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STRUCTURAL ADJUSTMENT, AGRICULTURE, AND NUTRITION: POLICY OPTIONS IN THE GAMBIA

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FOREWORD

Increased commercialization of agriculture is an important part of efforts to increase incomes and improve living standards in rural areas of many developing countries. However, effects on the incomes, food consumption, and nutritional status of the rural poor depend on how the increased commercialization is brought about; that is, the design and implementation of projects and policies and the response by the rural poor to changes in incomes, prices, labor demand, and other relevant factors.

The International Food Policy Research Institute is undertaking research to assess the effects on income and nutrition of increased commercialization of traditional agriculture in several countries and to generate new knowledge useful for those designing and implementing policies and projects, thus helping to avoid negative and to enhance positive nutrition and income effects.

Some of the results from this research are published as IFPRI research reports. This series of working papers is intended to meet requests for additional information on commercialization of agriculture in various countries. These working papers complement IFPRI's research reports by providing detailed but primarily descriptive analyses.

Structural adjustment, when it reduces barriers to trade and increases incentives for market production, may broadly stimulate agricultural commercialization. In this working paper, the actual effects of adjustment for production, input utilization, income, consumption, and nutrition are traced in The Gambia. The study is one outcome of a long-standing fruitful cooperation between IFPRI and the Planning Unit of the Ministry of Agriculture in The Gambia.

Joachim von Braun

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The prepared documents benefited from constructive review, especially during the policy workshop on "Constraints and Options for Agricultural Development in The Gambia," held in Banjul on September 13, 1989. We thank the individuals who participated in that workshop; their names are included in an appendix.

Much of the research presented is based on primary data collected from a sample of households in The Gambia with whom the International Food Policy Research Institute and the Planning, Programming, and Monitoring Unit (PPMU) have been interacting since 1985. The patience and honesty of the women and men in the sample households were instrumental in gaining the insights provided here; we gratefully acknowledge their participation. The surveys were undertaken by a competent field survey staff, whose efforts and commitments were essential to the success of this research project.

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1. INTRODUCTION AND OVERVIEW

Joachim von Braun

It is now well understood that increasing productivity in agriculture is central to rural economic development in Sub-Saharan Africa.[1] Increased labor productivity that raises food output--an essential part of the story--is also conditioned, however, on the health and nutritional situation of the labor force. Studying relationships among labor productivity, health, and nutrition reveals clearly that agricultural development is interacting with poverty, consumption, and nutrition in West Africa's rural areas. During the past decade the growth of food production in West Africa was even lower than the highly unsatisfactory growth in Sub-Saharan Africa as a whole. The Gambia was no exception.

The scope of this research is thus to trace the effects of alternative agricultural policies at the microlevel of rural households in order to identify the effects of specific policies on the poor. The implications of structural adjustment policies are far-reaching in The Gambia, and this research fills a gap in the discussions of agricultural policy reform, which until now have focused on the macrolevel.

The papers in this volume emphasize, in turn, the effects of price policies on production response; the introduction of technology, especially irrigation and low-cost mechanization; the promotion of increased supplies of inputs, especially fertilizer; and the effects of institutional reforms, including privatization and market reform.

Apart from assessing the effects of specific agricultural policy measures on growth and welfare, these papers also examine interaction of these effects and the constraints on implementing policy reform measures.

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[1]A comprehensive assessment of related policies is given in Mellor, Delgado, and Blackie (1987).

OVERVIEW

In "A Review of Agricultural Policy Before and After Adjustment," Sambou Kinteh assesses the evolution and provides a comprehensive historical perspective of The Gambia's agricultural policy. Kinteh examines the role of public institutions in delivering growth-oriented services to Gambian agriculture, which sets the stage for analyzing the potential and limitations of policies on prices, liberalized input supply, credit, mechanization, and agricultural support services for stimulating growth and rural development.

In "The Impact of Structural Adjustment and Program Disruptions on Rural Income, Consumption, and Nutrition," Detlev Puetz and Joachim von Braun trace the effects of income and prices induced by the structural adjustment policy and by developments specific to the survey area on consumption and nutrition. They find that income distribution has become more skewed in the context of the policy reforms and that the consumption of food calories has slightly increased because relative price changes favor calorie-dense commodities, such as oil, sugar, and cereals. The relative share of food in the total spending of consumers has increased at the cost of nonfood expenditures.

Specific to the study area, the yield of irrigated rice has declined because of operational problems that have drastically reduced the income of lowland villages; this decline translates into substantially increased rates of malnutrition at the survey location. Thus the favorable links between income and nutrition that were generated by irrigated rice can easily be reversed when that source of income is disrupted.

In "Price Policy under Structural Adjustment: Constraints and Effects," Puetz and von Braun find that structural adjustment has to a certain extent provided incentives for the agricultural sector, but that most of the price policy changes produced substitution effects between export crops (groundnuts) and staple foods (especially millet). The aggregate supply response of Gambian agriculture is found to be rather low during the study period (1984-88). Although labor returned to agriculture, its productivity was constrained because of input supply constraints and a shortage of capital.

The "Technology Constraints and Policy Option" are further evaluated in Chapter 5. Puetz, von Braun, and Johm find that substantial growth potentials are tapped when farm implements are used in upland crops. The more mechanized farms increase their labor use overall even though labor input per hectare decreases with mechanization. The existence of surplus land facilitates productivity and extends employment by applying mechanization to upland crops. Furthermore, complex trade-offs characterize the alternative technologies of irrigation. The potential of rice irrigation and the benefits of double cropping in the dry season are highlighted. Also, constraints in irrigation projects can produce yield fluctuations similar to those observed in

the rainfed sector. Despite the improved incentives, input use has not developed satisfactorily. Even though the marginal productivity of fertilizer is high, constraints on its delivery prevent the use of fertilizer from expanding.

In Chapter 6, "Attempts at Market Deregulation and Institutional Constraints," Puetz and von Braun look into the problems of market reform, including input provisions. In Senegal and The Gambia parallel market activities in the groundnut market have expanded dramatically in the context of differential protection rates. Relatively poor income groups are less able to participate in parallel markets. Since the private sector has by and large shunned the fertilizer market, disruptions in the public institutions supplying fertilizer have reduced the total use of fertilizer. The fertilizer use rates of the low-income groups have declined disproportionately more than those of the high-income groups. Regarding technological improvements, capital has a high marginal productivity in Gambian agriculture. The official market for credit covered about 45 percent of agriculture's input credit. Lower-income rural households show a much higher share of credit from official sources (66 percent) than high-income households, which obtain more credit from traders and other members of the extended household system (compounds).

In a final section, "Policy Issues and Options for Agricultural Development in The Gambia," Ken Johm provides a comprehensive overview of policy options and discusses in particular privatization and the role of the public sector in agriculture. Among other basic issues, Johm stresses the importance of recognizing the government's scarce financial and manpower resources and the positive financial and material support of nongovernmental agencies.

POLICY FINDINGS

In sum, this volume contains micro-based information and analysis of agriculture and the situation of rural households in a period of economic adjustment that highlight the following:

- The level and structure of agricultural output prices in the context of structural adjustment failed to "get prices right."
- The response of outputs to increased aggregate (though modest) incentives was constrained by institutional factors.
- Income distribution in rural areas became more skewed.
- Food consumption levels remained more or less unchanged.
- The failure of projects and programs in rural areas had serious consequences for the rural poor, including increased malnutrition.

Stimulating agricultural growth requires building viable and effective institutions--which is an investment--as well as creating a conducive market-oriented price environment.

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2. A REVIEW OF AGRICULTURAL POLICY BEFORE AND AFTER ADJUSTMENT

Sambou Kinteh

THE EVOLUTION OF AGRICULTURAL POLICIES

Prior to the mid-1970s no clearly articulated agricultural policy existed in The Gambia. Although conscious of the role and potential of agriculture in the national economy, much of the public efforts in agricultural development, until the end of the first decade of nationhood in 1975, concentrated on consolidating programs initiated in the colonial era: conventional agronomic crop evaluation and research, regulatory extension and farmer training, animal health, swampland development, rice land tractor ploughing services, and promotion and dissemination of agricultural inputs, including credit.

Becoming increasingly aware of the need for a concerted public effort to base an orderly social and economic development on a clearly articulated social philosophy, the government formulated its first Five-Year Development Plan (1975/76 to 1979/80). As a basis for public interventions in the socioeconomic development of the nation, this plan was succeeded by a second Five-Year Plan (1981/82 to 1985/86) with basically the same objectives. Both plans emphasized an agricultural policy based on the goals of improving nutritional standards in rural areas, limiting bulk cereal imports, increasing cash crop production, and diversifying the agricultural base to reduce the vulnerability of the economy to both internal and external forces. In pursuit of these goals, the government made concrete subsectoral and commodity targets the basis for the public investment and program guidelines of the then Ministry of Agriculture and Natural Resources, its technical departments and divisions, and the parastatals concerned with agriculture. Thus before the inception of its Economic Recovery Program, the major agricultural policies of the government were articulated through policies in the following functional areas: institutions, export crop development and diversification, pricing, agricultural inputs (including mechanization), cereals and diversification, credit, and agricultural investment.

Institutions

An important feature of postindependence public policy concerns in agricultural development was the rapid proliferation of agricul-

tural institutions along functional lines. The technical divisions of crop protection services, forestry, fisheries, livestock, and hydrometeorological services of the Department of Agriculture were rapidly expanded and strengthened to become full-fledged technical departments with separate budgetary allocations. This institutional proliferation culminated in 1981 with the creation of two ministries charged with formulating and implementing policies for the agricultural sector: the Ministry of Agriculture and the Ministry of Water Resources and Environment. Within the parent Department of Agriculture, the main functions of research and extension were differentiated further. Livestock extension activities were annexed to veterinary services as the Department of Animal Health and Production, while functional divisions were created for horticulture, seed production, agricultural engineering, mechanical services, mechanical ploughing services, production of farmer training materials, and soil and water management services. This institutional rationalization was matched by a parallel expansion of staff and budget. Alongside this rapid buildup of technical agencies was the development of service agencies for agriculture. In 1973 the government appropriately restructured The Gambia Oilseed Marketing Board to become The Gambia Produce Marketing Board (GPMB), which was responsible for marketing all input imports and output exports. The cooperative movement initiated by the Department of Cooperation was strengthened in 1970 with the creation of the apex Gambia Cooperative Union (GCU), which assumed responsibility for marketing its members' produce domestically and distributing of inputs, including credit. The government created an Agricultural Development Bank for channeling agricultural credit, a Livestock Marketing Board for all livestock and livestock products, and a Fish Marketing Corporation for marketing fish and fish products. Finally, as the policy planning work load of the two ministries increased, so did the need for the work of their technical departments, divisions, and parastatals to be planned, programmed, and coordinated effectively and their analysis and planning of investment projects to be sound. To address these needs, the government, established a Planning, Programming, and Monitoring Unit for the Agricultural Sector (PPMU) in 1983.

Export Crop Development and Diversification

Promoting increased cash crop production and diversifying the agricultural base has, of necessity, been the principal cornerstone of the government's agricultural policy. In this endeavor, the government unsparingly engaged the financial, technical, organizational, and managerial resources of the GPMB, the GCU, the Department of Agriculture (DOA), the Department of Cooperation (DOC), and the Department of Crop Protection Services (DCPS) to promote increased groundnut production and to establish cotton as a second cash crop. The GPMB purchased groundnuts and cotton, either directly or through licensed buyers and agents, and processed and marketed the produce on behalf of the government. The Board also ordered agricultural inputs and

distributed them to farmers at low, highly subsidized prices. The GCU, under the technical supervision of the DOC, extended highly subsidized credit, both in kind and in cash, to farmers and helped organize the domestic marketing of their produce, principally groundnuts. The DOA offered free technical advice; provided free village seed storage systems; established mixed farming centers that trained farmers to use animal draft equipment for expanding their cultivation; and screened, identified, and disseminated at highly subsidized rates improved seeds and animal draft equipment. The DCPS provided highly specialized spraying and protection services at no cost.

Pricing Policies

Throughout the last two and a half decades, the government's agricultural price policy has been double-edged. During the period from 1974 to 1984, the government kept the producer price of groundnuts artificially low (at about 62 percent of the export price) and kept agricultural input prices at a highly subsidized rate or even zero.

Agricultural Inputs

Given the eventual limitations of arable cropland, the government perceived improved soil productivity and intensive agronomic practices to be the most economically feasible avenue for increased crop production. Thus the government's input policy placed heavy emphasis on providing farmers with highly subsidized fertilizers, improved seeds, mechanization, and agricultural chemicals. Highly specialized institutional elements were created, developed, and maintained to deliver these inputs at no cost or at highly subsidized rates.

Cereals and Diversification

A major political concern of postindependence agricultural policymakers was to articulate a food policy that satisfied both rural producers and urban consumers alike. The government approached this conflict-ridden objective by providing relatively inferior imported cereals and implementing heavily subsidized domestic food production programs. With the assistance of bilateral and multilateral support, the government began to develop systematically irrigated rice production in the fresh-water zones of The Gambia River Basin. It actively encouraged expanded rice production in the rest of the country by offering mechanical rice land ploughing services and developing suitable land and infrastructure. It also implemented an upland Cereals Package Deal Program and provided highly subsidized food processing technologies to promote expansion of traditional cereal crops.

Credit

Until 1972 agricultural credit was highly commodity- and service-specific and, therefore, diffused among a large number of agencies. The hope was that this diffusion would speed the uptake of the various modernization efforts. Since 1972 the government has streamlined this situation by establishing The Gambia Commercial and Development Bank (GCDB), strengthening the Cooperative Credit System, and creating the Agricultural Development Bank (ADB) so as to centralize credit in a few key institutions. Like the new technology packages it was supposed to support, agricultural credit was also available with highly subsidized interest rates of about 13 percent, few security requirements, and weak legal lending instruments, which created the need for huge credit write-offs.

Agricultural Investment

The overall public spending on investment during the decade from 1975 to 1985 averaged about 15 percent of the gross domestic product (GDP) annually, but the net share of agriculture was never more than 28 percent. Of even more importance than the total allocation was its skewed internal distribution, which reflects the grossly low absorptive capacity of certain elements of the sector. Much of the investment in agriculture went into infrastructure, such as that of irrigated rice; little attention was paid to local training and institution building, and inadequate emphasis was placed on the recurrent cost implications. The investment policy followed no clear technical and economic guidelines for allocating resources among subsectors.

AGRICULTURAL POLICIES IN THE PERIOD BEFORE THE ECONOMIC RECOVERY PROGRAM

Viewed against the development goals of improving nutritional standards in rural areas, limiting cereal imports, increasing cash crop production, and diversifying the agricultural base, the agricultural policies of pre-Economic Recovery Program (ERP) period had only modest success. The accelerated rural-urban drift symptomatic of an ailing rural economy created acute labor shortages during periods of peak labor requirement on farms. The declining groundnut foreign exchange earnings, coupled with the escalating food import bill, exhausted the Central Bank reserves and left the government unable to fulfill its official debt obligations.

Table 1 presents the arable land use and production pattern in The Gambia during the period from 1974/75-1984/85. Although from 1981 to 1985, the overall contribution of agriculture, including crop production, livestock, fishing, and forestry, to the GDP (in constant 1976/77 prices) declined by an average annual margin of 0.8 percent, grain production increased modestly. The total production of cereals

Table 1--Arable land use and production in The Gambia, 1974/75-1984/85

Crop and Indicator	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	Average Annual Percentage Change
Findo												
C	2.70	2.90	2.50	2.40	2.10	1.40	2.30	4.60	2.10	0.90	0.40	-8.5
H	...	...	...	...	...	0.40	2.10	3.20	1.50	0.70	0.30	...
Y	556	413	364	263	429	591	609	687	783	555	487	-1.2
P	1.50	1.20	0.90	0.60	0.90	0.20	1.30	2.20	1.20	0.40	0.10	-9.0
Early millet												
C	6.00	6.50	4.60	6.40	10.00	2.30	9.00	12.50	19.40	19.50	21.30	25.5
H	...	...	...	...	...	1.70	6.00	11.40	13.60	14.10	19.20	...
Y	1,135	561	660	688	954	941	898	1,270	1,241	1,020	1,197	0.5
P	6.80	3.60	3.00	4.40	9.60	1.70	5.40	14.50	16.90	14.40	22.90	24.4
Late millet												
C	16.40	15.90	10.30	13.00	15.30	12.50	12.80	14.40	18.90	12.30	14.70	-1.0
H	...	...	...	...	...	9.30	11.60	11.60	16.00	11.10	13.70	...
Y	710	591	791	494	671	752	853	1,271	1,050	1,057	1,136	6.0
P	11.70	9.30	8.10	6.40	10.30	7.00	9.90	14.70	16.80	11.70	15.60	3.3
Sorghum												
C	11.30	9.60	10.90	14.70	13.90	17.30	15.90	15.30	20.20	9.60	8.90	-2.1
H	...	...	...	...	...	11.60	14.30	11.90	16.30	6.90	7.30	...
Y	697	766	883	811	876	759	958	1,079	965	1,029	1,121	6.1
P	8.00	7.40	9.60	11.90	12.20	8.80	13.70	12.80	15.70	7.10	8.20	0.3
Maize												
C	5.50	4.40	4.00	6.20	6.80	8.50	6.70	8.70	10.00	8.40	10.00	8.2
H	...	...	...	...	...	5.40	5.90	7.60	9.40	6.90	9.20	...
Y	1,873	1,104	1,129	1,131	1,396	1,228	1,068	1,645	1,800	1,241	1,357	-2.8
P	10.90	4.80	4.50	7.00	9.50	6.60	6.30	12.50	17.00	8.50	12.50	1.5
Total coarse grain												
C	41.90	39.30	32.30	42.70	48.10	42.00	46.70	55.50	70.60	50.70	55.30	3.2
P	38.90	26.30	26.10	30.30	42.50	23.30	36.60	56.70	67.60	42.10	59.30	5.2
Swamp paddy												
C	23.20	25.40	21.70	...	...	14.50	22.50	24.00	24.70	14.80	6.90	-7.0
H	...	...	...	...	...	10.30	17.30	22.30	22.90	10.20	6.20	...
Y	1,125	1,067	613	...	...	1,699	1,464	1,251	1,296	1,774	1,450	2.9
P	26.10	27.20	13.30	...	...	17.50	25.30	27.90	29.60	18.10	8.90	-6.6

(continued)

Table 1 (continued)

Crop and Indicator	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	Average Annual Percentage Change
Upland paddy												
C	...	...	...	21.40[a]	22.10[a]	9.20	2.00	4.60	4.80	4.50	2.00	-13.0
H	...	...	...	...	...	4.90	1.50	4.20	4.30	3.30	1.50	...
Y	...	...	...	661	1,097	537	1,200	1,129	969	792	1,447	17.0
P	...	...	...	14.10	24.20	2.60	1.80	4.70	4.10	2.60	2.20	-12.1
Irrigated paddy												
C	...	...	1.10	0.80	0.80	1.90	2.90	1.30	n.a.	1.30	2.90	20.5
H	...	...	...	...	...	1.90	2.90	1.30	n.a.	1.30	2.90	...
Y	...	...	4,349	4,064	5,131	4,869	5,390	5,059	n.a.	4,207	5,590	3.6
P	...	...	4.70	3.10	4.10	9.30	15.60	6.90	n.a.	5.40	16.10	30.3
Total paddy												
C	23.20	25.40	22.80	22.20	22.90	25.60	27.40	29.90	29.50	20.60	11.80	-4.9
P	26.10	27.20	18.00	17.20	28.30	29.40	42.70	39.50	33.70	26.10	27.20	0.4
Total cereals												
C	65.10	64.70	55.10	64.90	71.00	67.60	74.10	85.40	100.0	71.30	67.10	0.3
P	65.00	53.50	44.10	47.50	70.80	53.70	79.30	96.20	101.30	68.20	86.50	3.3
Cotton												
C	n.a.	n.a.	n.a.	n.a.	1.70	1.00	2.75	2.86	3.00	2.00	3.20	14.7
H	n.a.	n.a.	n.a.	n.a.	1.70	1.00	2.30	2.57	2.76	1.23	3.23	...
Y	n.a.	n.a.	n.a.	n.a.	506	904	608	1,034	873	611	762	8.4
P	n.a.	n.a.	n.a.	n.a.	0.90	0.90	1.40	2.70	2.40	0.75	2.46	28.9
Groundnuts												
C	104.80	98.80	107.60	105.40	106.20	96.90	82.50	92.50	98.50	110.00	98.50	-0.6
H	...	...	...	...	...	67.80	68.90	80.70	95.00	97.20	91.40	...
Y	1,385	1,429	1,329	949	1,256	986	874	1,349	1,593	1,172	1,150	-1.7
P	145.20	141.10	143.00	100.00	133.40	66.90	60.20	108.90	151.40	113.80	105.10	-2.8
Total area	169.90	163.50	162.70	170.30	178.90	165.50	159.35	180.76	201.50	183.30	168.80	-0.06

Source: PPMU-Ministry of Agriculture.

Notes: C = Cultivated area in thousands of hectares; H = Harvested area in thousands of hectares; Y = Yield in kilograms per hectare of grain; P = Production in grain or undecorticated form for groundnuts.

[a] Swamp and upland paddies were combined in 1977/78 and 1978/79.
n.a. means not available.

increased at an average annual rate of 3.3 percent. The coarse grain fraction of this total grew by an average annual percentage of 5.2, while the paddy component grew by a negligible 0.4 percent. Groundnut production actually shrank at an average annual rate of 2.8 percent.

The institutional proliferation overextended the public service without improving public sector management or, as a result, the quality of the agricultural services provided. Inadequate training and inappropriate experience clearly constrained the effective deployment of financial resources to development, while the lack of skills and judgment required by the technical aspects of agriculture seriously limited the output of otherwise profitable agricultural investments and retarded the development of viable cash crops such as cotton to supplement groundnuts. The whole process of crop diversification was thwarted by an overall scarcity of trained, high-level, indigenous researchers and the consequent dependence on short-term technical personnel. The result was a lack of programs to undertake concerted follow-up research.

An injudicious pricing policy and low marketing margins proved to be serious disincentives. The availability of heavily subsidized input and credit facilities and of free animal and crop treatment services distorted the incentives. The following were among the symptoms of policy problems:

- Of a total national fleet of about 50 tractors, over 80 percent were dysfunctional because adequate repair and maintenance facilities were lacking or because the equipment was already obsolete when the ERP began. Although much progress has been made in broadening the adoption of animals for traction, their use still fulfills only 50 percent of the country's requirement.

- The use of chemical fertilizers stagnated at about 30 percent of the recommended amount for the country until 1984, when it dropped even further (see Table 2).

- The lack of quality seeds in the appropriate varieties of crops not only limited yield improvement, but constrained the ability of the production systems to adjust to climatic changes.

- The practice of writing off credit, coupled with poor credit management and administration, seriously undermined financial discipline.

- The lack of adequate training facilities at the Mixed Farming Centres (MFC) not only retarded rapid mechanization of agricultural practices, but also failed to check the traditional methods of crop and livestock husbandry, which include extensive devegetation and uncontrolled grazing.

