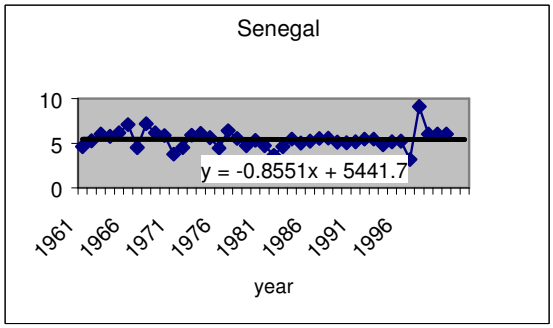
Border price: is a world market price that is theoretically assumed to reflect the relative scarcity of resources, used as efficiency benchmark to which domestic prices are compared and against which domestic policy efficiency is evaluated. These price benchmarks represent the opportunity cost of producing various commodities domestically. The border price, for comparison, is obtained by converting the world price into the domestic currency equivalent using an appropriate foreign exchange rate and adjusting it for internal transportation and marketing margins. *Agricultural price policy text by Tsakok, 1990, has detail.*

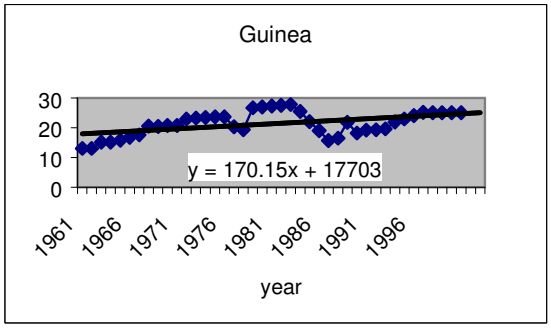
Appendix C: Comparison of Rice Production Trends for Selected West African Countries, 1961-2001