Table 2--Annual import and sales of fertilizer and rice in The Gambia, 1977-87

Year	Fertilizer Imports	Fertilizer Sales	Rice Imports[a]
		(tons)	
1977	n.a.	8,425	28,000
1978	n.a.	5,915	25,000
1979	n.a.	10,710	31,000
1980	11,493	10,377	23,000
1981	11,563	12,133	36,000
1982	12,875	8,357	28,000
Pre-ERP			
1983	2,854	10,143	35,000
1984	13,027	12,099	54,000
1985	22,466	4,738	31,550
Post-ERP			
1986	0	5,610[b]	56,000
1987	4,890	4,105[b]	70,000

Sources: The Gambia, Ministry of Finance and Trade, Agricultural inputs subsector programme (Banjul: Planning, Programming, and Monitoring Unit, 1989 and 1987b).

n.a. = not available.

[a] Assumes import and sales figures to be the same.
[b] Estimated from supply and stock changes. Actual sales by GCU, the only distributor in these seasons, were 4,080 tons in 1986 and 2,435 tons in 1987.

Finally, it could be argued that the huge volume of pre-ERP public policy efforts in the agricultural sector has, over the past two decades, crowded out essential private sector initiative from the agricultural development process.

RATIONALE OF THE ECONOMIC RECOVERY PROGRAM'S AGRICULTURAL POLICY

In response to the decade-old economic deterioration, the government formulated and adopted a comprehensive Economic Recovery Program (ERP) in June 1985. The ERP had two fundamental objectives: to stabilize the economy in the short term by reversing the overextended government administration and parastatal activities and making them in line with the productive base of the country; and to generate sustainable, long-term growth by creating an environment favorable to the

productive activities of the private sector. These basic objectives foreshadowed a series of radical policy actions and reforms that became the main elements of the program:

- Reform the exchange rate;
- Promote agriculture;
- Promote other productive sectors;
- Reform civil service and parastatal institutions;
- Reform fiscal and financial policies; and
- Restructure the Public Investment Program.

Since the inception of the ERP, fundamental policy changes and reforms have been made in these policy areas. The following discussion focuses on the major policy actions in agriculture.

Specific Measures and Their Objectives

Since the economy is basically agrarian, agriculture has played a central role in both the short-term objective of stabilizing the economy and the long-term objective of generating growth. Accordingly, the government's new strategy is to (1) improve incentives for producers, (2) transfer responsibilities for input and output marketing to the private sector, (3) eliminate pricing distortions in both input and output markets, and (4) improve public sector services by focusing its resources on research, extension, planning and policy formulation, and natural resource management. Implementing these strategies has been the primary preoccupation of the agricultural policy measures to induce economic recovery. These policy measures cover issues related to pricing and trade, specific crops, credit, investment, institutions, and privatization. Apart from their short-term impact on macroeconomic issues, such as public financing, foreign trade and balance of payments, the financial system, and supply and use of resources, these policies have the following sectoral objectives:

- Increase rainfed agricultural production of both food and export crops;
- Diversify the crop mix and improve its integration with livestock;
- Reduce and reverse the loss of soil fertility;

- Promote efficient irrigated farming in order to reduce, as far as is economically feasible, the dependence on rainfed agriculture; and

- Reduce the involvement of the public sector in activities that can be performed more efficiently by the private sector.

Some of the major ERP reform measures were largely transitory. These include the reorganization of the Ministry of Agriculture and the associated structural alignment and functional rationalization of its technical departments. These reforms will not be fully translated into higher sustained levels of agricultural production and productivity for some time. Nonetheless, examining the immediate policy expectations of the ERP is instructive, if only to underscore the exploratory nature of a process that involves actions that build on the results of earlier interventions.

The immediate objective of the ERP reforms was to arrest and then reverse the deterioration of agricultural production that began in the early 1970s. This was to be achieved by changing the relative cost and return structures of agricultural enterprises, which would have an immediate impact on the microlevel behavior of agricultural producers. The policies of pricing and trade, liberalization, and privatization, in particular, were designed to contribute directly or indirectly to the achievement of this immediate objective.

Pricing and trade. The exchange rate reform was expected to have an immediate impact on realigning the Dalasi and thus to enhance the competitiveness of export-oriented and import-competing activities. The policy of subsidizing groundnut prices at high levels in the initial phase of the ERP (which was to be gradually phased out) was intended to counteract the prevailing, attractive price across the border, maximize official foreign exchange earnings, and reactivate groundnut production.

Liberalization. The liberalization of agricultural commodity markets was intended to open these markets to the private sector. On the supply side, the policy sought to increase competition, and improve the efficiency of these markets, and thereby increase the net returns to rice producers and the availability of agricultural inputs, such as fertilizer, seeds, and implements. On the demand side, it aimed to shift production and consumption toward coarse grains, where the potential for expanding production fast was great.

Privatization. The immediate objectives of privatizing essential services such as rice mechanization, vehicle maintenance and repair, vaccination, and crop protection were to make budgetary savings, increase efficiency in the provision of these services, and ensure their availability.

Implementation and Sequencing

The deterioration of Gambian economy approached a point of total collapse by mid-1985. The external debt burden escalated to a $312 million high with arrears reaching about 58.5 million Special Drawing Rights (SDR) by June 1985. By August 1985, the managing director of the International Monetary Fund had begun formal proceedings to declare the country ineligible for membership. Against this macroeconomic picture of urgent national problems, an internationally acceptable, far-reaching, and bold set of measures were taken.

Rice importation was liberalized in July 1985. Shortly after, in September 1985, the Central Bank raised interest rates; four months later the Dalasi was floated and the importation and distribution of fertilizer were liberalized. Moreover, the import tax on rice was raised to 30 percent, which was subsequently reduced to a sales tax of 10 percent in July 1988. A temporary shortage of rice followed the decontrol and floating of the Dalasi, pushing up the price of rice from D 1.05 to D 3.00 per kilogram in early 1986 (US$1 = 5.06 Dalasi in February 1986).

The price later stabilized at D 2.00 to D 2.25. Similarly, the price of fertilizer, after 2,500 tons of grant fertilizer were auctioned in 1986, rose more than 50 percent from the official price before the auction and has since come closer to its economic level. The liberalization of fertilizer was accompanied by the liberalization of other agricultural inputs. But the development of market forces in crop protection chemicals, for example, continued to be confounded by the need for state intervention in emergency outbreaks of pests to support efforts of the international donor community. Also, on the market for seed that has traditionally been dominated by the private sector, in 1986 the government implemented a seed exchange program on a full-cost recovery basis to boost private sector initiative after a poor groundnut harvest in 1985.

Comparing changes in the rice and fertilizer markets is instructive. The figures for rice imports, which are assumed to be the same as those for sales, rose rapidly by more than 100 percent, from 31,550 tons in 1985 to 70,000 tons in 1987 (Table 2). Except for a short lag, the private sector responded well to the new opportunities to make a profit in the rice trade in spite of the chronic scarcity of foreign exchange and the high cost of borrowed capital. The strong profit motive was further reinforced by the existence of high demand in the rice market both locally and in neighboring countries through reexport outlets, the stable physical properties of the commodity itself, and the existence of an adequate market infrastructure at all levels.

The case of fertilizer presents a different scenario. Fertilizer imports slumped from an all-time high annual record in 1985 to a low in 1987, with no imports in the intervening year (Table 2). Virtually

all the fertilizer imported in these two years were from Italian fertilizer grants. In spite of perennial complaints from farmers about the lack of fertilizer, the private sector is still not interested in importing and distributing fertilizer. This apparent lack of private sector interest is due mainly to (1) the seasonality of demand for agricultural inputs in The Gambia, (2) the inadequacy of the market infrastructure, such as wholesale storage facilities, (3) the high risk caused by the perishable nature of fertilizer in The Gambia's environment, (4) the lack of knowledge and experience in marketing agricultural inputs, (5) the low profit margins of marketing agricultural inputs compared with those of other commercial activities, and (6) the erratic government and donor interventions in this market.

Table 3 presents the structure of the official groundnut market for 1974/75 to 1985/86, which typities the structure of the official agricultural output markets in The Gambia. Traditionally handled by the private sector, the marketing of groundnuts has, in the past decade, become dominated by the GCU through a systematic policy of public subsidies and favoritism, which has crowded out the private sector. After 1985/86 the general ERP privatization policy had little effect on the official groundnut market, which remained under state control until 1989/90. All groundnut dealers in the country (both GCU and private dealers) continued to need a license by and to sell

Table 3--The structure of the groundnut market, 1974/75 to 1985/86

Year	GCU Market Share	Private Sector Market Share	Total	GCU Share as Percent of Total
		(tons)		(percent)
1974/75	56,387	78,340	134,727	41.8
1975/76	52,064	81,477	133,541	39.0
1976/77	51,174	73,261	124,436	41.1
1977/78	39,051	48,927	87,978	44.4
1978/79	71,533	48,008	119,541	59.8
1979/80	44,216	21,588	65,804	67.2
1980/81	35,568	9,286	44,854	79.3
1981/82	59,955	21,899	81,854	73.2
1982/83	90,490	36,910	127,400	71.0
1983/84	68,257	24,651	92,980	73.5
1984/85	41,530[a]	10,529	52,059	79.8
1985/86	41,892	10,158	52,050	80.5

Source: Christine W. Jones, The domestic groundnut marketing system in The Gambia (Cambridge, MA: Harvard Institute for International Development, 1986).

[a] Includes 6,230 tons reserved for seed.

exclusively to the parastatal, monopolistic marketing board (GPMB). This became increasingly unattractive as, among other things, higher groundnut prices on the unofficial, parallel market in neighboring Senegal promised larger returns for private sector traders. Therefore, even after the considerable reduction in 1986 of the preferential treatment given to the GCU, the private sector did not reenter into the official market. Also, such a private sector reentry is, and will likely continue to be, slowed down by (1) the lack of an adequate private transportation network, (2) poor rural road conditions, (3) lack of adequate and reliable sources to deliver spare parts, (4) inadequate private market infrastructure, especially level storage, which has deteriorated over the years, and (5) inadequate and high-cost capital.

TRENDS IN AGRICULTURAL PRODUCTION AND INPUT USE

The quintessence of the short-term ERP objective is to stabilize the economy, which has been under mounting stress since 1976 from external and internal structural, economic, and physical forces. Within the context of this short-term task, agriculture is expected to arrest and reverse the deterioration in agricultural production by changing the microlevel behavior of agricultural producers. These behavioral changes encompass changes in the level of agricultural output, the composition of agricultural production, and in factor use, on the one hand, and in rural patterns of food consumption and expenditure, on the other. This section examines the production of coarse grains, rice, and groundnuts (Figure 1) and the use of fertilizer. Table 4 presents the average annual percentage changes in land use and production for two periods, 1974/75 to 1984/85 and 1985/86 to 1987/88. Since Gambian agriculture's performance is highly influenced by weather conditions, production performance is also described in the context of the annual rains and their distribution.

Coarse Grains Production

Total production of coarse grains (millet, maize, sorghum, and findo) rose from 39,000 tons in 1974 to 72,000 tons in 1987. A weak relationship between total production and total cultivated area is explained by fluctuations in average yields (total production divided by cultivated area), which reached a low of about 0.6 ton per hectare in 1975 and a high of 1.1 in 1985. Average yields were apparently strongly correlated with rainfall, especially rainfall in July and August (see Figure 2). The trend in coarse grain production apparently increased until 1985, when it began to decline after the ERP was set in motion.

Figure 1--Crop production in The Gambia, 1974-87

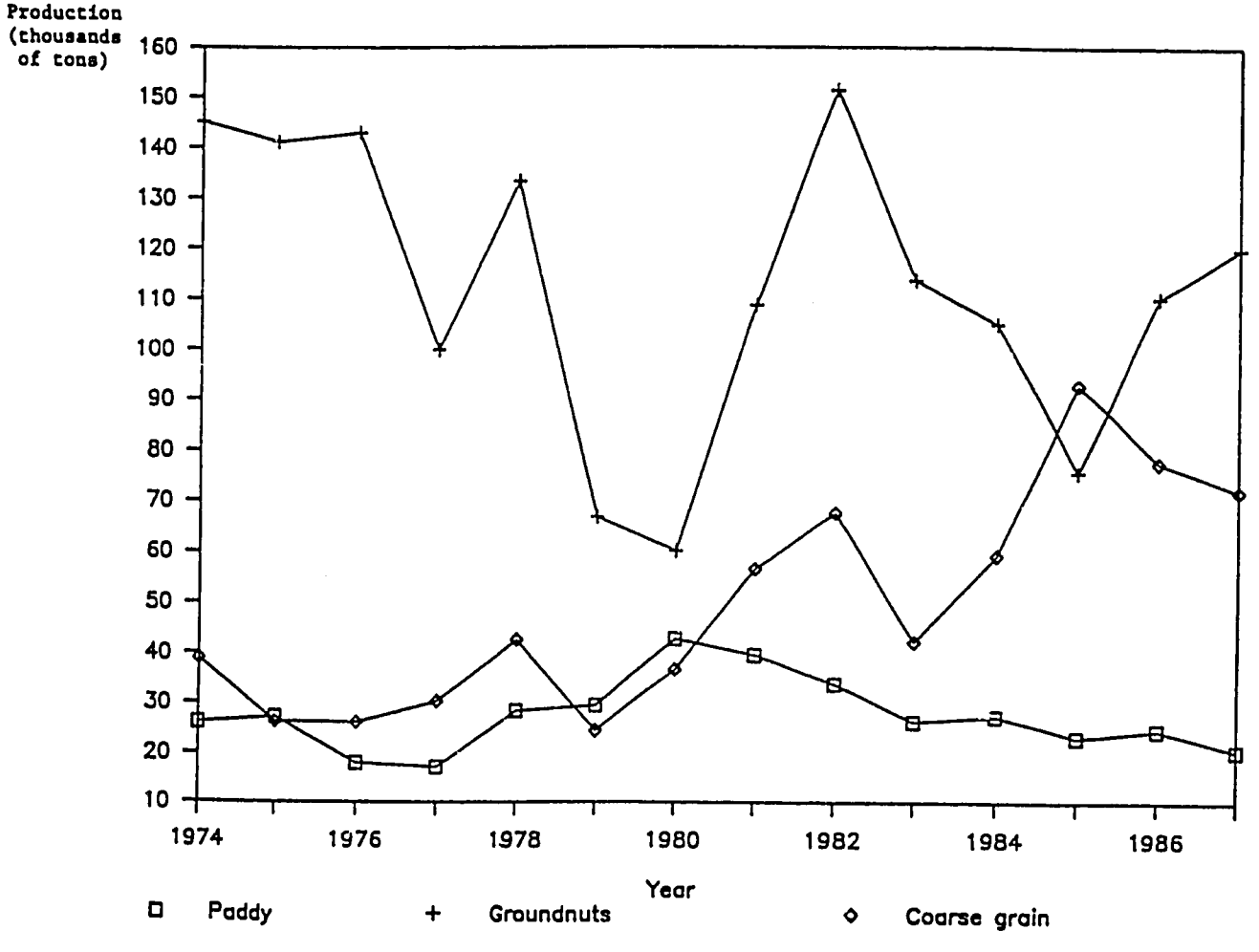


Table 4--Average annual change in land use and production, 1974/75-1984/85 and 1985/86-1987/88

Crop and Indicator	1985/86	1986/87	1987/88	Average Annual Percentage Change 1974/85	Average Annual Percentage Change 1985/87	Percentage Gain or Loss from 1974/85 to 1985/87
Findo						
C	0.60	0.60	0.56	-8.50	-3.33	5.17
H	0.50	0.30	0.56	...	...	...
Y	490	666	699	-1.20	21.33	22.50
P	0.30	0.20	0.39	-9.00	15.00	24.00
Early millet						
C	37.60	34.30	32.33	25.50	-7.01	-32.51
H	35.40	32.15	31.37	...	...	...
Y	1,214	1,205	1,218	0.50	0.16	-0.34
P	43.00	38.75	38.20	24.40	-5.58	-29.98
Late millet						
C	15.40	15.20	13.28	-1.00	-6.88	-5.88
H	14.50	12.55	12.85	...	...	...
Y	798	988	888	6.00	5.63	-0.37
P	11.60	12.40	11.42	3.30	-0.78	-4.08
Sorghum						
C	13.70	9.40	9.91	-2.10	-13.83	-11.73
H	12.80	8.75	8.98	...	...	...
Y	911	1,029	729	6.10	-9.99	-16.09
P	11.60	9.00	6.55	0.30	-21.77	-22.07
Maize						
C	17.50	13.60	13.43	8.20	-11.63	-19.83
H	16.70	11.05	13.01	...	...	...
Y	1,590	1,566	1,187	-2.80	-12.67	-9.87
P	26.50	17.30	15.44	1.50	-20.87	-22.37
Total coarse grain						
C	84.80	73.10	69.51	3.20	-9.02	-12.22
P	93.00	77.65	72.00	5.20	-11.29	-16.49
Swamp paddy						
C	8.50	12.25	12.79	-7.00	25.24	32.24
H	7.30	9.65	12.39	...	...	...
Y	1,599	1,321	1,009	2.90	-18.45	-21.35
P	11.70	12.75	12.50	-6.60	3.42	10.02

(continued)

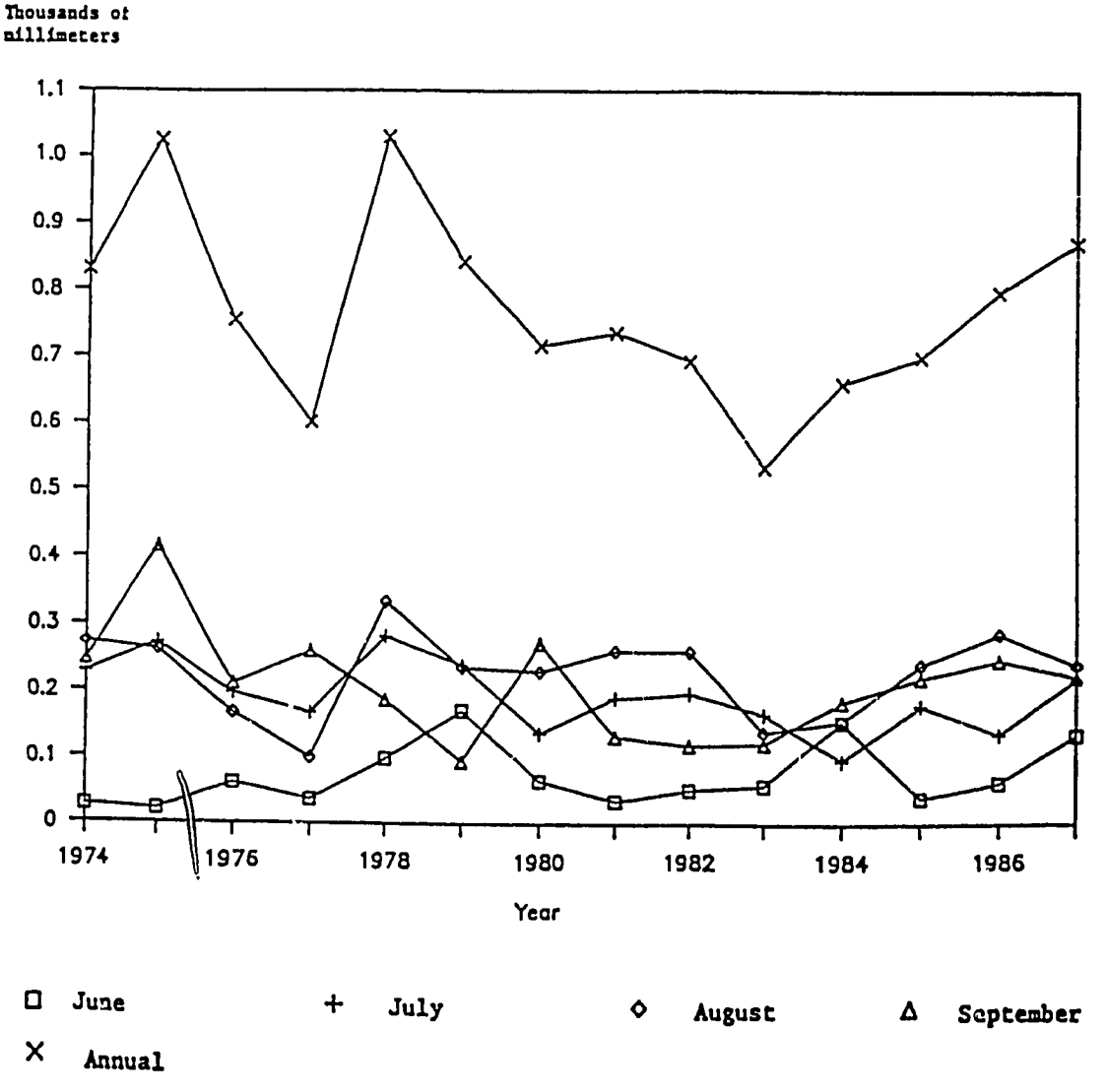
Table 4 (continued)

Crop and Indicator	1985/86	1986/87	1987/88	Average Annual Percentage Change 1974/85	Average Annual Percentage Change 1985/87	Percentage Gain or Loss from 1974/85 to 1985/87
Upland paddy						
C	3.50	5.40	1.65	-13.00	-26.43	-13.43
H	3.10	3.80	1.63	...	...	...
Y	1,160	1,018	884	17.00	-11.90	-28.90
P	3.60	4.25	1.44	-12.10	-30.00	-17.90
Irrigated paddy						
C	1.70	1.77	1.91	20.50	6.18	-14.32
H	1.70	1.77	1.91	...	...	...
Y	4,458	6,165	3,651	3.60	-9.05	-12.65
P	7.80	7.46	6.49	30.30	-8.40	-38.70
Total paddy						
C	13.70	19.42	16.36	-4.90	9.71	14.61
P	23.10	24.46	20.43	0.40	-5.78	-6.18
Total cereals						
C	98.50	92.52	85.87	0.30	-6.40	-6.70
P	116.10	102.11	92.43	3.30	-10.19	-13.49
Cotton						
C	4.60	2.48	1.30	14.70	-35.87	-50.57
H	4.60	2.21	1.17	...	...	...
Y	540	694	707	8.40	15.46	7.06
P	2.49	1.54	0.82	28.90	-33.54	-62.44
Groundnuts						
C	65.90	81.90	96.52	-0.60	23.23	23.83
H	58.50	80.40	95.01	...	...	...
Y	1,295	1,374	1,263	-1.70	-1.24	0.46
P	75.80	110.34	119.95	-2.80	29.12	31.92
Total area	169.00	176.90	183.69	-0.06	4.35	4.41

Source: Gambia (1987a), Ministry of Agriculture, Planning, Programming, and Monitoring Unit.

Notes: C=Cultivated area in thousanad hectares; H=Harvested area in thousand hectares; Y=Yield in kilograms per hectare of grain; P=Production in grain or, for groundnuts in undecorticated form in thousand tons.

Figure 2--Monthly and annual rainfall in The Gambia, 1974-87



Rice Production

Total paddy production, including upland, traditional swamp, and irrigated rice declined from 26,000 tons in 1974 to 20,000 in 1987. Annual paddy production is determined by production of rainfed swamp and upland paddy and by variations in irrigated rice cultivation and yield. A gradual decrease in paddy production characterized much of the 1980s including the ERP period.

Groundnut Production

Groundnut production declined from 145,200 tons in 1974 to 119,950 in 1987; land devoted to groundnut cultivation also declined in these years, from 104,800 to 96,520 hectares. The fluctuations in the average annual yield, which ranged between a low of 0.874 ton in 1980 and a high of 1.593 tons in 1982, underscore the strong influence of yield in explaining total groundnut production. The variations were, in turn, strongly influenced by the July, August, and September rains. Overall, groundnut production decreased slightly before 1985, but made a sharp upturn in the ERP period.

Fertilizer Use

As shown, the use of fertilizer declined in the mid-1980s and did not recover during the ERP period. Overall, the consumption pattern of individual fertilizers such as single super phosphate and compound fertilizer resembles that of all fertilizers. But IFPRI/PPMU household survey data from McCarthy Island Division show that fertilizer use in irrigated paddy production increased markedly between 1985 and 1987 unlike the decline of its use in coarse grains, groundnuts, and other crops. The use of fertilizer on paddy increased because programs in irrigated rice receive all the essential inputs. Traditional rice and maize grown in the same area could also benefit from leakages of the fertilizer made available for irrigated rice. Thus fertilizer use is apparently strongly correlated with availability.

THE SYNERGY OF POLICY OPTIONS FOR THE AGRICULTURAL SECTOR

As an integral part of the ERP agricultural policy reforms, the government adopted a market-determined price policy for all major agricultural commodities, except groundnuts and cotton, with a view to encouraging production and consumption of domestic products and expanding export and foreign exchange earnings. For groundnuts and cotton, the government provided highly attractive prices based rather on the prices prevailing in neighboring countries than those in the world market.

In 1985 the government temporarily adopted a policy of highly subsidizing the price of groundnuts in order to revitalize groundnut production and counteract the prevailing, attractive price in Senegal (see Figure 3). The outcome of this policy is analyzed in greater detail by Puetz and von Braun in Chapter 4. Both the amount of land devoted to groundnut production and total output of groundnuts had increased substantially by 1987 from very low levels in 1985. The stimulated output of groundnuts was apparently achieved at the expense of both coarse grains and paddy and happened mainly by expanding the area of cultivation rather than improving the yields. Furthermore, in spite of the expanded cultivation, the policy of pricing groundnuts attractively did not induce farmers to maximize their overall use of land. Total cropped area was down about 10 percent in 1986 and 1987 compared with 1983, when the price ratios of groundnuts to all other crops were at their lowest. Moreover, the rainfall conditions in 1986 and 1987 were optimal for groundnut production. The conjuncture of these factors allude to the absence of critical elements, which may be in the nature of a synergy of the conditions necessary for stimulating optimum output through price policy. The critical elements appear to be improved seed, fertilizer, and appropriate farm equipment, all of which have been either nonexistent or in acutely short supply since 1985. The availability of a profitable package of technology backed by timely, accessible credit would constitute a complementary option to relying on price policy alone to stimulate a sustainable growth of output (see Chapter 5).

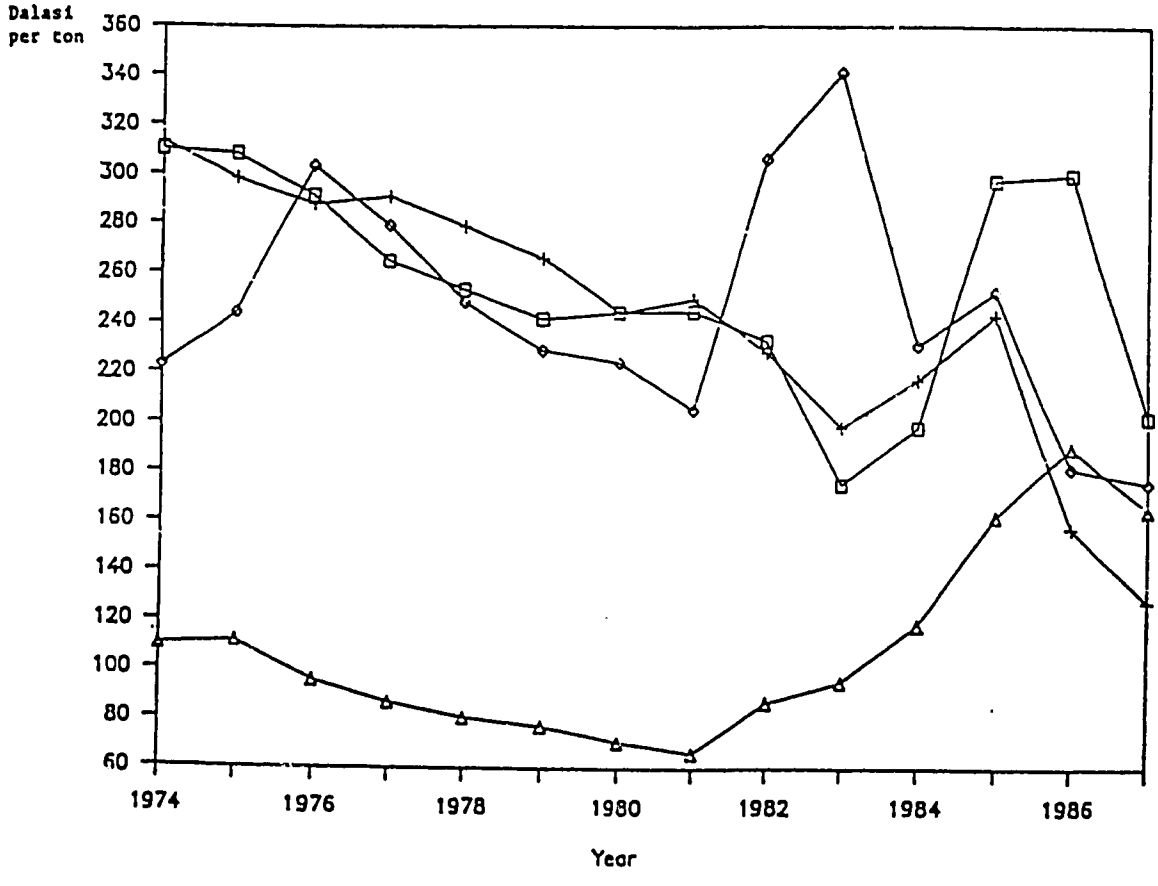
Liberalized Input Supply Policy

Liberalizing of agricultural input markets was intended to promote private sector involvement and increase the efficiency of the input delivery system. Major difficulties militating against the speedy entry of the private sector were clearly the lack of infrastructure, capital, and experience with marketing inputs (see Chapter 6). To overcome these constraints quickly would require amounts of credit and training that the economy could not support. A policy of gradually liberalizing input markets by, first, withdrawing all subsidies and economic pricing while allowing the traditional public agencies to continue providing the services as wholesalers would satisfy the huge budgetary concerns of the ERP. Within the context of this full-cost recovery policy, the liberalization policy would also examine the possibility of a financial and credit system that addresses the resource requirements of both local distributors or suppliers and farmers.

Credit Policy

The government's commitment to creating a viable, rural financial credit system continues in its efforts to restructure the cooperative credit system and obtain assistance from major non-governmental

Figure 3--Crop and fertilizer prices adjusted for inflation, 1974-87



□ Groundnuts ◇ Coarse grains + Paddy

Δ Fertilizer (Compound)

organizations (NGOs) and from projects. However, the lack of a centralized institutional arrangement and of a policy that addresses the scarcity of resources continues to constrain the government's efforts and to dilute the effective deployment of resources at the farm level. This dilutes, in turn, the effectiveness of credit for specific commodities. As critical issues in credit policy, interest rates and security of loans tend to be overemphasized in the policy debate, whereas availability, access, and effective use do not receive sufficient attention.

The issue of whether to establish a centralized agricultural credit and banking institution with the necessary capacity and technical and managerial expertise is an important element in a policy that aims to create a viable rural financial system. Such an institution would, in administering credit and mobilizing savings, link the input supply system with the farming community. Credit resources capable of capitalizing the institution and institutional arrangements that indemnify credit resources are prerequisites for institutional viability that a comprehensive rural credit policy should address.

Mechanization Policy

The government's mechanization policy allowed for the simultaneous development of equipment powered both by engines and by animals. The use of the engine-powered equipment has been more restricted than that of animal-traction equipment, and it is confined largely to a variety of specific regional programs and projects, such as tractor ploughing to increase paddy production. Steps to privatize these engine-powered services are under consideration. Credit is of central importance to maintain farmers' effective demand for the services.

The system of supplying and managing the operational and service requirements of animal-drawn equipment is mainly in private hands. A matter of policy concern is the decline in stocks of equipment at a time when ERP-induced incentives should increase them (see Chapter 5). Indigenous, local businesses, such as local blacksmithing are constrained by the lack of capital equipment and raw materials; these constraints require attention from public policymakers.

Agricultural Support Policy

One of the primary objectives of reorganizing the Ministry of Agriculture and the privatizing its commercial service functions was to achieve greater efficiency by reorienting its activities around the core functions of policy planning, research, extension, monitoring and evaluation, and collection and dissemination of information. These functions were assigned to two staff departments (administration and planning) and four line departments (research, agricultural services, livestock services, and cooperatives). Although much of this struc-

tural reorganization will not immediately increase production and productivity at the farm level, its short-term benefits include more efficient public sector management and better quality agricultural services. Achieving these short-term benefits will likely be constrained more by poorly coordinated services, inadequate training, and inappropriate experiences than by budgetary limitations.

Constraints on improving the quality of agricultural services can be mitigated in the short term by relying on technical assistance personnel; the long-term solution, however, requires heavy investment in human resource development. To launch an effort to develop human resources (such as that being undertaken by the USAID-supported GARD project) requires balanced manpower, especially high-level researchers, with various essential skills. This need has not received appropriate attention. Indeed, the difficulty in improving public sector management is tied to the poor training of public sector personnel; these difficulties can be mitigated in the short term, however, by effectively coordinating, monitoring, and evaluating the various services. The creation of a National Research Advisory Board (NARB) was a timely institutional development, which provided agricultural research efforts with a needed sense of direction and purpose. The degree to which the Board fulfills these expectations will, however, depend on the quality of its membership and of their experience with agricultural research issues and priorities. Coordinating technical departments is vitally important to improving public service management and increasing the quality of services rendered. At present, the level of technical expertise, skills, and judgment that exists in most of these departments is low. Such coordination role is a function of line management and requires technical experience balanced with analytical skills at the level of the ministry. This balance does not exist at present.

A number of far-reaching policy reforms have been implemented since the inception of the ERP. These reforms affect and will continue to impinge on the economic and social fabric of society, particularly in the rural sector. Although the Department of Planning (formerly PPMU) has been charged with monitoring and evaluating these processes in the agricultural sector, its tasks require a level of institutional capacity that does not exist. The staff and operational resources of the Department of Planning should be strengthened and enabled to identify emerging policy issues, analyze options, and monitor the execution of decisions. These functions are critical management issues that will determine the extent to which the reorganized Ministry of Agriculture can positively promote and direct long-term agricultural growth in The Gambia.

3. THE IMPACT OF STRUCTURAL ADJUSTMENT AND PROGRAM DISRUPTIONS ON RURAL INCOME, CONSUMPTION, AND NUTRITION

Detlev Puetz
Joachim von Braun

The impact of structural adjustment programs on human welfare has attracted much attention (see, for instance, Cornia, Jolly, and Stewart 1987). Detailed assessments of the effects of structural adjustment on consumption and nutrition in Africa are constrained by a lack of data that can be compared over time for countries experiencing adjustment stress. Baseline information is especially lacking. The IFPRI/PPMU data set from 1985/86 and 1987/88 provides a rare opportunity to assess changes in consumption and nutrition during a period of adjustment in a rural area in Africa. Although the data set cannot claim to be representative of all rural Gambia, it nevertheless contains information on the directions that changing outcome variables (consumption and nutrition) can take and on the relation of these changes to changes in production, income, and prices.

As described elsewhere in this volume, the major actions of The Gambia's structural adjustment at the microlevel were (1) to deregulate the food market with the effect of decreasing the real price and improving the availability of rice in the market, (2) to increase substantially the price of the key export commodity (groundnuts), and (3) to privatize input markets and restructure credit for agriculture. Fiscal restraint and administrative reforms had a substantial effect on urban employment and contributed to urban-rural net migration (see Chapter 4).

Although the surveys of the effects of adjustment on consumption and nutrition in rural areas provided some generalizations, they also produced information for assessing specific disruptions in income that are typical of the particular setting, such as local crop failures and the (temporary) ineffective operation of a project in the survey area (the Jahally-Pacharr irrigation project).

This paper assesses in a disaggregated way, changes in real income and in income distribution between the two survey periods and evaluates the effects of those changes on total consumption and on food consumption in particular. The focus is on calories (food energy) because earlier research has identified food energy deficiencies as a key problem of the poor in rural Gambia (von Braun, Puetz, and Webb 1989). Finally, it assesses changes in the nutritional

status of preschool children and women living in the same household in 1985/86 and in 1987/88.

DATA SOURCES

In this paper, income is defined as the total of cash and in-kind income from agricultural production and nonagricultural sources, including remittances. Similarly, household expenditures cover cash expenditures and the value of goods produced for home consumption. Total household income and expenditure are adjusted for household size and presented as per capita figures, with household members counted in adult equivalents.[2]

Income data were collected annually during two distinct seasons: season 1 covers the latter part of the dry and the early part of the wet season, from March through August. Season 2 covers September through February, and thereby includes the income from the wet season crops harvested between September and December. The information on expenditures and food consumption presented in the following discussion relates to season 2. Anthropometric measurements of the weight and height of mothers and children took place shortly after the expenditure survey was completed.

INCOME CHANGES: SKEWED DISTRIBUTIONS

Inflation between the two periods reduced the real value of income and expenditures in 1987/88. A weighted price index, calculated from survey data covering February 1986 through February 1988, showed the inflation rate to be 43.8 percent for the two-year period. In order to compare the two periods, all data are presented in constant 1986 Dalasi (US$1 = 5.06 Dalasi in February 1986).

The average annual income of survey households declined between 1985/86 and 1987/88 by 26.0 percent, from 778 to 576 Dalasi per adult equivalent (Table 5). The dramatic decline in cereal crop income in 1987, both of the dry season rice and wet season cereals (which was 56.7 and 70.6 percent, respectively), could be offset only partly by increased income from groundnuts and off-farm sources.

The decline affected women more than men: women's share of total income decreased from 24.0 percent to 19.3 percent. Off-farm income actually rose 10.5 percent, as a result more of increased off-farm employment than of increased remittances, and its share of total income rose as high as 47.3 percent in lowland villages.

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[2]Adult equivalent units are based on recommended food energy requirements of adult men (using standards set by the Food and Agriculture Organization).

Table 5--Income and income sources, 1985/86 and 1987/88

Year	Total	Annual				Wet Season					Dry Season		
		Crops	Off-Farm and Other	Male	Female	Total	Crops	Cereals	Groundnuts	Off-Farm	Total	Crops	Off-Farm
	(Dalasi per adult equivalent)a	(percentage of the total)											
All villages													
1985/86	778	78.8	21.2	76.0	24.0	74.0	65.4	41.9	22.0	8.6	26.0	13.4	12.2
1987/88	576	69.0	31.0	80.7	19.3	76.7	61.5	16.7	44.4	15.3	23.3	7.8	15.8
Lowland													
1985/86	728	72.5	27.5	69.5	31.5	63.7	52.2	41.6	9.8	11.5	36.3	20.3	17.3
1987/88	405	52.7	47.3	81.0	19.0	59.8	36.8	14.1	22.5	23.0	40.2	16.8	25.2
Upland													
1985/86	845	85.8	14.2	83.6	16.4	85.8	80.5	42.1	36.1	5.2	14.2	5.3	6.4
1987/88	803	79.7	20.3	80.6	19.4	88.2	78.0	18.3	59.3	10.2	11.8	1.7	9.6

Sources: IFPRI/PPMU surveys.

[a] In constant 1986 Dalasi

There is, however, a marked difference in the decline of income between lowland and upland villages: while the former lost 44.4 percent of their 1985/86 income, the latter retained nearly the same income as before (a 5.0 percent decline), which increased the income disparity between lowland and upland villages considerably. The increasingly skewed distribution of income is also evident in the coefficient of variation of income (cross section), which rose from 0.47 in 1985/86 to 0.73 in 1987/88 for the total sample. Figure 4 graphically illustrates this point. A higher variation can be observed even within the group of upland villages: the number of households with an annual income of less than 500 Dalasi increased from 10 to 17 at the same time that the number earning more than 900 Dalasi went down far less, from 28 to 25. On the other hand, lowland households moved consistently toward lower income levels.

EXPENDITURES: INCREASED FOOD SHARES AND STABILIZATION BY DISSAVINGS

Fluctuations in income do not necessarily translate directly into similar fluctuations in expenditure. Although expenditures in lowland villages decreased 10.7 percent in 1987/88 compared with 1985/86, they declined far less than income (38.4 percent). When income decreases, savings and disinvestments (for example, selling animals) may stabilize expenditure levels. Actually, in lowland villages animal ownership dropped 34 percent between 1986 and 1988, while in upland villages it increased 8 percent.

It is important to keep in mind that the expenditure surveys were conducted only a few weeks after farmers received their groundnut income, a main source of cash. The liquidity observed during this period of the year is typically followed by a period of austerity, the hungry season.[3]

While total expenditures declined 7.3 percent on average, food expenditures decreased only 2.5 percent (see Table 6). Instead, people seemed to save first on nonfood expenses, particularly for seasonal goods like clothes and household items. This is particularly evident in lowland villages, where the share of seasonal items decreased from 16.8 to 11.9 percent of total expenditure when income declined by 38.4 percent.

Overall, food's share of the expenditure budget increased somewhat during the period of observation. The decline in nonfood expenditures--absolutely and relatively--suggests that the changes in the agricultural incentives and production environment under the structural adjustment policy did not stimulate growth in the rural nonfarm economy.

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[3]On the seasonality of expenditures and consumption at the survey site, see von Braun, Puetz, and Webb (1989).

Figure 4--Annual income distribution, 1985/86 and 1987/88, by location

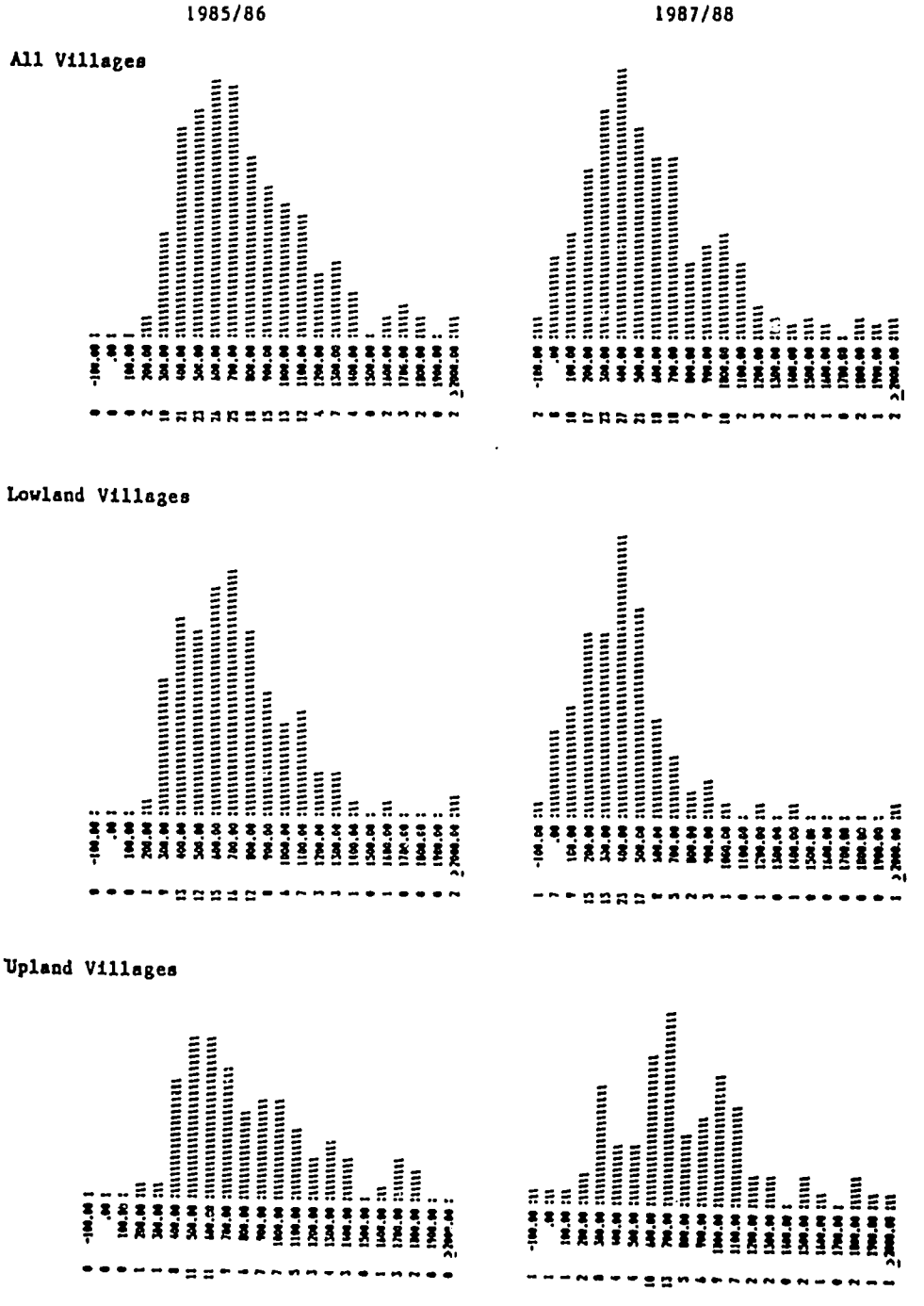

Table 6--Expenditure, 1986 and 1988

Type of Expenditure	All Villages 1986	All Villages 1988	Lowland 1986	Lowland 1988	Upland 1986	Upland 1988
Total[a]						
Dalasi per adult equivalent	792	734	791	706	793	771
Percentage of the total	100.0	100.0	100.0	100.0	100.0	100.0
Food[a]						
Dalasi per adult equivalent	528	515	525	507	531	525
Percentage of the total	66.7	69.0	66.5	70.2	66.9	67.6
Short-term nonfood[b]						
Dalasi per adult equivalent	131	129	132	129	129	130
Percentage of the total	16.5	17.3	16.7	17.9	16.2	16.7
Long-term nonfood[b]						
Dalasi per adult equivalent	133	102	133	86	134	122
Percentage of the total	16.8	13.7	16.8	11.9	16.9	15.7

Source: IFPRI/PPMU surveys.

Note: In constant February 1986 Dalasi.

[a] Include foods produced by the farmer himself and priced at market value.

[b] Short-term means weekly and long-term means seasonal purchases.

CALORIES: EFFECTS OF CHANGES IN INCOME AND FOOD PRICES

Caloric consumption was higher in 1988 than in 1986 by 5.8 percent (see Table 7). Since the relative price of calorie-intensive foods (such as oil, sugar, and cereals) declined, consumers increased their caloric intake of these. Nominal prices for sugar increased 2.8 percent, cereals about 20 percent, and oil 29.2 percent compared with the general price index, which increased 43.8 percent. As a result, oil and sugar in particular were in high demand in 1988: they account for nearly 80 percent of the additional calories consumed in 1988 compared with 1986.