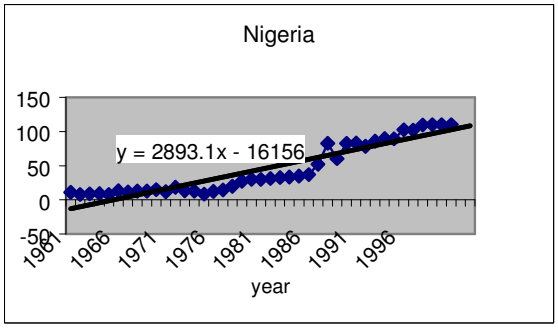


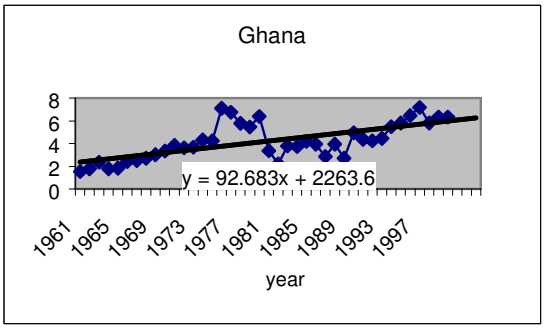


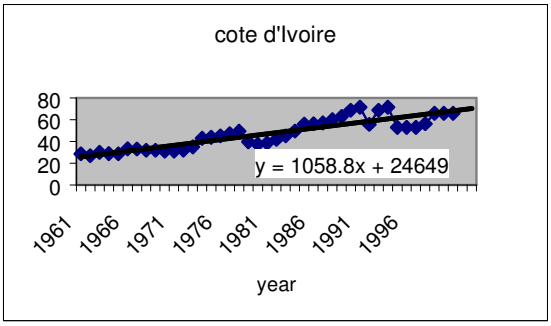






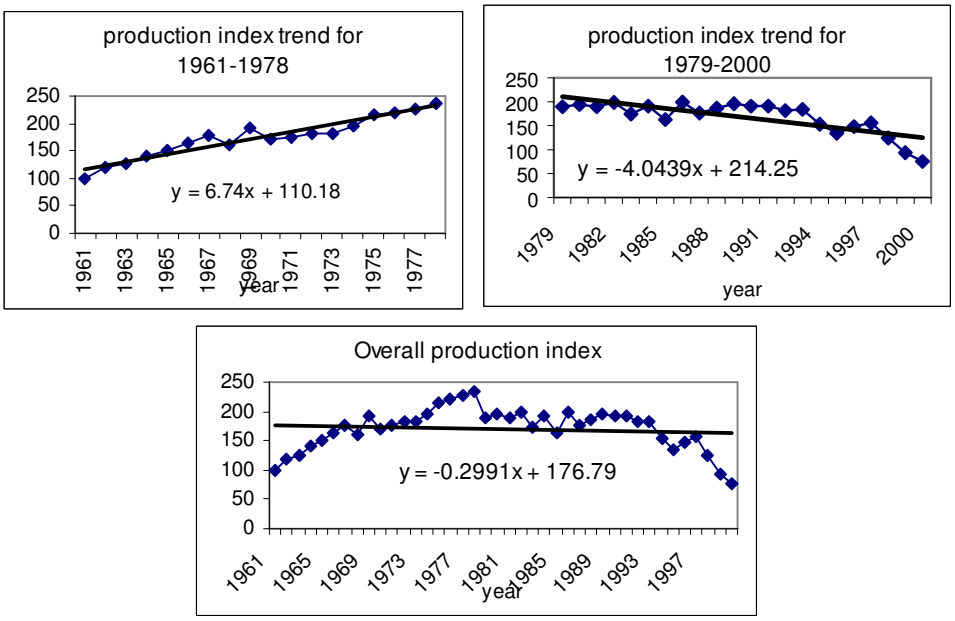






Source: Derived from FAO database; see website www.fao.org for rice.

Appendix D: Breakdown of rice production trend for 1961-2000



Source: from appendix A

Appendix E. **Interviews with Researchers & Agricultural Officials in Sierra Leone**

Economic researchers and agriculture officials I interviewed during my research trip in Sierra Leone pointed out most constraints discussed earlier. What is peculiarly and emphatically advanced by one official in the name of Mohamed Kandeh, Deputy Director of Land and Water

Development Division in Sierra Leone, is that decline in domestic rice production in the country is deeply rooted in the attitude of politicians. That during the government regime of the All People's Congress (APC) party ---longest serving ever---government was embarking on unprecedented importation of rice, with each parliamentarian carrying quota, which they distributed to their ally businessmen at very cheap price on political ties; these business people in turn sold the imported grain to consumers at lower price than the one produced domestically; this discouraged domestic production. Local farmers, according to the official, used to get bumper harvest but a large part of it was going unsold; some resorted to informally selling the stock to neighboring countries, Guinea being most popular.

Appendix F: Description of the Nerlovian Supply Response Model

(See Sadoulet and de Janvry, 1995, pp. 86-95)

The specification of the model is based on the following premises.

(1). That farmers respond to expected prices as opposed to observed. The observed prices are those prevailing during the time production decision is being made, which are not seen effective in influencing farmers' decision to plant. The production or planting decision and hence the committal of resources onto the land is believed to be more strongly influenced by prices farmers expect to prevail in future period at harvest time. For this reason (due to time lags in agricultural production), it is thought fit to model price expectation formation in supply response analysis.

(2). Another premise is that there is a lag sensed in adjusting actual quantities (output, acreage, or yield) to the desired levels when there is an incentive signal, say, increased output price. These lags are as well required to be captured in specifying the model.

The Model:

$Q_t^d = \lambda_0 + \lambda_1 P_t^e + \lambda_2 Z_t + \varepsilon_t$ ……1

Q_t^d = the desired quantity of output in period t
P_t^e = expected price vector, including price of other crop
Z_t = a vector of exogenous shifters
ε_t = disturbance term with zero expected value by assumption

Because full adjustment of output is unlikely in the short run, the actual adjustment will only be a fraction of the desired denoted by π as shown in the following equation.

$Q_t - Q_{t-1} = \pi (Q_t^d - Q_{t-1}) + \omega_t$ …… 2

$0 \leq \pi \leq 1$

Q_t = actual output produced of the crop
π =partial adjustment coefficient and ω_t is the random factor with expected value of zero.

It is advanced that farmers form price expectation based on past and present prices. But since price guesses may not be realized their expectations are a fraction, η, of the mistake they made in the previous period; that is a fraction of the difference between the actual and the expected in period t-1. This describes adaptive expectation formation as expressed in the following function.

$P^e_t - P^e_{t-1} = \eta (P_{t-1} - P^e_{t-1}) + \upsilon_t$ ……3

$0 \leq \eta \leq 1$

P_{t-1} = prevailing price when decision making for production in period t occurs
η = adaptive expectation coefficient and υ_t is the random term assumed to have zero expectation value

By Koyck's transformation, the solution to equation (3) is

$$P_t^e = \eta \sum_{i=1}^{\infty} (1-\eta)^{i-1} P_{t-i} \text{.....4}$$

i.e., $P^e_t = \eta P_{t-1} + \eta(1-\eta)P_{t-2} + \eta(1-\eta)^2 P_{t-3} +$ ……$\eta(1-\eta)^{i-1}$Pt-i