Table 7--Calorie consumption per adult equivalent and share of food groups, all villages (1986, 1988)

Food Group	1986 Calories	1986 Share of Total	1988 Calories	1988 Share of Total
Total calories[a]	2,899	100.0	3,067	100.0
Sinkiro[b] common meal calories		87.1		86.3
Snack foods		12.9		13.7
Cereals		64.4		59.5
Groundnuts		14.0		14.8
Oil		2.2		4.9
Sugar		6.1		8.3
Other		13.3		12.5

Source: IFPRI/PPMU surveys.

[a] Median.
[b] Cooking unit.

Relatively low food prices also helped catch up on weight lost during the preceding wet season. These losses were higher in 1987/88 than in 1985/86. In general, food intake in rural Gambia during the wet season is low because of liquidity constraints and depleted food stores shortly before harvest. Combined with a heavy agricultural work load this usually leads to high weight losses during the wet season. These losses can be considerably reduced, however, if an additional dry season crop is provided, as occurred in the irrigated rice project in the survey area. Improved access to dry season rice significantly decreased seasonal weight fluctuations in 1985/86 (see von Braun, Puetz, and Webb 1989). In 1987, however, this dry season crop was badly hit by poor weather conditions. Yields in 1987 were far below those of 1985, and the crops of many project rice farmers failed completely. This situation diminished significantly the potential positive effect on nutrition. In addition, the farmers' consumption levels were also affected by poor yields of rice and upland cereal in the following wet season. The storage and production account figures for 1987/88 indicate, too, that farmers were consuming less of their own cereals between September 1987 and February 1988 than they had in 1985/86.

Given this situation farmers tried to compensate for the reduced consumption by buying more food, particularly calorie-dense items, as

soon as they received cash income from groundnut sales. This partly explains the increase observed in caloric consumption in 1988 compared with 1986. This expansion of food purchases, however, led to the net decline in expenditures on nonfood goods observed above.

In order to determine the effect of decreased income and lower food prices on caloric intake, a consumption model was specified and estimated jointly, as well as separately, for the dry seasons of 1986 and 1988. The dependent variable was caloric consumption per adult equivalent in each household, and the explanatory variables included income (with total expenditure as a proxy for income), income composition, price of the major traded staple (rice), demographic characteristics, and staple food composition (for details, see Table 8).

A similar model was estimated after the first IFPRI survey during the wet and dry seasons of 1985/86 (von Braun, Puetz, and Webb 1989). Thus the two models allow the stability of the parameters to be tested over time and compared with earlier findings on the income elasticity of caloric consumption. They also allow the price elasticity to be estimated more reliably by using time-variant prices in addition to cross-sectional data.

The estimates of income elasticity were found to be quite stable over time, in both the separate and the joint estimations of the recent surveys: the income elasticity of calories, taking into account the income changes between 1985/86 and 1987/88, ranges between 0.35 and 0.37, compared with 0.37 in the former model for the wet and dry seasons of 1985/86. Thus a 10 percent increase in income will trigger a 3.5 to 3.7 percent increase in caloric consumption at sample mean.

On the other hand, consumers seem to react somewhat stronger to price changes than was suggested by the cross-sectional model: with a 10 percent increase in the price of rice caloric consumption was reduced 4.7 percent (compared with 3.6 percent in the cross-sectional model for 1986).

Given the decrease in real income and in food prices between 1986 and 1988, these partial elasticities produce, on the one hand, a 2.6 percent decrease in calories due to the income effect, but, on the other, a 6.2 percent increase as a consequence of lower food prices. Thus the positive price effect outweighed the negative income effect and led to a net calorie consumption increase of 3.6 percent. This increase reflects the observed actual change of caloric consumption. The actual increase of caloric consumption (5.8 at the median) was somewhat higher, perhaps due to the increased consumption of oil, sugar, and groundnuts, which was not fully captured by the aggregate model.

Table 8--Determinants of caloric consumption during the dry season, 1986 and 1988

Explanatory Variables	1986/88			1986			1988		
	B	T	Mean	B	T	Mean	B	T	Mean
Income[a]	2.07762	8.66	762.94	1.90618	5.30	791.67	2.49400	7.42	734.05
Income squared[a]	-0.00038	-5.10	$(762.94)^2$	-0.00028	-2.69	$(791.67)^2$	-0.00055	-5.12	$(734.05)^2$
Number of persons eating	-44.58853	-7.65	10.47	-47.49490	-5.04	10.30	-38.68763	-5.24	10.64
Share of millet in cereal calories	430.01120	4.05	0.35	360.96911	2.32	0.37	489.97830	3.19	0.32
Real price of rice	-791.45277	-4.28	1.91	-532.08831	-1.37	2.04	44.39892	0.13	1.77
Price ratio of rice to groundnuts	1447.07068	2.91	0.78	182.50620	0.20	0.74	...	...	...
Share of women in sinkiro	1052.97883	4.19	0.32	619.06908	1.77	0.33	1607.14561	4.30	0.31
Share of cash income in total income	31.98091	0.21	0.51	-66.64111	-0.26	0.38	43.68140	0.20	0.63
R^2/F/degrees of freedom	0.39/30.68/357			0.37/14.47/172			0.41/19.64/177		
Income elasticity of caloric consumption	0.35			0.37			0.37		
Price elasticity of caloric consumption (rice)	0.47			0.36			not significant		

[a] Total expenditure as an income proxy.

THE DECLINE IN NUTRITIONAL STATUS

Few comparative data are available from The Gambia on nutritional welfare and infant mortality--two fundamental indicators of welfare--during the second half of the 1980s. A detailed study conducted by Greenwood and others (1989) on the north bank of The Gambia River, not far from our survey population, found that between 1982/83 and 1986/87 the infant mortality rate declined from 155 to 134 deaths per 1,000 live births.[4] Most of that decline occurred during 1985/86 and 1986/87, after the adjustment program was implemented. At the same time, however, the prevalence of malnutrition (weight-for-age less than 80 percent among children from birth to 59 months of age during the rainy season) increased substantially from 47 to 63 percent.

Although consumption levels had picked up by the second IFPRI/PPMU survey, anthropometric data support the findings of Greenwood and others (1989) that the nutritional status of preschool children and their mothers declined overall from 1986 to 1988. The structure and causes of that change are complex. In general, average weights were slightly below those observed in the 1985/86 survey, particularly in lowland villages (see Table 9): mothers weighed 0.6 of a kilogram less (1.0 kilogram less in the lowland villages) and children's average weight-for-age Z-scores[5] decreased from -1.32 to -1.34 (from -1.26 to -1.34 in the lowland villages). But among both mothers and children the distribution of weight increased (see Figure 5, which shows the percentiles). In 1988, for example, the distribution curve for children's weight-for-age Z-scores generally shifted to the left, that is, they became more malnourished. Children above the 60th percentile, however, improved their nutritional status that year. Nonetheless, the pattern of distribution still indicates a substantially higher prevalence of malnutrition, measured as children falling below 80 percent of the median weight for their age group. The increase was particularly strong in lowland villages, where the percentage of malnourished children grew from 23.9 in 1986 to 42.5 in 1988 (in upland villages it increased from 33.3 to 35.0). The distribution of mothers' weight also shifted to the left and became wider (Figure 5, bottom).

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[4]This includes villages without primary health care interventions as a reference.

[5]Z-scores are computed for each child as follows:

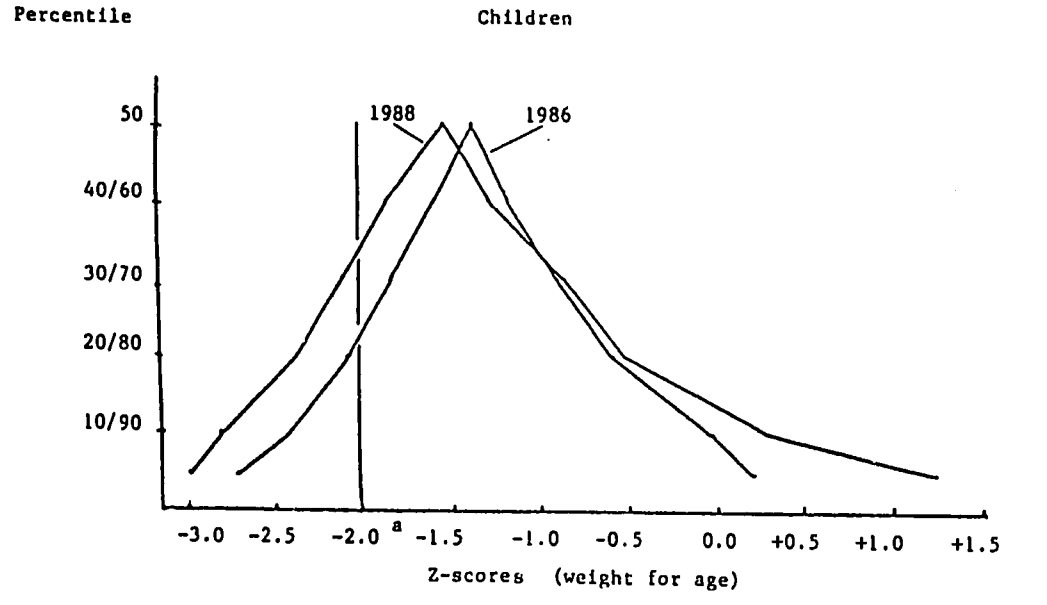
$$\frac{\text{Actual child's measure (reference value)}}{\text{Standard deviation of reference population}}$$

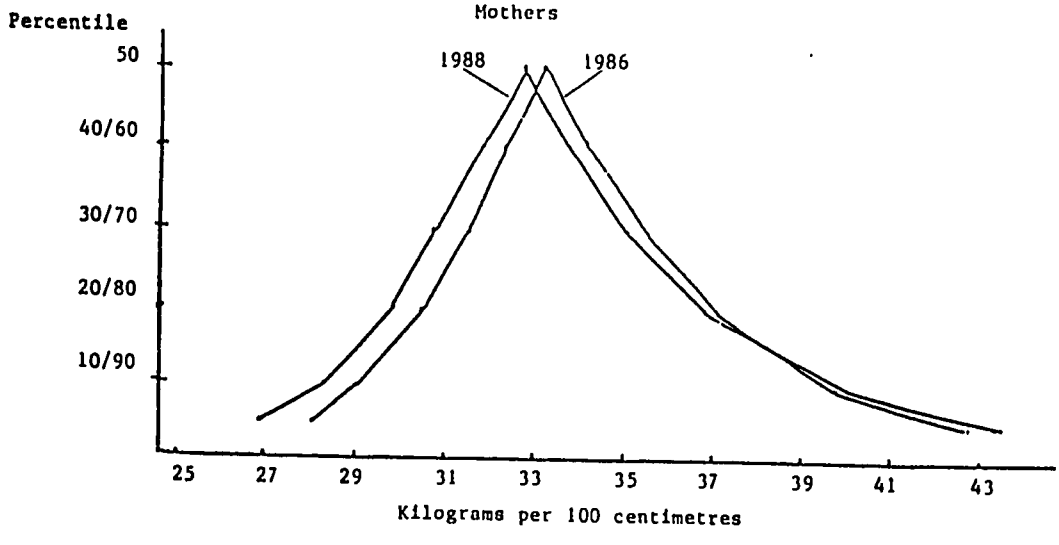
A Z-score of zero is considered normal; a Z-score of below minus 2 can be considered malnourished.

Table 9--Changes in income, expenditure, calories, and nutritional status, 1985/86 and 1987/88

Indicator	All Villages			Lowland			Upland		
	1985/ 1986	1987/ 1988	Percent Change	1985/ 1986	1987/ 1988	Percent Change	1985/ 1986	1987/ 1988	Percent Change
Income (in Dalasi)									
Annual	778	576	-20.7	728	405	-38.4	845	803	-1.6
Season 2	576	442	-23.3	464	242	-47.8	725	708	-2.3
Expenditure (in Dalasi)									
Total September-February	792	734	-6.3	791	706	-10.7	793	771	-2.8
Food	528	515	-2.5	525	507	-3.4	531	525	-1.1
Nutritional status									
Children (6-59 months of age)									
Weight-for-age, mean Z-scores	1.32	-1.34	-0.02	-1.26	-1.34	-0.08	-1.38	-1.34	+ 0.04
Weight-for-age, percentage less than 80 percent	28.3	39.3	+11.0	23.9	42.5	+18.6	33.3	35.0	+1.7
Mothers									
Weight-for-height (in kilograms per 100 centimeters)	34.02	33.57	-0.45	33.87	33.23	-0.64	34.23	34.00	-0.19

Figure 5--Nutritional status of children 6-59 months of age and mothers, 1986 and 1988





a Z-scores below -2.0 indicate moderately malnourished, and below -3.0 severely malnourished children

In contrast to the deteriorating short-term nutritional indicators (weight-for-age and weight-for-height), the long-term nutritional indicator (height-for-age) changed less between the two surveys. Only the prevalence of stunting (height-for-age less than 90 percent of the median) increased slightly among children, from 15.7 to 17.3 percent; even the mean values for height-for-age improved. Thus the long-term impact of the worsening economic situation is not yet visible.

CONCLUSIONS

Stable and growing agricultural income is an important element of efforts to improve food security and nutrition in rural Gambia. Through its effect on output and prices, agricultural policy greatly influences nutritional welfare.

The Gambia went through a period in the second half of the 1980s in which its economic policies changed rapidly. The Economic Recovery Program included major changes in agricultural policies, the impact on income and price of these changes can potentially affect the welfare of the rural poor both positively and negatively. The net effects are still unclear and continue to require monitoring and policy attention. The monitoring at the IFPRI-PPMU survey sites provides some interesting, though largely location-specific, insights into these effects.

Assessing the effects of policy changes on consumption and nutrition finds that average real income in rural Gambia remained almost constant between 1985/86 and 1987/88 (as represented by the upland villages in the IFPRI/PPMU surveys), but that distributions became more skewed. The relative food prices declined, however, the effect on food energy consumption was favorable, though slight.

The erosion of income in the lowland villages caused by problems in the local project had measurable and significantly adverse effects on household food security and nutrition. Child malnutrition in particular increased substantially.

Although the experience of the lowland villages cannot be extrapolated for the country as a whole because the disruption of the local irrigation project caused particular patterns, a general policy conclusion does emerge from the findings: program planners must take responsibility for stabilizing schemes of this nature. Sustainable technology is essential to maintain nutritional improvement effects of technological change. The favorable effects on nutrition that were achieved by earlier technological improvements at the site (von Braun, Puetz, and Webb 1989) can be easily reversed when programs are disrupted.

4. PRICE POLICY UNDER STRUCTURAL ADJUSTMENT: CONSTRAINTS AND EFFECTS

Detlev Puetz
Joachim von Braun

The rationale for agricultural price policy before the Structural Adjustment Program (ERP) was initiated in 1985 was to:

- increase food self-sufficiency by protecting cereal producers (at the expense of consumers);
- provide tax revenue (from groundnut exports and rice imports);
- stabilize producer prices; and
- finance input subsidies and public agricultural services from tax revenue (that is, groundnut exports).

This policy, aggravated by climatic and international commodity price factors, caused producer prices to decline (in real, inflation-adjusted terms), per capita groundnut production to decrease steeply, and per capita cereal production to expand slightly. Subsidized inputs and agricultural services, provided mostly by overextended public institutions, reached farmers only sporadically and wasted resources, largely because management and personnel were limited.

As a result of that experience, the new policy principles of the ERP were to:

- provide incentives for agricultural production and investment (to farmers and private sector intermediaries alike) by means of remunerative and (largely) untaxed producer prices;
- remove distortions in the output price of cereals and groundnuts and thereby increase groundnut revenue to farmers; and
- reduce subsidies on inputs and public services to avoid waste and inefficiency and encourage the private sector to participate in providing inputs.

Preventing the illegal flow of commodities between The Gambia and Senegal, which arises because of differential pricing, has always been

a major price policy concern for fiscal and monetary reasons. Before 1985, the problem was mainly fiscal: lost tax revenue from illicit groundnut exports and lost subsidies from fertilizer exports. More recently--since groundnuts became protected--the groundnut border trade out of The Gambia has saved the government money that otherwise would have been spent on subsidies. However, concerns about the monetary and political implications as well as the usage of existing processing capacities persist.

Impressive nominal increases of producer prices between 1984 and 1987 were offset largely by domestic inflation, which increased production costs and eroded the purchasing power of producer income. For instance, a nominal price increase for groundnuts of about 295 percent turned into a 67 percent increase when adjusted for inflation; real prices for cereals actually declined. Figures 6 and 7 show the inflation-adjusted prices farmers encountered when making their production decisions during those years.

While relative prices shifted dramatically to favor groundnuts and to discourage cereals, the aggregate output price index changed little (a 17 percent increase between 1984 and 1987). Moreover, the aggregate input price index increased faster (58 percent) than the output price index. Fertilizer prices were the exception and this provided an incentive for more intensive use, especially in groundnuts, yet availability constraints actually prevented increased usage of fertilizer (see Chapter 6).

The change in relative output prices shifted cultivated area and production from cereals to groundnuts: for instance, in the upland villages of McCarthy Island Division,the share of area cultivated with groundnuts increased from 46.3 percent in 1984 to 60.4 percent in 1987, after a brief dip to 40.7 percent in 1985.[6] Similarly, the share of groundnuts in the value of total production went up from 56.4 percent to 75.0 percent. On the other hand, total crop production (including cereals) changed little in these four years (Table 10) partly because local environmental conditions (such as rainfall patterns, pests) were relatively unfavorable in 1987. Groundnut yields were highest in 1986: 1.5 tons per hectare compared with 1.1 in 1985 and 1.3 in 1987. Upland cereals also peaked in 1986 (0.9 ton per hectare), up from 0.8 ton per hectare in 1985 and 0.7 in 1987. Farmers decreased total area in the process of extending groundnuts because groundnut production is more labor intensive per unit of land than coarse grains, and labor is a scarce production factor.

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[6]Only sample data for farms that were relatively unaffected by local irrigation projects (for example, Jahally-Pacharr) were used.

Figure 6--Output price indices adjusted for inflation with a one-year lag, 1984-87

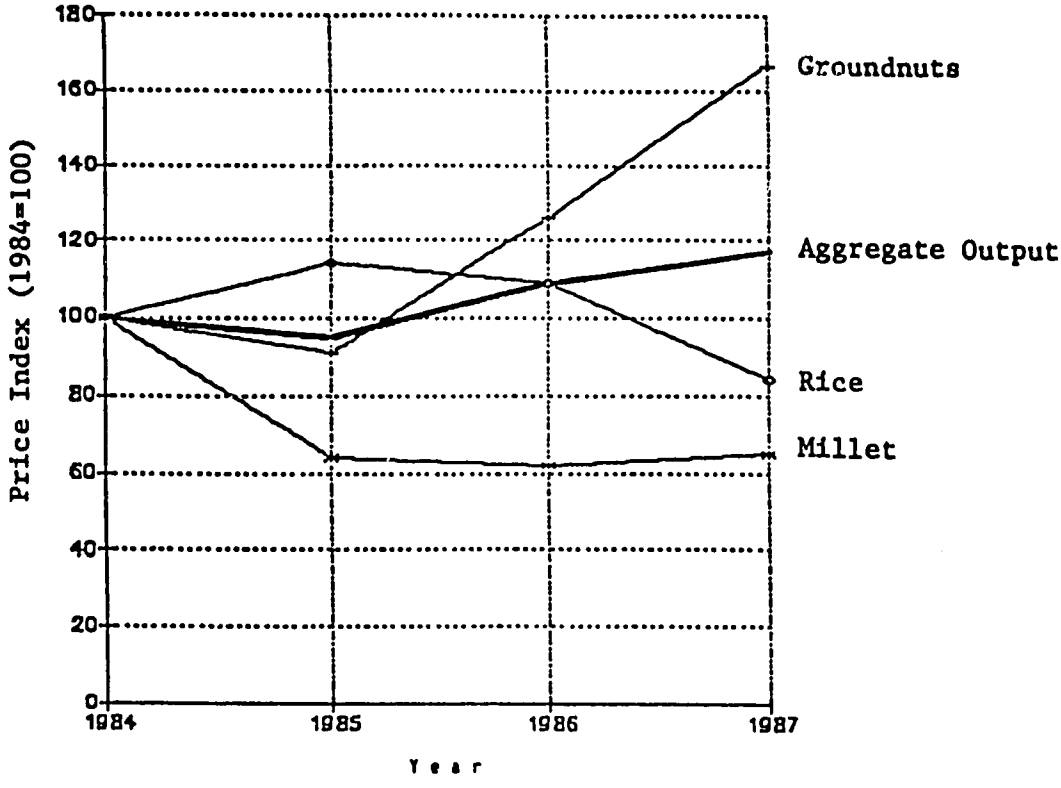

Figure 7--Input price indices adjusted for inflation, 1984-87

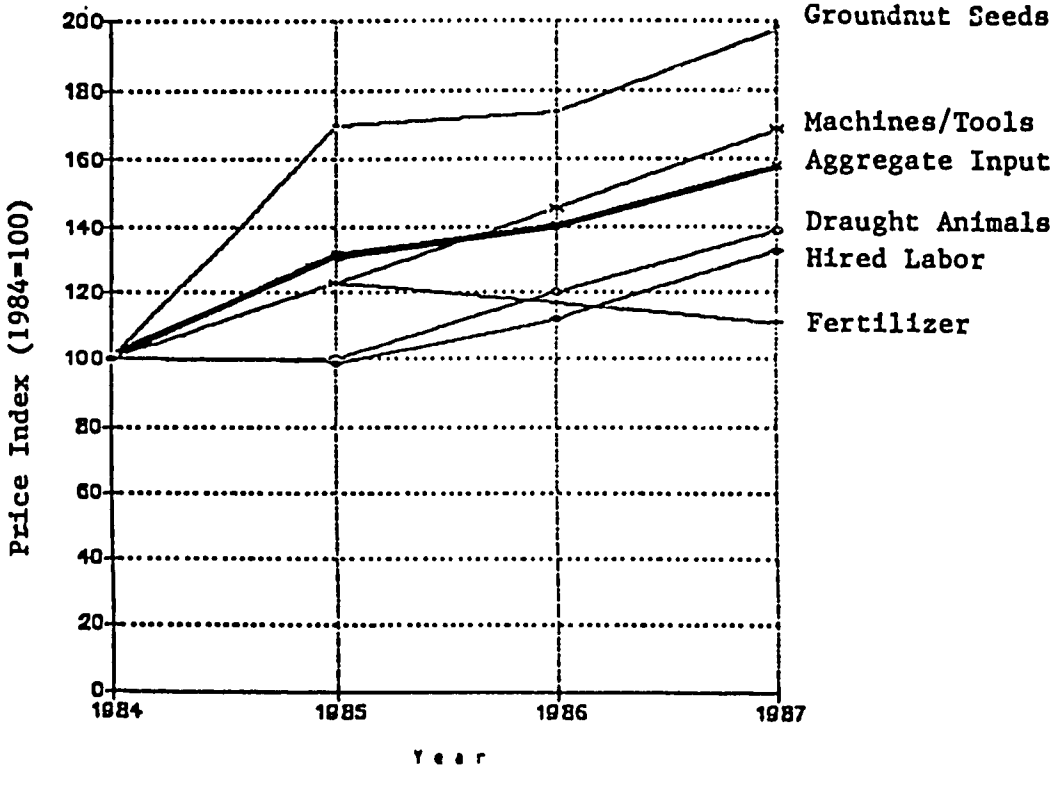

Table 10--Area and production in upland villages, 1984-87

Year	Total		Share of Groundnuts	
	Area	Production	Area	Production
	(index, 1984=100)		(percent)	
1984	100	100	46.3	56.4
1985	97	101	40.7	47.2
1986	81	106	48.9	57.3
1987	91	101	60.4	75.0

Source: IFPRI/PPMU surveys, 1985/86 and 1987/88.

ECONOMETRIC ANALYSIS OF SUPPLY RESPONSE

The purpose of econometric supply response analysis is to examine how agricultural output is related to a number of factors. These factors include prices, technology, agricultural infrastructure and institutions, and climatic conditions. Of special interest are variables that can be influenced by policy decisions. Empirical supply functions that are econometrically estimated serve to assess the extent of farmers' response to the changing prices of outputs and inputs in their decisions to allocate resources to different crops and to agriculture in general.

The question of price response is relevant to assessing the role of the price policy instrument in increasing production and investments compared with that of structural policy instruments. Furthermore, a policy of increased price incentives for farmers has well-known trade-offs: higher consumer prices (at least in the short run) and less tax revenue for governments (in the case of an export crop).

Although there is a growing consensus that farmers respond positively to price incentives as long as they have access to appropriate resources and production inputs, opinions differ about the need for complementary policy interventions, particularly in the areas of institutional and market policy to improve farmers' access to essential inputs and new technologies.

Most research on price response focuses on Asia and North Africa (Askari and Cummings 1977, Scandizzo and Bruce 1980). But conditions in Sub-Saharan Africa differ remarkably from those in Asia: particularly the general abundance of land, the shortage of labor, and the underdevelopment of factor and output markets. As Martin and Crawford (1989) report, supply response studies in Africa have mostly focused on individual cash crops for which positive price responses were generally found. Bond (1983) and Cleaver (1985), however, find that

producer prices have little or no impact on aggregate production, and Martin and Crawford find in their simulation model that the price response of cereals is low. Most studies, particularly those focusing on individual crops, do not take into account the complex substitution processes and intercommodity relationships that occur at the farm and household level in the multiproduct farm environments prevailing in most of Africa. Other studies, such as Martin and Crawford's, are not based on actual behavior of farmers in the face of changing prices; instead they make behavioral assumptions and derive supply elasticities from production functions or programming models. Haughton (1986) finds for Asia that measures of response elasticities vary markedly depending on the particular functional form used. He suggests using direct-price based estimates of input demand and output supply equations rather than conventional quantity-based production function analysis when measuring price elasticities. This approach has been limited in Sub-Saharan Africa since appropriate field data are either not available or inadequate for statistical estimation.

The present study in The Gambia uses both national time-series information (equations [1] and [2] below) and detailed household survey data collected in 190 farm households between 1984 and 1987 (equations [3], [4] and [5]). This approach captures ranges of estimates and also allows results of the short-run response to recent policy changes to be compared with the more long-term response pattern in The Gambia. Individual crop and aggregate supply functions are estimated for both the national time-series data (1975-87) and the four-year time series along with cross sections of sample household observations (1984-87). Both land allocation and output supply models were estimated since farmers may respond by changing the area cultivated and by intensifying production through the use of more inputs per unit of land (which increases the yield per hectare).

National-Level Models

At the country level, the supply response for an individual crop i in time period t was specified as:

$$Q_{it} = f\,(P_{i,t-1,t-2},\ R_t,\ T_t), \qquad (1)$$

where:

Q_{it} = per capita production of crop i in year t,

$P_{i,t-1,t-2}$ = ratio of weighted, expected prices of competing crops and price of crop i, (averages of prices from year t-1, t-2),

R_t = various rainfall variables (total annual rain, rainfall distribution), and

T_t = technology: irrigated rice area (for rice only).

Similarly,

$$A_{it} = f\,(P_{i,t-1,t-2},\ R_t), \qquad (2)$$

where:

A_{it} = per capita area cultivated of crop i in year t,

$P_{i,t-1,t-2}$ = ratio of weighted, expected prices of competing crops and price of crop i, and

R_t = rainfall distribution variable: share of rain in the early wet season.

Household-Level Models

In the farm-level models, additional variables control for farm and regional cross-sectional differences in resource endowment and technology (to reduce the number of unobserved latent variables). Two approaches for estimating the farm household supply models were chosen to exploit their specific strengths, and avoid the weaknesses of particular models:

1. The direct specification of an output supply and area allocation function (equations [3] and [4]), and

2. The estimation of output supply functions derived analytically from a restricted profit function (model [5]).

In the direct estimates, the supply response functions for an individual crop i in time period t were specified as:

$$Q^h_{it} = f\,(P^v_{i,t-1},\ L^h,\ K^h,\ D^h,\ E_t). \qquad (3)$$

Area models take the form:

$$A^h_{it} = f\,(P^v_{i,t-1},\ L^h,\ K^h,\ D^h,\ J^h_t), \qquad (4)$$

where:

Q^h_{it} = farm production of crop i in year t of household h,

A^h_{it} = area cultivated with crop i in year t of household h,

$P^v_{i,t-1}$ = ratio of weighted, expected prices of competing crops and price of crop i (which is village specific),

L^h = farm labor force in base year 1985,

K^h = machine and draft animal capital per farm worker in base year,

D^h = variables related to demography and cross-sectional production differentiation,

E_t = yield environment variable, and

J_t^h = improved rice land owned in project area per farm worker (in equivalents of double cropped land).

In all models of aggregate production, Q_{it}^h is the value of total output. In aggregate production and area models, P_i^y is the production-weighted index of expected prices for all crops.

In model [5] a restricted profit function relates maximized profits to input and output prices and to other exogenous variables such as fixed inputs or climate outside the farmer's control. Formulating a farm model in terms of a profit function is useful because the output supply and input demand functions of the farm can be computed as first partial derivatives of the profit function with respect to market prices. This model assumes that the farmer maximizes his expected profits within the constraints imposed by quasifixed factors. For the present case, machine and draft animal equipment, labor, and irrigated area are presumed to be quasifixed factors. We further assume that technology is represented in a quadratic form.

Since production decisions on one crop may be affected by decisions on another, the three linear product supply equations and the profit function were estimated jointly as a system of seemingly unrelated regressions using generalized least squares, thus they were subject to symmetry constraints.

The restricted profit function and the linear supply equations for groundnuts, coarse grains, and paddy are given as:

$$\pi_t^h = f\ (P_{i,t-1}^y,\ L^h,\ K^h,\ J_t^h)$$

and

$$Q_{it}^h = f\ (P_{i,t-1}^y,\ C_{i,t-1}^y,\ L^h,\ K^h,\ J_t^h,\ E_t), \qquad (5)$$

where:

π_t^h = farm profit in year t calculated at expected crop prices ($P_{i,t-1}$) and normalized by the price of fertilizer,

Q_{it}^h = farm production of crop i in year t of household h,

$P^v_{i,t-1}$ = expected price of crop i normalized by the (village specific) price of fertilizer,

$C^v_{i,t-1}$ = expected prices of competing crops normalized by the (village specific) price of fertilizer,

L^h = farm labor force in base year,

K^h = machine and draft animal capital per farm worker in base year,

J^h_t = improved rice land owned in project per farm worker (in equivalents of double cropped land), and

E_t = yield environment variable.

Some caution is required in interpreting elasticities derived from this profit function approach. Statistical tests did not provide sufficient evidence of profit maximization, which limits the significance and reliability of parameters in the supply functions.

Definitions of Specific Variables

For individual crop response estimates, the relevant price to be considered is that of the crop in question deflated by the price of alternative crops. Thus the price variable is expressed as a ratio of the price of the crop in question to a weighted average of the prices of competing crops. In aggregate supply models, a weighted aggregate price index of real (inflation-adjusted) prices is used.

Farmers base their decisions on price expectations. Expected prices are nonobserved variables, and a hypothesis of how price expectations are formed is required. The *a priori* assumption was made that farmers' base their price expectations on the crop prices of previous years.[7]

To investigate price effects, we controlled the output function for fluctuations and trends in production caused by nonprice factors, such as population growth, changes in technology, and climate. Labor is the basic agricultural resource in this land-abundant environment, and population growth directly translates into agricultural growth in

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[7]In the country-level models, mean prices for the previous two years entered the estimations; the household-level models were regressed on one-year lagged prices. Prices used in the household models were measured at the farm level, but averaged by village to avoid price endogeneity. Whenever absolute prices were applied, nominal prices were adjusted for inflation and converted into real prices.

an excess-land situation. Thus the long-term, country-level model used per capita figures as dependent variables (per capita refers to the rural population).

To measure long-run response requires disentangling the price response from the effects of new technologies and enhanced infrastructure; this was done for rice production by incorporating irrigated rice land as an explanatory variable. No reliable information is available in The Gambia on productivity changes in other crops, but in general the overall productivity in upland crops changed little during the observation period.

Yield levels are conditioned by total rainfall and the distribution of rain across the seasons. Total annual rainfall is expected to have a positive influence on total agricultural production, which decreases, however, at the margin. Heavy rains favor not only crops, but also weeds and crop pests. As discussed earlier, critical periods of rainfall vary by crop: early rainfall favors planting groundnuts in larger areas, while drought in August damages cereals considerably. Several of these variables were tested in the long-run response models.

In the household-level models, a crop-specific yield environmental variable was used to adjust for annual variations in yield that cannot be attributed to differences in the intensity of inputs (fertilizer, seed density, or labor). This variable captures the effects of rainfall, rainfall distribution, and pest incidence. Indices are derived from annual dummy variables in a regression analysis of yield levels per hectare that controlled for annual input variations (see Table 11). The results show that yield conditions for aggregate production in 1984 and 1986 were similar to those in the reference year 1985, although they were unfavorable in 1987. A closer look at individual crops, however, shows large variations over this period: in 1984, a positive environment for rice balanced very unfavorable conditions for upland crops; in 1986 the reverse occurred. In 1987, the slump in all cereals, rice and coarse grains, produced the overall negative picture for that year.

Including input prices in supply models, though desirable, encounters several problems in the Gambian environment:

- Market integration and the use of purchased production inputs are limited, and prices rarely reflect actual scarcity because of subsidies and rationing, as in the case of fertilizer or crop protection services. Supply response models generally assume that price changes are the only signals that should elicit behavioral responses. Where markets are not competitive and inputs are rationed, however, access to limited quantities may be relatively more important than prices.

Table 11--Yield environment indices, 1984-87

Year	Groundnuts	Coarse Grains	Rice	Aggregate Production
	(kilogram/hectare)			(Dalasi/hectare)
1984	-344	-349	723	26
1985	0	0	0	0
1986	402	167	-845	44
1987	194	-227	-1,716	-318

Note: The indices are derived from annual dummy variables in a regression analysis of yield levels, controlling for input variation. They reflect variation in weather and pest incidence at village level.

- Prices for key inputs are difficult to determine. Quality differences, in-kind transactions, and interlinked markets make calculating rates (of, for example, hired labor and machine services) difficult. Often input prices (except for fertilizer) are simply not available.

- Where price information is available--as it is in the household survey data--econometric estimation is difficult because prices of scarce production inputs frequently are closely correlated with output price expectations, which creates multicollinearity problems.

For these reasons the present study focuses on output supply rather than input demand analysis. Attempts to include variable input quantities (fertilizer) in the countrywide models did not yield any significant results: national sales data do not always reflect actual use in a given year (because of storage and the border trade).

The Price Response

The response of output to price is expressed as elasticities; that is, the relative change in output at a 1 percent change in price. Thus an elasticity of 0.5 means that a price increase of 10 percent will lead to a production increase of 5 percent. The elasticities reported in Table 12 were calculated at mean sample values.

In general, where the results are significant the models show positive own-price response of area *and* of production for all crops, and for food and cash crops. Elasticities range from 0.47 for coarse grains to 0.80 for rice; that is, the response of these crops is

Table 12--Elasticities of area and production for own- and cross-output prices

	National Level Models 1975-87 (1), (2)	Household-Level Models: All Villages: Direct Estimation Model 1984-87 (3), (4)	All Villages: Profit Model 1984-87 (5)	Upland Villages: Direct Estimation Model 1984-87 (3), (4)	Upland Villages: Profit Model 1984-87 (5)
	(Elasticities at means)				
Area					
Groundnuts					
Own	0.64	0.26	n.a.	0.22	n.a.
Coarse grains	-0.50	-0.12	n.a.	-0.10	n.a.
Rice	-0.20	-0.17	n.a.	-0.15	n.a.
Coarse grains					
Own	0.45	0.41	n.a.	0.37	n.a.
Groundnuts	-0.39	-0.26	n.a.	-0.23	n.a.
Rice	-0.09	-0.20	n.a.	-0.18	n.a.
Rice					
Own	2.11	0.86	n.a.	1.06	n.a.
Coarse grains	-0.88	-0.62	n.a.	-0.40	n.a.
Groundnuts	-1.44	-0.32	n.a.	-0.78	n.a.
Aggregate	...	-0.31	n.a.	-0.26	n.a.
Production					
Groundnuts					
Own	(0.59)[a]	0.59	0.84	0.63	0.84
Coarse grains	(-0.47)	-0.27	-0.29	-0.36	-0.34
Rice	(-0.18)	-0.38	(-0.21)	-0.40	(0.23)
Coarse grains					
Own	0.57	0.44	(-0.21)	0.45	(-0.04)
Groundnuts	-0.51	-0.28	-0.49	-0.28	-0.52
Rice	-0.12	-0.21	(-0.33)	-0.21	(-0.31)
Rice					
Own	1.00	0.81	(0.22)	(0.08)	(-0.15)
Coarse grains	0.22	-0.30	(-0.31)	(-0.03)	(-1.18)
Groundnuts	-0.68	-0.51	(-0.33)	(-0.06)	(1.33)
Aggregate	...	0.64	...	(-0.02)	...

Note: For details of the model estimates, see Detlev Puetz, "Supply Response and Policies for Overcoming Technology Constraints to Agricultural Growth in The Gambia," in Joachim von Braun, Ken Johm, Sambou Kinteh, Detlev Puetz, and Patrick Webb, Final report to GTZ (Washington, D.C.: International Food Policy Research Institute, mimeo).

n.a. means not applicable.

[a] Elasticities in parentheses are not significant at the five-percent level.

rather inelastic. Usually area response is somewhat lower than production response, except for the long-run groundnut elasticities. Elasticities are generally higher in the long than in the short run, which is plausible. This is particularly true for groundnut area, where seeds, an important factor for extended areas, are often scarce in the short term. This leads to a low immediate response in groundnut area.[8] Interestingly, farmers manage to compensate for this limited area response by intensifying production: short- and long-term production elasticities are similar.

In contrast, coarse grains with low seed input requirements reveal similar short- and long-run area elasticities. In rice production, however, an institutional factor--the irrigated rice project in survey area--seems to reduce the short-run response, particularly of area, to changing prices. In the long run the response of area is more pronounced than that of total production.

The supply of crops compared with that of competing crops takes mostly expected signs: nearly all cross-price elasticities are negative, although not necessarily significantly so. The use of relative prices (that is, price ratios) implies that cross-price elasticities are negative if own-price responses are positive. The profit models with individual output prices as independent variables support the finding. Significant cross-price elasticities prove that crops are competing for scarce production factors and that substitution effects are taking place.

The magnitude of elasticities, a measure of relative change, depends to some degree on the level of production of a particular crop. Crops with a relatively small share of total production permit a stronger response to price incentives than those with a high share. This is particularly true for rice, whose share of national production was on average slightly less than 15 percent between 1975 and 1987. Because rice uses a relatively small proportion of total land and labor reallocating resources in response to price changes is easier for rice producers, which is why rice has the most elastic area and production response.

This phenomenon also needs to be considered in comparing supply elasticities for groundnuts and coarse grains: average acreage and production of groundnuts in The Gambia are about twice as high as those of coarse grains. Thus the same elasticities mean different

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[8]These figures for groundnut area elasticities may still be slightly overestimated because the early rainfall variable that showed significantly positive effects on area in the national-level models could not be included as an explanatory variable in the household-level models. Early rains strongly correlated with groundnut prices, which led to multicollinearity problems.

incremental changes for each crop. The absolute price response for groundnuts is larger than for coarse grains.

Although the results of the two estimation approaches (direct and profit function) at the household level are remarkably similar for groundnut production, they differ for coarse grains and rice. Results from the profit function model indicate that coarse grains respond more strongly to price changes in competing commodities, particularly groundnuts, than to own-price changes--where the sign is not significant. Prices and markets for upland cereals have never been regulated the way groundnut and paddy markets have been. Furthermore, the amount of traded upland cereals is low, which produces volatility and uncertainties in the markets. Prices depend on harvest conditions, the volume of imported rice, and the price of rice and fluctuate strongly. Thus the driving force, for changes in upland cereal production, particularly in the short run, appears to be the price of groundnuts.

Models (3) and (4) are also being used to estimate aggregate supply response elasticities. The results suggest a significant but inelastic price response when the sample of all villages is used (0.67) but an insignificant response in the subsample of upland villages.

Simulation of a 10 Percent Increase in Groundnut Prices

Simulating a 10 percent increase in groundnut prices (based on the own- and cross-price elasticities presented in Table 12) shows the limited effect of changes in relative prices on aggregate output. The effects of land and labor substitution reduce a 6 percent positive production response of groundnuts into a net aggregate production increase of only 1.2 percent in the long run and close to zero (0.6 percent) in the short run (see Table 13). This is particularly true in lowland villages, where the switch to groundnuts substantially reduces rice production. In upland villages, however, substitution effects between crops are somewhat less pronounced and produce a net increase in total output of about 2.8 percent. Negative effects on total area are caused again by differences in the area intensity of labor use in upland crops, which is higher in groundnuts than in coarse grains.

Although the preceding simulation does not necessarily account for changes in the level of absolute prices, results derived from a simulation using the profit function approach (and absolute prices) confirm those findings and suggest a somewhat stronger supply response. In this case an absolute 10 percent increase in groundnut prices raises aggregate output about 1.9 percent in all villages.

Table 13--Effects of a simulated 10 percent increase in groundnut prices on response in groundnuts and aggregate agricultural supply

Level of Analysis	Production		Area	
	Groundnuts	Aggregate	Groundnuts	Aggregate
	(percent)			
National level	5.9	1.2	6.4	0.6
Household level				
All villages	5.9	0.6	2.6	-0.5
Upland villages	6.3	2.8	2.2	-0.6

Source: Based on models (1), (2), (3), and (4).

POLICY CONCLUSIONS

Much of the price response was the result of reallocating labor and area from cereals to groundnuts. The change of relative prices and wages to favor agriculture over other sectors also triggered some movement of labor back into agriculture (for more on this, see Chapter 5).

Between 1985 and 1987, farmers invested in draught animals; the stock of machinery stagnated, however, and machine purchases actually declined in 1986/87 compared with 1982-85. Thus the price policy does so far not seem to have added substantially to the accumulated production capital in agriculture, which could have induced a more long-term response in output.

Availability and restricted credit drove down the use of fertilizers in upland crops. The use of groundnut seeds also declined.

The ERP price policy succeeded, to some degree, in providing incentives to producers and turning around the negative trend in groundnut production. The subsidy costs were high, however, and achievement of other goals of the price policy was less successful. First, previous distortions that favored cereals (through taxation) were replaced by distortions that favored groundnuts (through subsidies). Second, although the outflow of groundnuts to Senegal was curtailed in 1986/87, in 1987/88, according to IFPRI-PPMU survey results 53 percent of groundnuts were sold in Senegal, and in 1988/89, according to national estimates this figure was between 60 and 80 percent. Third, removing price subsidies and reducing public agricultural services reduced the fiscal burdens in the governments but did not, as yet, induce private sector participation. In the meantime,

the availability of inputs and services at the farm level decreased dramatically.

Remunerative producer prices support agricultural production and investment. However, The Gambia's experience before and during the ERP showed that such prices, though necessary, are not sufficient to produce a large aggregate output response. To make price policy work, capital (that is, credit) and improved techniques and inputs must be available at the farm level. If farmers cannot expand their use of inputs, increased prices will only transfer income to producers.

The fiscal costs of output price subsidies make a policy of prices that exceed international levels unattractive. Getting production costs down and increasing labor productivity through improved technology are the prefered option to prevent further declines in farmers' income. The next section addresses related issues.

5. TECHNOLOGY CONSTRAINTS AND POLICY OPTIONS

Detlev Puetz
Joachim von Braun
Ken Johm

In the past, much emphasis has been put on improving crop yields per unit of area, especially of rice. Although increased yields per hectare are desirable, the real issue in The Gambia is to focus on total productivity and on labor productivity in particular.

Technologies for improving overall labor productivity--through area extension and intensification--are known and are available in The Gambia to a limited extent. The key is to promote the relevant technologies at the appropriate scale in the various agroclimatic environments.

This chapter first assesses the relative roles of the production factors--land, labor, and capital--using production function analysis. This is followed by an assessment of the constraints on agricultural growth and related policy options. Three elements of growth-oriented agricultural policy are then discussed that are not alternatives to, but complements of:

- promoting upland crops (that is, implements),
- introducing technologies for growing rice (irrigation), and
- improving the use of inputs (fertilizer, seed, and crop protection).

THE RELATIVE ROLE OF PRODUCTION FACTORS

Unrestricted Cobb-Douglas functions are estimated using input and output data for 1985 and 1987. Separate functions are estimated for the total sample and for upland villages in these years. In order to test the consistency of parameters over time, separate estimations are also conducted for 1985 and 1987.

Under the given technological conditions, farm output is viewed as a function of cultivated area, labor, and capital. Formally, this relationship can be expressed as:

$$Q_i^h = F(A_i^h L_i^h, K_i^h), \tag{6}$$

where:

Q_i^h = output per farm h of individual crop (kilogram) or aggregate production (crop value) i,

A_i^h = land, which is measured as total area cultivated. Except for rice, this is a simple sum of hectares. In rice production, land is weighted to reflect different technologies (such as irrigated area),

L_i^h = farm labor input measured by labor days worked (which are equal for males and females) with adjustments made for children's labor. Both family and hired labor are included, and

K_i^h = capital, which includes fertilizer, seeds, and the annualized value of fixed capital (tools and draught animals). Interest costs are assumed to amount to 20 percent per year for working capital. For individual, upland crop production fixed farm capital was allocated to groundnuts and coarse grains, according to the production shares of the crop in question.

In aggregate production functions, rice land (in irrigated land equivalents) is included as an explanatory variable.

To aggregate the total production value of all crops and calculate the value of marginal products, output is valued at mean 1985/87 deflated prices for the stacked 1985/87 models and at the respective deflated annual prices for the separate 1985 and 1987 estimations.

Elasticities of production related to increased factor use and marginal factor productivities (in production values) are presented in Table 14. The related parameters are largely robust and significant. Elasticities describe the percentage change in output following a 1 percent change in input. Thus the sum of factor elasticities (the returns to scale) represents the effect of a simultaneous 1 percent change in all inputs. Elasticities also indicate the relative importance of a factor in the production process. On the other hand, marginal productivities represent the change in output that results from an increase (or decrease) in one unit of input if other factors are held constant--that is, the result of one additional day worked, one more Dalasi invested, or one more hectare cultivated.