Putting (1) and (4) into (2) reduces the process to

$Q_t = \pi \lambda_0 + \pi \lambda_1 [\eta P_{t-1} + \eta(1-\eta)P_{t-2} + \ldots\ldots] + \pi\lambda_2 Z_t + \pi \varepsilon_t$
$+ (1-\pi)Q_{t-1} + \omega_t$……...5

It follows from five that

$$Q_{t-1} = \pi \lambda_0 + \pi \lambda_1[\eta P_{t-2} + \eta(1- \eta)P_{t-3} + \ldots\ldots] + \pi\lambda_2 Z_{t-1} + \pi \varepsilon_{t-1} + (1- \pi)Q_{t-2} + \omega_{t-1}$$

Multiplying through by (1- η) gives

$$(1-\eta)\, Qt_{-1} = (1- \eta)\, \pi \lambda_0 + (1- \eta)\pi \lambda_1[\eta P_{t-2} + \eta(1- \eta)P_{t-3} + \ldots\ldots] + (1-\eta)\, \pi\lambda_2 Z_{t-1} + (1- \eta)\, \pi \varepsilon_{t-1} + (1- \eta)\, (1- \pi)Q_{t-2} + (1- \eta)\, \omega_{t-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 6$$

Subtracting (6) from (5) results to

$$Q_t = \pi \eta \lambda_0 + \pi \lambda_1 \eta P_{t-1} + [(1- \pi)+(1- \eta)]Q_{t-1} - (1- \eta)\, (1- \pi)Q_{t-2} + \pi\lambda_2 Z_t - (1-\eta)\, \pi\lambda_2 Z_{t-1} + \pi \varepsilon_t - (1- \eta)\, \pi \varepsilon_{t-1} - (1- \eta)\, \omega_{t-1} + \omega_t$$

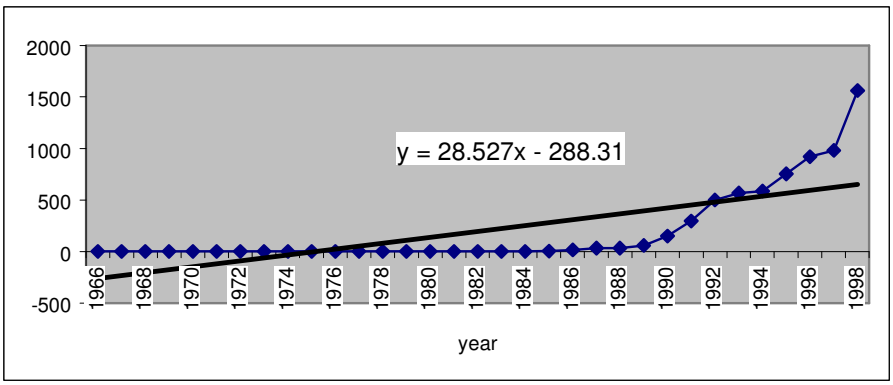
$$Q_t = \theta_1 + \theta_2 P_{t-1} + \theta_3 Q_{t-1} - \theta_4 Q_{t-2} + \theta_5 Z_t - \theta_6 Z_{t-1} + \S_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 7$$

(7) is the reduced form equation, the estimable state.

$\theta_1 = \pi \eta \lambda_0$
$\theta_2 = \pi \lambda_1 \eta$
$\theta_3 = (1- \pi)+(1- \eta)$
$\theta_4 = - (1- \eta)\, (1- \pi)$
$\theta_5 = \pi\lambda_2$
$\theta_6 = - \pi\lambda_2\, (1-\eta)$
$\S_t = \pi \varepsilon_t - (1- \eta)\, \pi \varepsilon_{t-1} - (1- \eta)\, \omega_{t-1} + \omega_t$