Table 14--Marginal productivities and production elasticities

Crop and Year	Mean Production per Farm[a] Kilogram	Mean Production per Farm[a] Dalasi	Sum of Elasticities	Labor Elasticities	Labor Marginal Productivity	Labor Mean Days	Capital Elasticities	Capital Marginal Productivity	Capital Mean Dalasi	Land Elasticities	Land Marginal Productivity	Land Mean Hectares
Groundnuts												
1985/87	2,689	1,990	1.23	0.77	6.03	254	0.50	2.12	556	(-0.04)	(neg.)	2.10
1985/87 upland villages	4,025	2,979	1.17	0.84	7.17	349	0.51	2.34	794	(-0.18	(neg.)	2.86
1985	2,100	1,764	1.27	0.51	4.41	203	0.50	2.19	504	0.26	264	1.76
1987	3,275	2,063	1.21	0.98	6.66	304	0.52	2.01	609	-0.29	-245	2.44
Upland cereals												
1985/87	1,308	895	1.39	0.74	4.88	129	0.33	1.84	274	0.32	161	1.71
1985/87 upland villages	2,267	1,552	1.07	0.67	5.53	178	0.26	1.83	413	0.14	87	2.33
1985	1,553	1,227	1.40	0.59	5.03	143	0.29	2.47	246	0.52	354	1.79
1987	1,038	530	1.38	0.85	3.93	115	0.53	1.76	306	(0.01)	(3.7)	1.61
Rice												
1985/87	1,380	999	1.21	0.24	1.36	142	0.23	1.11	196	0.74	571[b]	0.65
1985/87 upland villages	705	534	0.80	0.11	0.46	95	0.18	0.45	203	0.51	332[b]	0.47
1985	1,769	1,416	1.28	(0.12)	(1.11)	159	0.39	3.39	193	0.77	985[b]	0.69
1987	691	263	1.04	(0.18)	(0.42)	112	0.03	0.05	202	0.83	218[b]	0.58
Aggregate												
1985/87	n.a.	3,578	1.08	0.50	3.55	503	0.42	2.67	630	0.16	135	4.15
1985/87 upland villages	n.a.	4,844	1.11	0.28	2.18	613	0.48	3.08	897	0.35	302	5.67
1985	n.a.	4,708	0.86	0.23	1.94	556	0.45	4.13	616	0.18	200	4.36
1987	n.a.	2,447	1.16	0.39	2.10	450	0.51	2.28	644	0.26	159	3.93

Source: Derived from Cobb-Douglas functions.

Notes: Elasticities in parentheses were not significant at the 5 percent level.
n.a. means not applicable.

[a] Only farms are included that cultivate the respective crop.
[b] Weighted for different levels of technology.

For all crops and villages combined, the analysis shows that labor is the most important production factor and, surprisingly, that the share of capital in aggregate production is high. Access to production capital allows farmers to make decisions on crop allocation that increase the overall value of production. Once the farmer decides what crop to grow, however, labor relative to capital and land is still the most important factor affecting the production of that crop, at least in upland areas where land is plentiful. This does not minimize the role of capital, which still has a high impact, particularly in groundnuts.

As expected, land is most valuable in rice cultivation since area, particularly irrigated area, is scarce and highly productive. Therefore, the marginal productivity of rice land is highest: the average is Dalasi 571 for each additional hectare. This figure can also be interpreted as the amount a farmer is willing to pay for renting a hectare of rice land.

Returns to scale are mostly above 1--for aggregate production, they are 1.08 (overall for 1985/87 and 1.11 in upland villages). This means that the increases in output are disproportionately large when coupled with increases in the level of overall input. Increasing returns to scale suggest that farmers are not maximizing potential farm profits and that economies of scale exist--that is, larger farms can produce relatively more efficiently. This is not surprising given the scarcity of labor and particularly of capital, largely the result of limited credit markets; which causes many farms to be underequipped.

Labor

Allocative efficiency means that marginal products of a particular factor are the same across all activities. In the present case, however, the marginal productivity of labor is higher in upland crops --Dalasi 4 per day and more--than in rice, where it does not exceed Dalasi 1.36. By reallocating labor from rice to upland crops, farmers could actually increase their total revenue. By working an additional day in upland crops, they would gain more than they would lose by not working that day in rice. Strict work schedules in the rice project emphasized maximum yields more than equating marginal returns with labor opportunity costs and produced this finding (von Braun, Puetz, and Webb 1989).

Marginal labor productivities in groundnuts and upland cereals fluctuate--with yield levels, output prices, and other factors--within the range of Dalasi 4 and 7 across location and years. These stable marginal productivities are proof that farmers manage to allocate their factors efficiently across upland crops. The separate estimation of allocative efficiency in upland villages is not markedly different. Their marginal labor productivities are higher than those

of the total sample, however, even with their higher average labor inputs (37.4 percent higher in groundnuts and 37.9 percent higher in coarse grains). Decreasing returns to labor are avoided by increased use of capital and land (in groundnuts, for example, capital was increased 42.8 percent, and land, 36.1 percent).

The neoclassical condition for maximizing profit is to increase the quantity of output until marginal revenue equals marginal costs. In this case, marginal revenue has already been established as the value of marginal production (marginal factor productivities) of labor, capital, and land. But marginal costs, or factor opportunity costs have not yet been established. For capital, which is expressed in monetary terms, the unit is one Dalasi, but for land, no price can be determined since practically no land market exists in the area. For labor, the unit is usually agricultural wage rates.

Table 15 comprises agricultural wage rates and marginal labor productivities for total output and groundnuts. In aggregate production, Gambian farmers nearly equate marginal productivity with labor opportunity costs. Although an additional day worked as hired labor would seem to yield higher returns, the wage rates reported here are paid during the peak cropping season and do not necessarily reflect annual or even average seasonal wages. They therefore tend to be higher than the average labor opportunity costs.

Table 15--Wages and marginal labor productivity

Year	Wage Rate[a]	Marginal Labor Productivity	
		Aggregate Production	Groundnuts
		(Dalasi)	
Average for 1985/87	3.92	3.55	6.03
1985	2.97	1.94	4.41
1987	4.86	2.10	6.66

[a] In 1984 Dalasi.

On the other hand, marginal productivities in upland crops generally exceed wage rates because of transaction costs involved in hiring labor (that are not included in the wage rate), liquidity constraints (that keep farmers from hiring labor even when doing so may be profitable at current wage rates), and quality differences between hired and family labor.

Table 16 comprises marginal and average labor productivities in February 1986 price. Average labor productivities are defined as the gross margins per day worked in each crop. Marginal and average productivities are very close in upland crops, which is plausible in a situation of excess land and is in line with similar findings by Delgado and Ranade (1987) in Burkina Faso.

Table 16--Marginal and average labor productivity

Year, Location, and Productivity	Groundnuts	Coarse Grains	Rice
1985/87, all villages			
Marginal productivity	8.15	6.98	2.19
Average productivity	8.82	7.87	9.49[a]
			5.24[b]
			2.61[c]
1985/87, upland villages			
Marginal productivity	9.69	7.91	0.74
Average productivity	9.80	10.20	10.43[a]
			4.59[b]
			5.45[c]
1985, all villages			
Marginal productivity	5.25	5.92	1.32
Average productivity	8.64	8.98	14.65[a]
			7.36[b]
			3.83[c]
1987, all villages			
Marginal productivity	10.57	5.62	1.05
Average productivity	8.99	6.76	4.33[a]
			3.24[b]
			1.39[c]

Note: In February 1986 prices.

[a] Irrigated rice.
[b] Tidal rice.
[c] Traditional swamp rice.

Capital

Capital has a significant and stable impact on production, although its influence differs by crop. Groundnuts are the most capital-intensive crop--if the capital invested in the irrigation structure for cultivating rice is excluded from the capital variable--and one Dalasi spent on producing groundnuts returns at least two Dalasi.

Aggregate production benefits even more (between Dalasi 2.67 and 3.08 in upland villages for each Dalasi invested). The return was even higher in 1985, a year of good harvests, but dropped in 1987 when problems affected cereal production. High returns suggest that capital is underutilized and explain why farmers are willing to pay high interest rates for credit.

LAND, LABOR, AND CAPITAL CONSTRAINTS

Technology options for increasing agricultural productivity depend largely on the availability and constraints of the three major production factors--land, labor, and capital.

Land

With about 56 persons per square kilometer, The Gambia is densely populated compared with other African countries. Nevertheless, arable land is still available for upland agriculture. Estimates of additional suitable land range from 20 percent to nearly 100 percent of the presently cultivated area (Food and Agriculture Organization 1985a). In addition, reducing the time during which land being farmed lies fallow could mobilize another 30 to 40 percent.

Although overall land in The Gambia is not scarce and is often available at virtually no cost, unused land is not distributed equally across the country. Among other factors, regional differences in the level of mechanization create higher demand for land in upland villages than in lowland ones. One indicator of availability of land is the amount of fallow land in crop rotation. An indication of pressure on land is when the amount of fallow area is small and the incidence of rotation is low. On average, 39 percent of all fields cultivated with groundnuts in 1987 had been fallow the previous year. On the other hand 21 percent had been planted continuously with groundnuts instead of rotated with other crops.[10] This also affects yields: the regression analysis shows that groundnut yields are 8.4 percent lower on fields that have not been rotated. On millet fields, fallow periods are rare, and continuous planting is common, particularly in upland villages. These grain fields are usually located close to villages because farmers use the organic manure of herds nearby. The finding of more continuous cropping in upland villages is in line with the results of production functions in which land in upland villages was more important as a production factor and had a higher production elasticity than in the overall sample.

Despite positive price incentives and no apparent direct constraint on land the amount of area cultivated was not extended

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[10] 16 percent in lowland and 24 percent in upland villages.

between 1984 and 1987, which indicates the critical role of labor and capital constraints.

Labor

Agriculture in The Gambia is organized almost exclusively on smallholder farms that rely largely on family or other residents of the compound for labor (for example, strange farmers). No landless labor class supplies hired labor, since access to land is free and average returns to cultivating one's own farm usually exceed wage rates. Thus hired labor is confined to an individual or group of individuals who supplement their own farming activities with work for wages. During peak seasons of planting and weeding, however, this work force is not easily mobilized. Thus hiring labor, except for rice cultivation, is rare. In 1985 only 8.3 percent of all work was performed by hired labor; in 1987 this figure was reduced even further to 4.8 percent.

The share of female labor varies markedly by village location and farming system: in lowland villages women provide about 39.7 percent of family labor, while in upland villages they provide only 26.7 percent. This distinction also characterizes female involvement in different crops: rice, an important crop in lowland villages, has a high share of female labor, while coarse grains and groundnuts--most prevalent in upland villages--have less. In general, household chores reduce the time women have for working in agriculture, particularly in upland villages, where they process the grains, a tedious and time-consuming task.

In 1985 the average household (*sinkiro*) of 11.6 persons in the survey area had a work force of 4.61 members.[11] The size of a household's work force has a significant impact on its farm production: a cross-sectional comparison between farms shows that a 10 percent increase in the number of farm workers raises production 7.6 percent and farm size 7.0 percent.[12] In upland villages, where opportunities for alternative employment are rarer than in lowland villages, production increases as much as 8.9 percent. The increase affects groundnuts and rice more than coarse grains.

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[11]For information on the concept of household in Gambian compound, see von Braun, Puetz, and Webb (1989). The resident work force of a farm was determined by weighting all adult men and women (between 15 and 60 years of age) in a household according to their average share of labor input in 1985 and 1987. Children between 10 and 14 years of age were counted as one quarter of an adult.

[12]For details of a related analysis, see von Braun, Puetz, and Webb (1989).

As a result of the ERP and the change of relative prices and wages to favor agriculture over other sectors, additional labor moved into agriculture. After natural population growth is taken into account, the average size of farm households rose about 5 percent between 1985 and 1987. This net immigration is more pronounced in upland than in lowland villages (an increase of 6.5 and 3.9 percent, respectively). At the extreme, the village of Njoben, with highly favorable conditions for groundnut production, had a net growth rate of 10.1 percent, while the labor force in Pacharr, most affected by the disturbances in the Jahally-Pacharr project, actually shrank 0.9 percent. The overall intertemporal increase in the work force in 1987 did not, however, translate into increased labor in farming. The number of days worked in agriculture per farm actually declined in 1987 compared with 1985 (see Table 17). Large increases in groundnuts could not compensate the decrease in other crops, particularly rice. Thus the potential of an enlarged work force to increase production was not realized. Capital scarcity was certainly a key factor, and labor was apparently pushed out of the contracting urban economy rather than pulled into the rural sector.

Table 17--Wet season labor input per farm

	All Villages		Lowland		Upland	
	1985	1987	1985	1987	1985	1987
	(person days worked/farm)					
All crops	556	450	505	337	624	602
Rice	225	90	303	134	121	32
Coarse grains	131	96	81	54	199	152
Groundnuts	175	264	100	149	275	418

Note: Includes hired labor.

Capital

Labor, not land, constrains increased production in The Gambia. Therefore, the key to higher production lies in increasing labor productivity by improving technologies and using capital more intensively. So far the ERP has had only limited success in adding to accumulated capital and improving the use of purchased production inputs in agriculture.

Between 1985 and 1987, farmers did invest in draught animals: on average, they increased their stock 18 percent; in upland villages they increased even more. The stock of machinery, however, stagnated for the most part, and machine purchases actually declined in 1986/87

compared with the period from 1982 to 1985 (see Figure 8). Credit restrictions on buying new machines as well as the limited availability and quality of second-hand implements were major constraints. Marketing problems and credit availability also led to a 54 percent decline in the use of fertilizer, the major production input bought by the survey households, between 1984 and 1987.

The following section identifies three major areas for technological change in Gambian agriculture.

FARM IMPLEMENTS FOR UPLAND CROPS

The productivity of incremental capital in Gambian agriculture is quite high. This is the case even though most farmers in The Gambia have access to machines (like ploughs, seeders, multiple purpose cultivators) and draught animals (donkeys, horses, or oxen), either inside or outside their own compound: 80.3 percent of groundnuts and 86.9 percent of millet fields are mechanically treated at least twice during the growing season. Production functions show, for instance, that using weeders may increase yields per hectare as much as 19 percent.

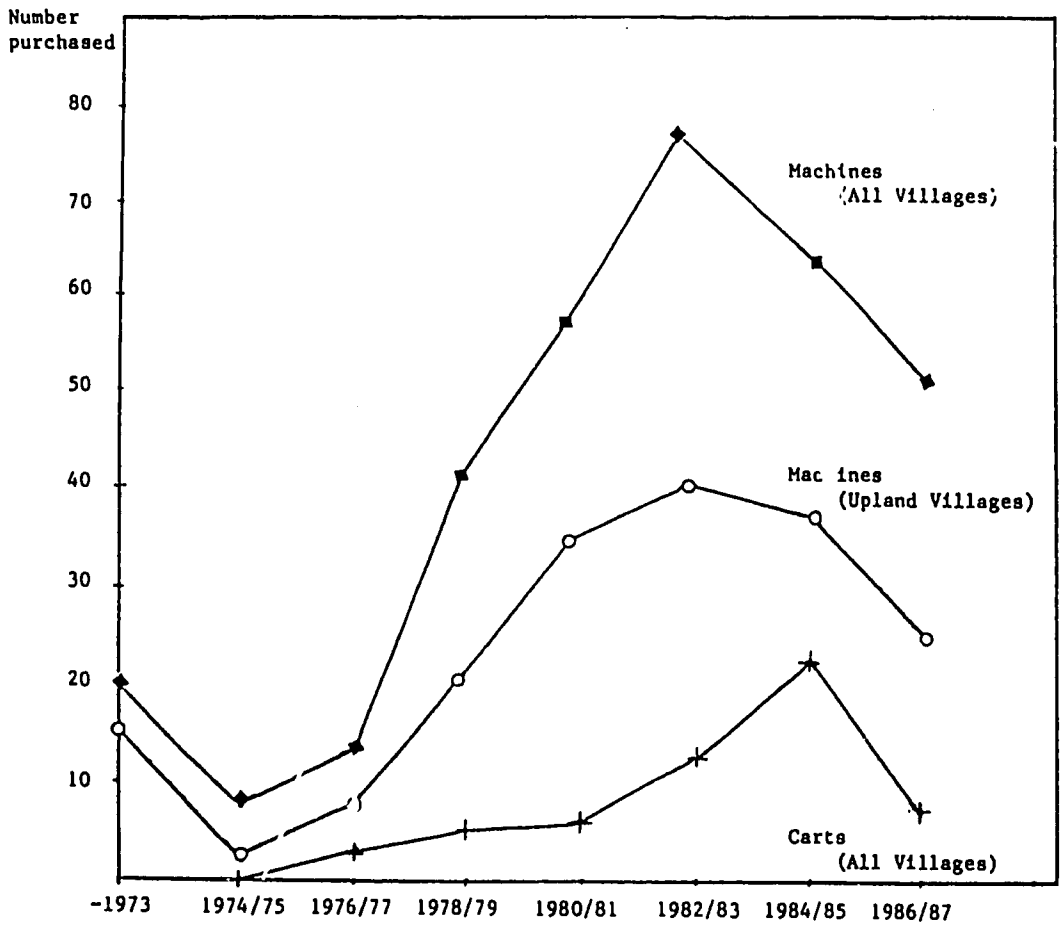
Farmers frequently borrow or rent implements for their own fields: thus 73.4 percent of seeders and 86.4 percent of weeders on groundnut fields are borrowed or rented. These sharing arrangements--however useful they are--do not make the best use of the potential of animal-drawn implements in The Gambia. Sharing often delays the execution of a task (and thereby produces yield losses) and creates plot sizes smaller than those that would be cultivated if more implements were available.

Women are a prominent example of how these technologies are underused, which contributes to the relatively low productivity of female labor. Women own less than 1 percent of all machines, and their use rates are lower than men's, particularly in weeding (72.2 and 82.3 percent, respectively, in 1987).

A comparison (see Table 18) of upland farms with different levels of machine and draft animal ownership shows that the area cultivated per farmer is 79 percent higher in the best-equipped farms than in the least. Machines are commonly associated with extended growing areas, but they also produce higher yields per hectare. In groundnuts, farms with machinery produce 1.6 tons per hectare, whereas farms without machines produce 1.2. The difference is that machines allow early planting, timely execution of tasks, and improved overall weed management.

Machines also play an important role in breaking labor bottlenecks, particularly in the planting and weeding seasons, which usually constrain the area managed per farmer. Thereby they increase overall

Figure 8--Implement stock in use in 1988, by year of purchase



Source: IFPRI-PPMU survey 1987/88.

Note: The acquisition of implements over time indicates the net and replacement investment in implements currently in use.

Table 18--Mechanization level and farm characteristics in upland villages

Mechanization Level[a]	Farm Size	Work Force[b]	Farm Size/ Worker	Frequency of Machine Use/Field	Ground-nut Yield	Wet Season Crop Income Per Worker	Wet Season Crop Income Per Labor Day
	(hect-are)	(num-ber)	(hect-are)	(num-ber)	(kilograms/ hectare)	(Dalasi)	
Least equipped (25 percent of farms)	3.11	3.40	0.91	1.85	1,224	1,112	8.24
Lower medium	4.89	4.46	1.10	2.35	1,415	1,552	11.67
Upper medium	5.94	4.20	1.41	2.40	1,588	2,099	15.67
Best equipped (25 percent of farms)	7.30	4.49	1.63	2.41	1,597	2,606	17.03

Source: IFPRI/PPMU survey, 1987/88.

[a] By quartiles of machine and draft animal capital per farm worker.
[b] In labor units: men = 1; women = 0.41.

labor input and income per farm worker. While labor input per hectare decreases from 132 days in the farms with the least equipment to 103 days per hectare in those with the most (the labor saving effect), the overall input of farm labor increases more than 30 percent because of increased area: from 123 days to 168 days per worker per season (the labor-augmenting effect) (see Figure 9). Thus implements create employment by smoothing out labor demand across the season and allowing more work in off-peak seasons (see Figure 10). The result is an increase in income, which rises as much as 134 percent from the bottom fourth to the top fourth of farms, grouped by the availability of implements.

Investment in machines and draught animals should go hand in hand. Doubling the stock of machines and draught animals increases the area cultivated 51 percent; draught animals account for 39 percent of the increase, and machines 12 percent. Presently, money spent on draft animals has a bigger impact on production than money spent on machines. This supports the observation that farmers invested more in draught animals than in new machinery between 1985 and 1987.

Figure 9--Agricultural labor use in upland villages, by level of mechanization

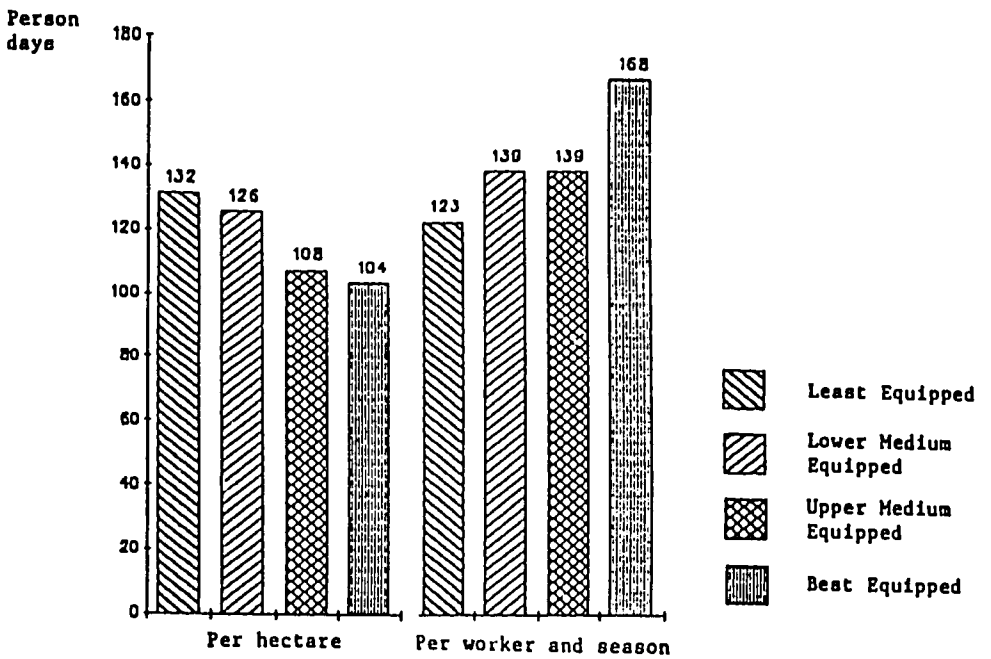
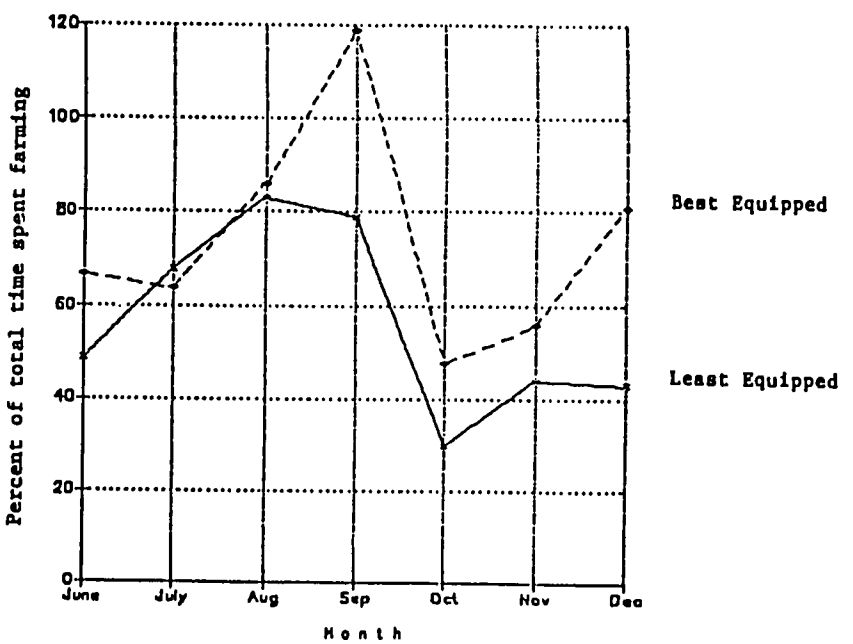


Figure 10--Monthly labor use in upland villages, by level of mechanization



TECHNOLOGIES FOR RICE

Agricultural development programs often focus on rice, for good reasons: the irrigation-seed-fertilizer technology is well known; rice is the main marketed cereal, and the import substitution effect is favorable for foreign exchange; and fertile lowland soils are waiting to be used. Key issues in choosing the appropriate technology for growing rice include the following:

- The cost of rice production under various technologies and their sustainability,
- The competition of rice and upland crops for scarce labor in the wet season, and
- The *distributional effects* of alternative policies, especially their implications for women farmers.

Various technologies produce rice, which are categorized roughly as traditional swamp rice; partly water-controlled, improved swamp rice; and fully water-controlled, double-cropped irrigated rice. In 1985, production costs in the Jahally-Pacharr project and surrounding areas--at shadow prices of inputs, including the recovery of investment costs and family labor input--were roughly $323 per ton of milled rice in fully water-controlled rice, $411 in partly water-controlled rice, and $256 in the off-project traditional swamp rice (see Table 19). These figures, compared with $288 per ton for imported rice (5 percent broken), call for lower-cost schemes to improve swamp rice, particularly since production costs were even higher in 1987, when the project was unable to sustain yields.

Swamp Rice Development for Women Farmers

The main constraints on improving labor productivity in traditional swamp rice, where women are in charge of 91 percent of the plots, are ploughing the heavy lowland soils, gaining access to the swamps, and managing the water and soil (salinity problems, for example). Policy should promote ploughing services--either tractors or oxen, but preferably decentralized and privately owned--and the development and distribution of appropriate varieties of seed. Micromanagement is required for improving area-specific infrastructure, mainly access and water control.

As a technically more advanced option of improving traditional swamp rice, partly water-controlled rice technology (with larger structural investments in, for example, gravity irrigation, land leveling) should be given more attention. This is still a more secure means of producing cereals than the technology for growing traditional swamp rice or that used in rainfed upland farms. For households in the lowlands, it is also important for diversification and beneficial

Table 19--Costs of producing clean rice, 1985

Costs	Fully Water-Controlled Rice[a]	Partly Water-Controlled Rice[b]	Traditional Rice
		(Dalasi)	
Costs per hectare			
Annual investment cost (10 percent interest, over 30 years)[c]	5,370	1,497	...
Annual operational costs (land preparation, water)	1,785	432	...
Other variable production costs[d]	1,860	527	160
Opportunity cost of unpaid (family) labor[e]	1,427	756	718
Milling, transport, and handling costs[f]	937	286	121
Rice yield per hectare (in tons of clean rice, dry and wet season, 1985)[g]	6.96	1.68	0.772
Costs per ton			
Total costs (in Dalasi)	1,635	2,082	1,297
Total costs (in U.S. dollars)[h]	323	411	256
Total costs, excluding investment costs (U.S. dollars)	171	235	256

[a] Jahally-Pacharr (pump-irrigated, double-cropped, dry and wet season).

[b] Jahally-Pacharr (tidal irrigated, rainfed, wet season 1985).

[c] Total investment costs are based on appraisal report figures; they exclude monitoring and evaluation, social services, and personnel (personnel costs, including expatriates, accounted for US$3.2 million in the initial four years of the project); the cost of pumps and related structures are assumed to amount to US$1.3 million for fully water-controlled rice; other investment costs are distributed proportionately per hectare across fully and partly water-controlled fields; the same land development costs per hectare are assumed in fully and partly water-controlled fields (pumps excluded).

[d] Including fertilizer, seed, hired labor, and interest on working capital.

[e] For both fully and partly water-controlled rice in the wet season, Dalasi 3.5 per person per day; in the dry season, Dalasi 1.5 per person per day; for traditional rice in the wet season, Dalasi 3.5 per person per day.

[f] These costs are assumed to be 10 percent of the value of total output.

[g] For fully water-controlled rice, the wet season yield is 5.2 tons per hectare for unhusked rice (paddy); the dry season yield is 6.4 tons per hectare; for partly water-controlled rice, the wet season yieldis 2.8 tons per hectare for unhusked rice (paddy); the milling ratio is 60 percent.

[h] US$1.00 = Dalasi 5.06 at the 1985 parallel exchange rate.

for women, who are more involved in this technology than in producing fully water-controlled rice (77 percent and 10 percent, respectively, of the fields are cultivated by women). Development of this technology is only justified, however, when production costs (and especially investment costs) can be drastically reduced and yield levels sustained. This was not the case in the Jahally-Pacharr project where average yields fluctuated between 2.86 tons per hectare in 1985 and 0.94 in 1987 (see Figure 11).

Double Cropping to Improve Food Security

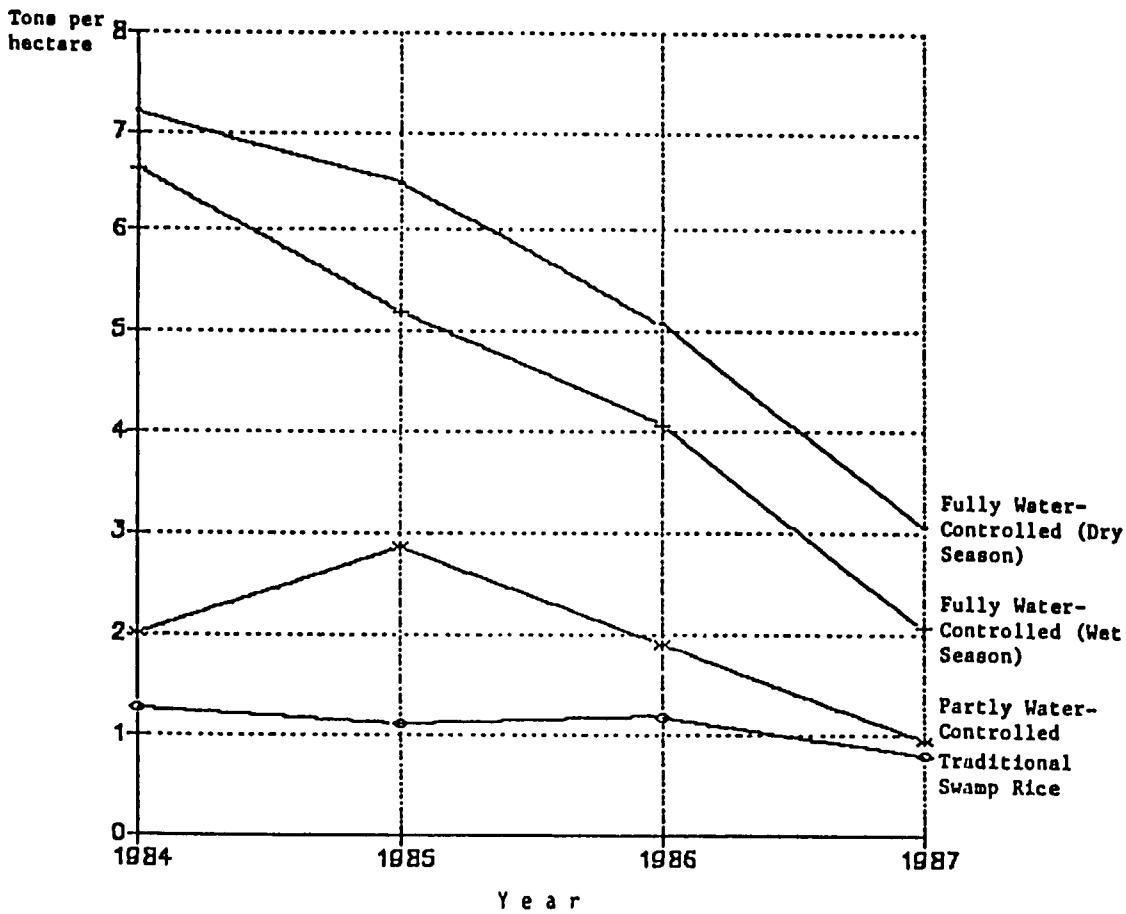
Although fully water-controlled, double-cropped irrigated rice is limited because of water constraints during the dry season, its potential should not be neglected, given the highly favorable impact of the dry season harvest on smoothing out the seasonality in income, food availability, and nutritional status at the household level. Figures from the Jahally Pacharr project area show that women with the most access to the project had the lowest weight losses in the rainy season (1.1 kilograms versus 2.9 kilograms for those with the least access).

Sustaining irrigated rice schemes--and double-cropping in particular--was difficult in the past. Also, the Jahally-Pacharr project had serious problems maintaining its double cropping schedule in 1987: in the wet season, slightly more than 50 percent of the potential irrigated area was cultivated and yield levels dropped to 2 tons per hectare (compared with 5.2 in 1985 and 4.07 in 1986). Fluctuating yields in irrigation schemes are not necessarily failures. In general, a major impediment to sustained double cropping and even to overall rice cultivation in the wet season is the year-to-year change of opportunity costs of labor that are mostly the result of rainfall-induced fluctuations in the productivity of competing crops (coarse grains, swamp rice, and groundnuts). Thus, in the 1985 wet season, every ton of paddy incrementally produced in the Jahally-Pacharr scheme produced a combined reduction of 201 kilograms of upland production, 110 kilograms of traditional rice, and 241 kilograms of groundnuts. Moreover, a substantial number of farmers attain higher labor productivity in upland crops than in rice. For instance in 1985, 23 percent of farmers with upland cereals and 17 percent of those with groundnuts exceeded the average return to labor in fully water-controlled rice. Thus two main alternatives exist for irrigation policy:

1. Setting up small schemes, mainly focused on household- and village-level food security, that provide a convenient dry season crop and some drought insurance in the wet season, but that do not necessarily focus on stable high use intensity, and

2. Developing a class of specialized rice farmers who can master the management difficulties of sustained double cropping. In this

Figure 11--Yield fluctuations in rice, 1984-87



option, however, no distributional objective justifies subsidies for rice production.

IMPROVING INPUT USE: FERTILIZER, SEEDS, AND CROP PROTECTION

These three areas for technological improvement--fertilizers, seeds, and crop protection--are not alternative, but complementary, elements of a strategy for vitalized growth in agriculture. They all require increased attention from public policymakers.

The marginal productivity of fertilizer in upland crops is high: results from production functions reveal that under the most conservative assumptions and model specifications in 1987, one additional kilogram of fertilizer would have yielded about 2.66 kilograms of groundnuts and 2.7 kilograms of millet at current mean values of fertilizer use. Similar figures estimated for 1985 and 1984 indicate the stability of output response to fertilizer. Even in 1984, the

year of a local drought, additional output per kilogram of fertilizer was above 2.5 kilograms for groundnuts, which suggests that fertilizer improves drought resistance. Value cost ratios--that is, the marginal value of produce from one additional Dalasi spent on fertilizer--range between 3.5 and 5.5 given current input and output prices. Almost all the ratios are also above 2 when subsidies are removed. Alternative model specifications show that marginal output may be as high as 4.2 kilograms for groundnuts and 2.9 kilograms for coarse grains in average years and may be even higher in years with a good harvest. For the same area a study by Mills, Kabay, and Boughton (1988) finds a marginal productivity of about 3.5 kilograms of groundnuts per kilogram of fertilizer (single super phosphate).

Gambian farmers use fertilizer on all crops, both cash and food. Figure 12 shows fertilizer shares by crop for 1984 and 1987. A remarkably high portion, on average more than 60 percent, is used on cereals. For upland crops, coarse grains use about 38 percent of all fertilizer and they used even more in 1987, when fertilizer was scarce (Table 20). Even so, fertilizer use per hectare is far below the recommended levels (in 1987 upland cereals and groundnuts used less than 20 percent of the recommended 200 kilograms per hectare) and has dropped significantly since 1984. The exception is the rice project, where fertilizer is more available and accessible.

High seed prices combined with restricted and failed distribution by the Cooperative decreased the use of groundnut seeds from 184 kilograms per hectare in 1984 to 141 kilograms hectare in 1987. This decrease reduced the potential yield levels by lowering plant densities.

Constraints on crop protection caused serious problems in coarse grain production in 1987 (average yields in millet declined from 1.1 tons per hectare in 1985 to 0.8 in 1987). Much of this decline was due to an infestation of blister beetles and other insects.

Figure 12--Average share of fertilizer, by crop, 1984, 1985, and 1987

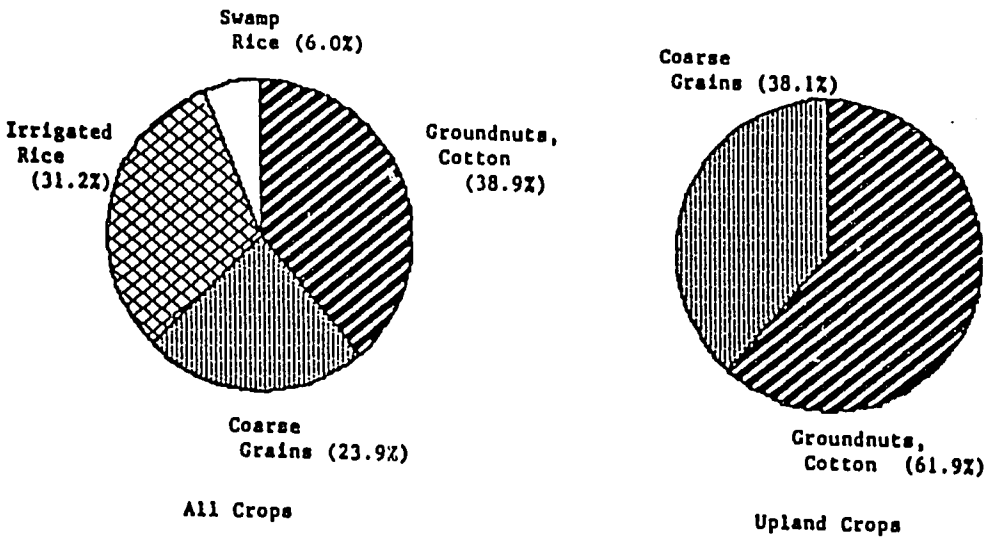


Table 20--Fertilizer use, 1984, 1987

Crop Grown	Share by Crop: Including Rice 1984	Including Rice 1987	Excluding Rice 1984	Excluding Rice 1987	Use Intensity 1984	Use Intensity 1987
	(percent of total)				(kilograms/ hectare)	
Groundnuts, cotton	46.6	34.0	63.1	53.8	90	38
Coarse grains	27.2	29.2	36.9	46.2	52	36
Irrigated rice	21.7	28.2	...	...	271	324
Swamp rice[a]	4.5	8.6	...	...	69	72

Source: IFPRI/PPMU surveys, 1985/86 and 1987/88.

[a] Traditional and improved.

6. ATTEMPTS AT MARKET DEREGULATION AND INSTITUTIONAL CONSTRAINTS

Detlev Puetz
Joachim von Braun

In the past four years, The Gambia has tried to develop and stimulate the private sector to take over agricultural input and output marketing. This usually takes time and creates friction, at least in the transitional period, when the government gradually reduces its intervention, but continues to influence unofficial markets substantially. The evolution of private markets remains closely interrelated with the activities of the official markets.

In The Gambia the prominent cases of continued government intervention in the initial stages of liberalization are the regulated groundnut market and the liberalized, but state-influenced fertilizer market. Official credit has been restricted, adding to the problems of the input markets. This chapter sheds light on the effects of this change in market organization on farmers in the groundnut, fertilizer, and credit markets. In the context of this assessment the distributional effects of the policy changes are of particular interest.

GROUNDNUTS ON THE PARALLEL MARKET

A parallel market is a structure generated in response to government interventions that create excess supply or demand in a particular product or factor market (Lindauer 1989). By imposing price and market controls and indirectly taxing the country's major agricultural export commodity (groundnuts), the Gambian government generated a surplus supply of groundnuts at a tax-exclusive price. As a result, a parallel market for groundnuts arose to avoid these controls.

During the mid-1980s both The Gambia and Senegal embarked on structural adjustment programs that included large price increases for groundnuts. The goal was to improve the terms of trade for the agricultural sector. In both countries, however, this policy raised domestic prices above the world market level (the nominal protection rate, the ratio of domestic to world market prices, was close to 2 in 1986/87). Subsidies were needed--and partly provided by international donors--to facilitate the export of groundnuts. Since 1984/85, the Gambian groundnut price has been between 73 and 84 percent of the

Senegalese price (see Table 21). There has always been an outflow of groundnuts from The Gambia, especially from the villages close to the border, but very favorable price differentials in 1988 and a purchase ceiling imposed by the Gambian marketing board combined to stimulate the outflow In the 1987/88 season, limited subsidy funds in The Gambia forced the government to decrease its guaranteed prices, thereby increasing the price differential with Senegal. The government was unable, however, to guarantee even the reduced price for the country's total groundnut output; its purchasing ceiling covered only two-thirds of the estimated marketing volume for the year. Because groundnuts sold to the parallel Senegalese market saved The Gambia from paying export subsidies, the government did not attempt to prevent smuggling or to enforce sales to the cooperative.

Table 21--Groundnut price ratio in The Gambia and Senegal and fertilizer subsidy and use, 1981/82-1987/88

Year	Price Ratio of Groundnuts The Gambia/Senegal	Fertilizer Subsidy per Unit
	(percent)	
1981/82	102.0	72.0
1982/83	108.0	77.0
1983/84	94.0a	63.0
1984/85	79.0b	31.0
1985/86	82.0	22.0
1986/87	84.0	26.0
1987/88	73.0	17.0

Source: Computed from various unpublished sources of the Ministry of Agriculture and The Gambian Cooperative Union.

[a] Fell to 75 percent when the local currency was devalued during the trading season.
[b] After price increases in The Gambia during the trading season.

The Gambian Cooperative Union (GCU), on the other hand, had a vested interest in official market sales because its marketing allowance increases with the volume marketed. The GCU also needed to recover input loans from farmers, which is easier when groundnuts are sold to the cooperative. Thus the GCU pressured farmers to market through the official channel.

A semilegal parallel market evolved, where parallel structures were tolerated on the Gambian side and attempts were made to safeguard the procurement system on the Senegalese side. The Senegalese govern-

ment in 1987/88 tried to discourage Gambian sales by ordering stores along the border to close, demanding Senegalese identification documents from groundnut sellers, and increasing its border controls. But the border is long, and during the course of the trading season most of these measures could not be fully enforced or were offset by bribes. Moreover, Senegalese groundnut-buying agents had an incentive to purchase Gambian nuts since their allowances also depend on the volume of groundnuts purchased.

Participation in the parallel market was highest in the upland villages, which added to the already unequal distribution of income--upland villages generally have more income than lowland ones. As Figure 13 shows, participation in the parallel market is significantly lower for the poorer income groups.

The following regression analysis assesses the factors that determine the share of groundnuts sold by individual farmers on the parallel market (see Table 22). Villagers close to the border sell a much larger share of their groundnuts on the parallel Senegalese market (64 percent more) than in nonborder towns. Their transaction costs are lower because transportation costs are comparatively low. Another reason is that family relations in Senegalese villages help them get access to information about Senegalese market conditions and risks and directly improve market access in this closely knit society. Farmers who received credit from The Gambian Cooperative sell 11 percent more on the official market. This underlines the importance of maintaining a close business relationship with the cooperative. Many of these farmers actually split their sales between the official and parallel markets.

The advantage of early selling is crucial for migrant farmers, who often return to their home village after selling their crop. By doing so, they avoid the risk of losing their main source of annual income--the sale of groundnuts--in an illegal transaction. The same applies to farmers who produce low cereal yields and urgently need money for food. They cannot afford to embark on the more risky and time-consuming border trade. Thus cash constraints and imperfect credit markets raise the supply of groundnuts for the official market. On the other hand, women farmers trade more in parallel markets; women, especially from the Wolof community, actively trade food and commodities within and among villages.

Taking these factors into account, the analysis also shows that a farmer's volume of groundnut output does not play a significant role in his or her participation on the parallel market. This suggests that there are no diseconomies of scale and that the marginal costs of marketing on the illegal market do not rise with volume.

Figure 13--Groundnuts sold on the parallel market, by income group, 1987/88

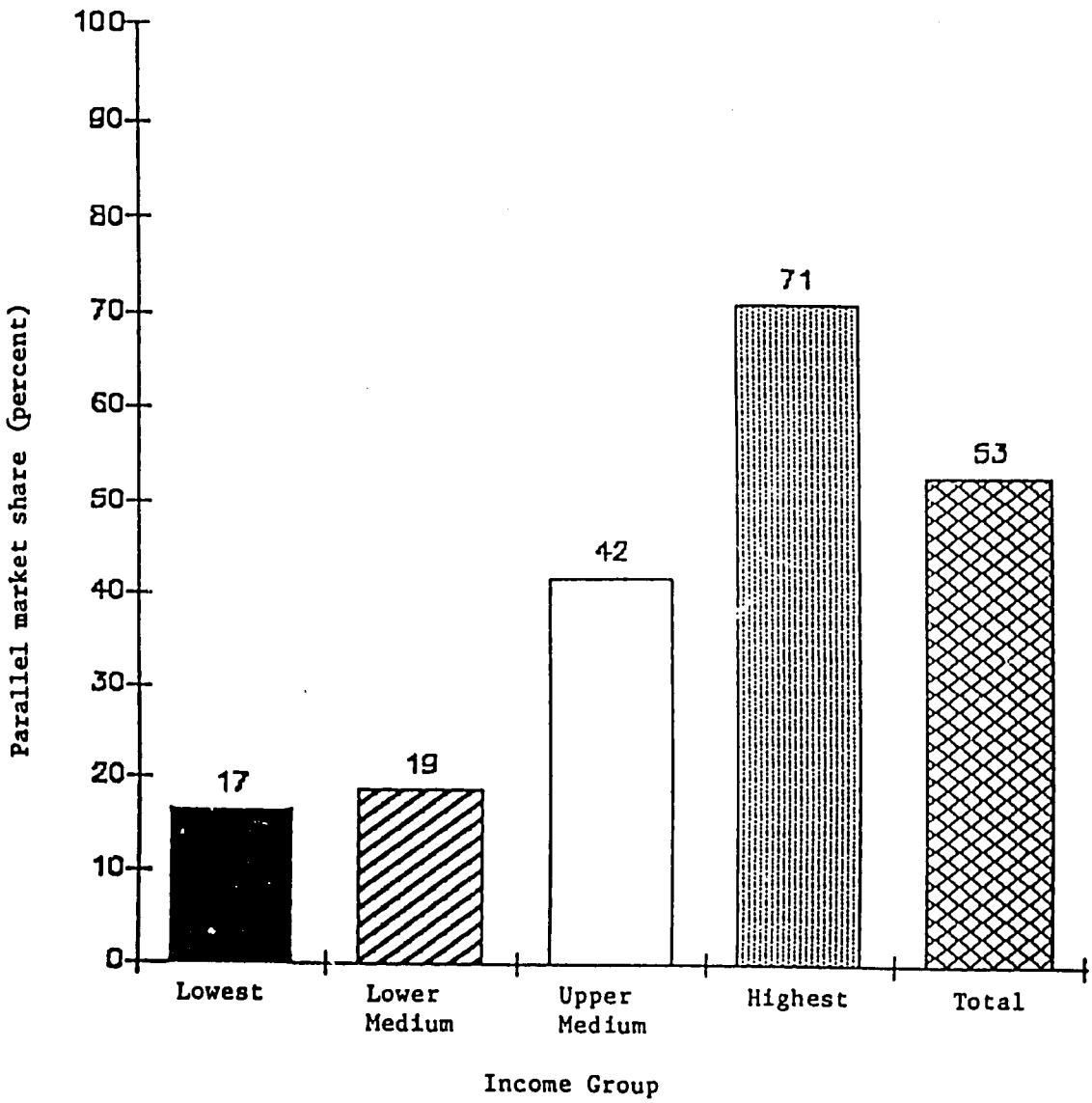


Table 22--Determinants of groundnut share sold on the parallel market

Dependent variable: share of groundnuts sold on the parallel market by an individual farmer

Independent Variable	Parameter	
GNSOLDKG	+1.174E-05	(0.70)
BORDER	+0.635	(20.35)
FEMALE	+0.064	(1.97)
MIGRANTW	-0.175	(-3.66)
COOPCRED	-0.109	(-2.43)
(Constant)	0.224	
R^2	0.409	
Degrees of freedom	712	
F-value	100.06	

Note: Numbers in parentheses are t-statistics.