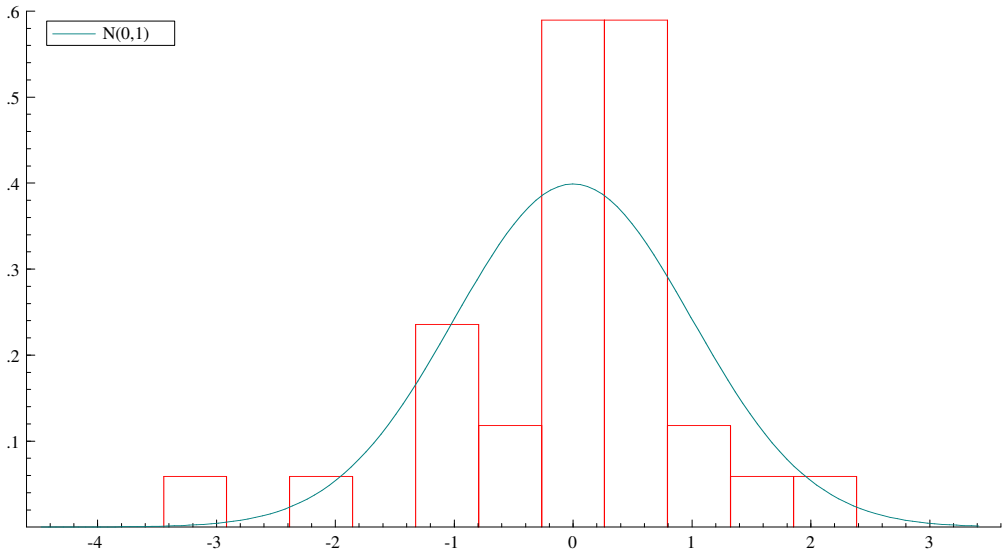
In this study, variables are left in log form to interpret estimates as elasticities, and the model (Nerlove, 1956) is modified to more reflect the realities of the situation under study. The coefficient θ_2 represents the short run price response while the long run is denoted by λ_1, defined as $\theta_2 /(1- \theta_3)$. This long run formula is obtained with the assumption that $\eta = 1$, a realistic assumption to some extent in the case of Sierra Leone as government-marketing corporations were influencing agricultural prices. There were instances when current producer price prevailed in the following period.

Appendix G: **Trend in Exchange rate (Leone per US$), 1966-1998**

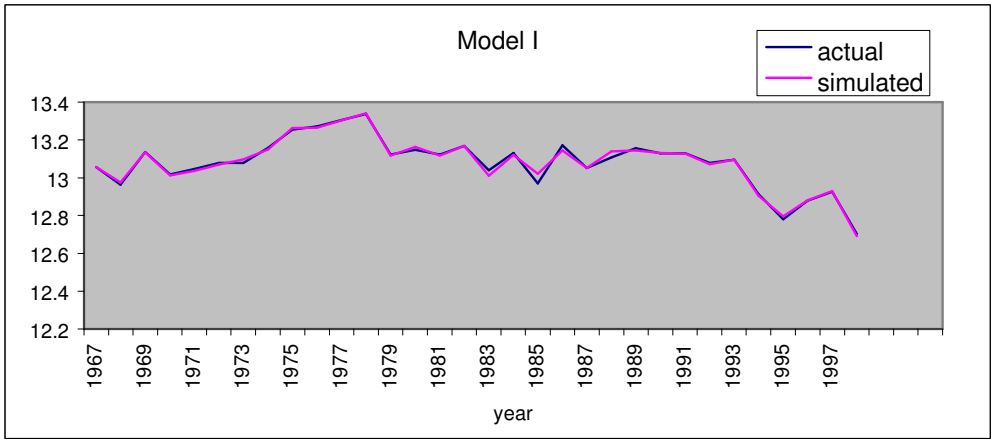


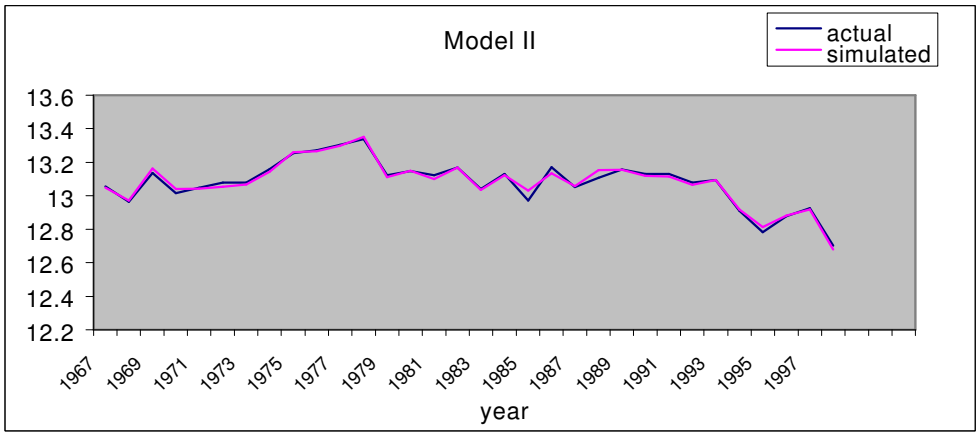
Source: Appendix A

Appendix H**: The normal curve of the error term**



Appendix I: **Model-tracking ability of actual values**


Model I
actual
simulated
13.4
13.2
13
12.8
12.6
12.4
12.2
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
year


Model II
actual
simulated
13.6
13.4
13.2
13
12.8
12.6
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