List of variables:

GNSOLDKG = total groundnuts sold, in kilograms;
BORDER = dummy = 1, for villages close to the border;
FEMALE = male = 0; female = 1;
MIGRANTW = dummy = 1, if groundnut seller is a migrant worker;
COOPCRED = dummy = 1, if the farmer received credit from the Gambian cooperative during the same cropping season.

FERTILIZER: A MARKET SHUNNED BY THE PRIVATE SECTOR

Between 1984 and 1987 fertilizer use in The Gambia declined by nearly two-thirds. Although some of this decline can be attributed to lower demand in response to sharp nominal price increases (for figures on subsidy removal, see Table 21), most results from delivery failures, the restrictive distribution policy of the official fertilizer retail system, and failure to involve private marketing at large.

First, in 1985 a national fertilizer crisis developed when an international donor provided The Gambia with a fertilizer grant, and the institutional responsibility for the logistics of fertilizer marketing changed. This disrupted supply since fertilizer shipments did not arrive in time and carryover stocks had to be used for the 1985/86 cropping season. The result was a substantial loss of production (von Braun and Puetz 1987). In this situation of limited short-term supply, farmers had to compete for scarce fertilizer on the parallel market. Although unauthorized fertilizer trading was illegal

at that time, there was little enforcement to discourage trading of small quantities.

Second, more disruptions and uncertainty followed when fertilizer markets were officially deregulated in 1986/87. The official marketing system was maintained, however, and until now, private traders have declined to take part in the retail trade of fertilizer. On the other hand, government and GCU policies restricted the supply of fertilizer available to the cooperative's primary societies even though the government stores had an ample supply. As a matter of policy, annual allotments to each of GCU's 85 primary societies are based on its sales the year before and adjusted downward by the amount of outstanding loans of each society. Until 1985 GCU had provided loans under generous interest and repayment conditions. Individuals who defaulted on a loan did not lose access to new loans as long as their primary cooperative society maintained a certain collective repayment rate. This policy changed with the structural adjustment program and beginning in 1986, individuals who defaulted were strictly excluded from obtaining further loans. The new credit policy also limited input loans to the amount an individual farmer had received the previous year; thus only cooperative members who actually received credit the year before were eligible for new credit.

Tightening access to credit had an adverse effect on the overall use of inputs because GCU did not put out special contingencies for cash sales. Thus in 1987 GCU purchased only 3,000 tons of fertilizer in public auction. Fertilizer shortages and excess demand continued to affect the fertilizer market. At the local level a parallel market existed for fertilizer, which was limited in size because private traders--operating interregionally--were not involved.

The decline in overall fertilizer consumption affected the poorer income groups disproportionately. The development of fertilizer use in upland crops from 1984 to 1987 (see Table 23) followed this trend:

Table 23--Fertilizer use for upland crops (coarse grains, groundnuts), by income group, 1984, 1985, and 1987

Year	Consumption	Share by Income Quartiles			
		Lowest	Lower Medium	Upper Medium	Highest
	(1984 = 100)	(percent)			
1984	100	17	20	24	39
1985	41	15	20	24	41
1987	46	10	15	32	43

Source: IFPRI/PPMU survey, 1985/86 and 1987/88.

while overall fertilizer use declined more than 50 percent during that period, the share of low-income groups in total fertilizer consumption also fell continuously. In 1984, the two lowest income groups consumed 37 percent of all fertilizer; in 1987 this figure had declined to only 25 percent.

Some of this decline was a consequence of limited access to credit. Cash purchases of fertilizer are lowest in the poorest groups: 44 percent compared with 57 percent in the richest. Since poor farmers need credit more than rich farmers, reductions in the availability of credit have a higher impact on the poor.

CREDIT MARKET: SUPPLY AND DEMAND IMBALANCES

Various factors limit the supply of agricultural credit on local markets. In an environment with high production risks (drought and pests) lenders who cannot spread their risks over large areas are reluctant to mobilize capital. The same lenders also face problems charging interest in relationships that are often highly personal, and in a society with a strong Islamic influence. The lack of collateral and the high opportunity costs for using capital are additional constraints.

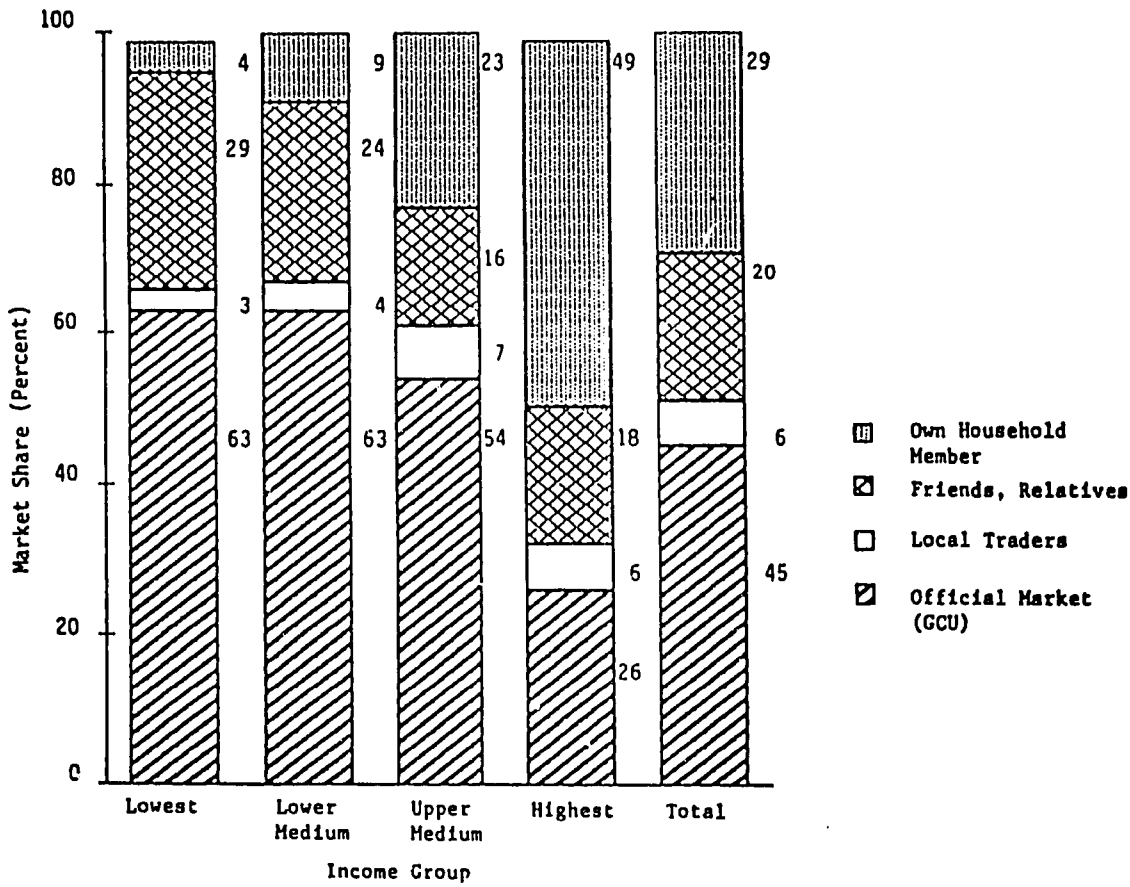
Where the private (informal) sector is unable or unwilling to provide more credit, and many farmers limit their cash outlays because of their low income and risk aversity, a comprehensive government credit policy may provide the only relief for farmers. Such a policy should encourage loan repayment by providing long-term loan perspectives and assigning responsibility for repayment to small groups.

Capital has a high marginal productivity in Gambian agriculture: the IFPRI-PPMU survey results estimate that one additional Dalasi spent in crop production increases output 2.67 Dalasi (see Chapter 5). Thus farmers are willing to pay high interest for credit. For instance, the informal seasonal credit market charges farmers 85.8 percent per year for credit to buy agricultural inputs. In 1987, 46 percent of all seasonal credit was for agricultural purposes.

In the survey area, the official market (GCU) supplied about 45 percent of the credit for agricultural inputs--mostly fertilizer and groundnut seed--in 1987. Friends and family members provided 49 percent. Local traders contributed only 6 percent (see Figure 14).

Even though the bottom half of the households receive only 30 percent of all the agricultural loans extended, their share of agricultural loans is higher than their share of the total crop income (22 percent). They obtain most of these loans on the official market: 63 percent of the agricultural credit extended to the poor is provided by the cooperative, which provides only 40 percent for the top income groups.

Figure 14--Participation in the official and informal agricultural credit markets, by income group, 1987/88



Although the total demand for inputs is constrained by the lack of credit facilities, farmers *do* pay cash for inputs (see Table 24): 51 percent of the fertilizer, 21 percent of the groundnut seeds, and 86 percent of the machines that are bought are paid for with cash.

Table 24--The source of inputs

Source	Groundnut seeds 1987	Machines 1974-87	Fertilizer 1987
		(percent)	
Own production	64	...	...
Cash	7	86	51
Loan	18	9	41
Other	9	5	8

Source: IFPRI/PPMU survey, 1985/86 and 1987/88.

POLICY CONCLUSIONS

The major challenge in the coming years will be to determine the proper role of public sector policies in market interventions. Sustained public interventions and investments are appropriate and necessary in the following cases:

- Where private benefits are not directly capturable, such as in major infrastructure investments, emergency supplies, research and agricultural extension;

- Where private investments are slow to take off, and the public sector can serve as a catalyst for private initiatives (by, for example, taking over wholesale and import/export functions in supplying agricultural inputs or promoting the creation of viable rural financial institutions);

- Where the public sector has to provide *fall-back institutions* in case private initiatives fail to develop immediately (these are particularly important to avoid destabilizing signals, such as a broken-down fertilizer market during the transition period); and

- Where the government must assume a *supervisory function* to assure that developing private markets are competitive, that monopolistic practices like overpricing, speculation, or hoarding are avoided, and that private markets for crucial inputs and outputs actually develop.

A strategy of gradual privatization is needed in which public and private enterprises and initiatives can and should coexist. Public services should not be dismantled without being replaced by private services, nor should liberalization approaches be halfhearted and partial (such as keeping key markets under public control and maintaining subsidized public institutions; see Kinteh's discussion of these issues in Chapter 1).

In pursuing a strategy of stimulating private initiative, a major priority is to abolish *unilateral subsidies* and the preferential status of public and parastatal institutions that make private enterprises uncompetitive (the best example in The Gambia is the GCU and its large institutional subsidies). Policy coordination is also needed to prevent continued destabilizing interventions, which have characterized the fertilizer market in the past. Volatile interventions and subsidies for parastatals are constraints on private sector involvement.

7. POLICY ISSUES AND OPTIONS FOR AGRICULTURAL DEVELOPMENT IN THE GAMBIA

Ken B. Johm

In 1986, The Gambia adopted a comprehensive economic recovery program to arrest the country's worsening economic climate, which was characterized by declining foreign exchange reserves and a huge balance of payments deficit. General evaluations of the pre- and post-ERP agricultural policies show a mixed outcome (see Chapter 1). Since agriculture is the single most important sector of the economy, stimulating agricultural growth was a key goal of the economic reforms. The new agricultural policies were aimed at:

- Increasing rainfed agricultural production;
- Diversifying the crop mix;
- Increasing foreign exchange earnings from groundnut production;
- Promoting irrigated agriculture;
- Reducing the public sector involvement in commercial activities; and
- Reversing the decline in soil fertility.

These objectives were to be realized through a number of actions:

- Aligning groundnut producer prices with world market prices;
- Liberalizing the fertilizer distribution system;
- Decentralizing the multiplication and distribution of seeds;
- Decontrolling the price of imported rice and liberalizing rice imports;
- Improving the operational efficiency of the state marketing board (GPMB);
- Revamping the agricultural credit system;
- Strengthening the agricultural extension service; and
- Reorganizing the Ministry of Agriculture.

These policies were put in place to varying degrees and yielded mixed results. The objective of this chapter is to provide a broad overview of the continuing constraints on agricultural modernization and to present an outline of the available policy options.

One of the most successful of these agricultural policies was decontrolling the price of rice and liberalizing the import market for rice. Contrary to the fears of spiraling retail prices for imported rice, prices have generally been stable following some major short-term fluctuations. This policy achieved competitiveness and fair prices in the medium term. Because it was oriented to consumers and involved private sector agents already involved in the rice trade, this approach cannot be easily applied to the domestic markets for agricultural inputs and outputs.

The problem that continues to bedevil policymakers is how to privatize the agricultural input markets in general, and the fertilizer market in particular. Repeated attempts to tackle this problem have not yielded much response from the private sector. The reasons for this can be summarized as follows:

- Price volatility;
- Seasonality of demand;
- Absence of adequate infrastructure available to the private sector; and
- Relative inexperience of the private sector in this market.

In the light of increasing fertilizer prices and declining usage, resolving this problem is all the more urgent. Aggregate fertilizer consumption slumped nearly 70 percent in the 1984-87 period.

Policymakers continue to grapple with how to manage price policy. This problem is most manifest in groundnut marketing, where the cross-border trade has recently reached high levels. Since 1985, groundnut prices in The Gambia have been higher than those in the world market and have not been in tandem with the movement of world prices, which slumped for oil seeds during most of the 1980s. Producer prices for groundnuts in neighboring Senegal are the most important factor in determining price decisions in The Gambia. The protection rate[13] for groundnut prices in Senegal, even with adjustments for an overvalued currency, was 2.7 in the 1985-87 period. This means that the level of prices was 170 percent higher than that prevailing on the world market. This can be contrasted with a protec-

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[13]The protection rate is the ratio of domestic prices in The Gambia and Senegal valued at shadow exchange rates and world market prices.

tion rate of 0.91 for 1979 to 1981, when producers were taxed an average of 9 percent under the world market price. Price levels in The Gambia were some 20 percent below Senegalese prices during the 1985-87 period, which means that Gambian producer prices for groundnuts were also protected at more than 100 percent over world market prices. This pressure to maintain a degree of price competitiveness with Senegal continues to strain an already stretched government budget.

RECENT TRENDS IN THE AGRICULTURAL SECTOR

In general, the agricultural sector has responded fairly well to the new agricultural policies. Government records show agricultural growth at constant prices in the 1984-87 period to be 6 percent per year (The Gambia, Ministry of Finance and Trade 1989). The movement was positive, although weather conditions, and not public policy alone, played an important role.

Much of the policy initiative was meant to stimulate agricultural production by either increasing the area devoted to agriculture or increasing the yield of major crops. Overall area per farm devoted to crop production in McCarthy Island Division (MID) declined 12 percent from 1984 to 1987, and this decline was more pronounced in the lowland-rice producing areas than in the upland cereal-producing areas. Within this general decline, however, a difference existed among individual crops: the share of total area devoted to upland cereals declined, while that devoted to groundnuts increased. This trend in the mix of crops may be attributed to several factors, of which the most prominent was the trend in producer prices. The ratio of groundnut to coarse grain producer prices has been moving in favor of groundnut production since 1984/85 (see Chapter 4 in this volume). Real groundnut prices have also been increasing. These developments are evident in the volume of production of the principal crops from 1984 to 1987. Overall, groundnut production in all the villages surveyed by IFPRI and PPMU in 1984-87 increased, but the increase was more stable in the upland villages than in the lowland villages. Much of the increases in the lowland areas was due to the high growth of yields from around 0.75 tons per hectare in 1984 to over 1 ton per hectare in 1987. These lowland levels were still below those of the upland areas, which averaged yields of 1.4 tons per hectare.

A further spur to groundnut production was the price differential between the Gambia and Senegal. Since 1983/84 producer prices in Senegal have been consistently higher than in The Gambia, with the difference ranging from 6 to 27 percent.

Farmers were also faced with a number of changes in input prices, which stemmed from a policy of removing subsidies and privatizing marketing functions. Since 1981/82, fertilizer subsidies, for example, have dropped from 72 to 17 percent, which means that farmers

must meet higher costs of production. The nominal price of fertilizer more than doubled since 1984; in real terms, however, this was only an 11 percent increase. Fertilizer consumption at the farm level declined substantially. The use of single-layer phosphates per hectare of groundnuts dropped from an average of 90 kilograms per hectare in 1984 to about 38 in 1987. Such a dramatic decline in fertilizer use does not augur well for increasing farm productivity.

Fertilizer prices were not the only input prices to rise. The nominal price of groundnut seed more than quadrupled in the 1984-87 period; in real terms, the increase was slightly less than double. The price of hired labor also more than tripled in nominal terms and increased about one-third in real terms. The same was true of draft animals. Thus the recent developments in input-output prices mean that farmers are being squeezed between the rapid increase of input prices and the slow growth of output prices; the price of groundnuts actually increased while that of coarse grains and rice declined in real terms.

Returns to labor and land in agriculture changed substantially with the recent adoption of new agricultural policies. Except for groundnuts and cotton, the gross margins per labor day declined for coarse grains and paddy (see von Braun, Puetz, and Webb 1989). This decline was most dramatic (70 percent) in the irrigated rice subsector largely due to declining paddy prices and declining yields. While in 1985/86 the average gross margin per labor day was Dalasi 3.17 for cotton production, this had increased substantially to an average of Dalasi 4.84. The gross margins for groundnuts also increased from 8.64 to 8.99. Conversely, while early millet production in 1985/86 yielded Dalasi 8.98 per person per day, this declined to Dalasi 6.76 in 1987/88. Returns to land were equally divided, with an increase in the gross margins of groundnuts and cotton and declines in those of all other crops. These indicators of income further emphasize the relative attractiveness of groundnut over coarse grain production that followed the new agricultural policies.

PRICE AND MARKETING CONSTRAINTS AND POLICY OPTIONS

Price Policy

The general policy objectives in the area of price policy were to provide incentives to producers and to remove subsidies and distortions in the pricing environment. The results were mixed. In general, farmers, especially farmers who produced cash crops received substantial incentives through hefty price increases. Price distortions continued, however. Cash crops (such as groundnuts and cotton) were protected much more than coarse grains, which reversed the gross margins to be gained from producing groundnuts and cotton rather than coarse grains and rice. The production of exports was enhanced at the

expense of food production; in other words, the gains in exports were at least partly offset by losses due to reduced import substitution. Subsidies were largely removed: the level of fertilizer subsidies fell from 72 to 17 percent from 1981/82 to 17 in 1987/88.

In summary, although the ERP objective of reversing the domestic terms of trade to favor rural areas was achieved in the aggregate, it was not achieved for all producers: groundnut producers gained at the expense of coarse grain producers, and upland producers at the expense of lowland ones. The policy options open to policymakers given the cross-border trade may continue to require a degree of protection (compared with the world market, but not with that of Senegal).

Second, policymakers need to realize that subsidies have played a role in reaching the poorer segments of the farming population. Providing access to inputs for these segments not only is an equity issue, but also permits large gains in productivity.

Third, pricing distortions need to be reduced. The relative price of groundnuts and coarse grains in particular needs to be addressed as a concern for the food security of the country as a whole. Groundnut pricing should consider the cross-commodity as well as the cross-border ratios. In the past, too much emphasis was placed on public management of output pricing; it should be borne in mind that the very real and lasting stimuli to agricultural production are inputs and technological improvements. In the future, policy should be directed to the technical factors that increase productivity.

Marketing Policy

The government has an important role to play in agricultural marketing when private sector involvement is slow to develop or non-existent. Government has a key role in providing infrastructure and disseminating market information. The current impasse in getting the private sector involved in marketing could be alleviated by making credit available and assuring competitiveness in the market place. Furthermore, a growing parallel market already exists for capital, inputs, and outputs in the rural areas. Thus the attempts at privatization should not be restricted to large-scale traders in the urban and periurban areas, but rather be directed to the growing segment of rural entrepreneurs. Given the recent experience of fertilizer marketing and the very different structures of The Gambia's input and output markets, this appears to be the only feasible policy option open to policymakers. The input and output markets are structurally quite different. The conditions (such as a ready consumer market) that make output marketing attractive to the private sector are not the same as those that make input markets unattractive (such as the producers' lack of cash at the critical season when they need to buy inputs).

TECHNOLOGICAL CONSTRAINTS AND POLICY OPTIONS

In the past, much emphasis was placed on increasing yields by improving crop varieties (for example, of maize and rice); little effort put into increasing labor productivity by breaking labor constraints in the peak season. The technologies for mechanizing field preparation and weeding already exist in The Gambia. The major problem lies in getting farmers, particularly women, who are constrained by financial limitations to adopt the technologies. Although the overall usage of most technologies (implements, draft animals, improved seed) is fairly high, the timeliness of operations is still constrained by insufficient supplies of implements, especially draft animals. For example, women often gain access to implements and draft animals later than men, which delays their operations and lowers their productivity. Survey results show that households with technological support work as much as those with none. In fact, the best mechanized producers work 31 percent more than those with no implements or draft animals. Thus, overall rural employment would be enhanced by the adoption of these technologies.

The constraints in paddy production are explored in greater detail by Kinteh and von Braun (1988). The policy options continue to be to lower the costs of production and of establishing projects. Much emphasis needs to be placed on improving the quality and availability of seeds and on stabilizing rice yields.

Fertilizer use is commonplace in both cash and food crops. The major problem continues to be suboptimal usage especially by smaller producers, who could increase their productivity the most. Fertilizer usage is also constrained by the general unavailability of fertilizer at the right times and the financial limitations of small-scale producers. Generally, public sector management of fertilizer distribution has not been able to get fertilizer to farmers when they need it most. Furthermore, optimal levels of usage can best be assured by a well-functioning rural financial market that affords even the small-scale producers access to fertilizer. Finally, public sector pricing of fertilizer is often beset by misinformation or a lack of information about prices. Most often, farmers do not know the prices for fertilizer until just before planting, when their cash revenues are low and they cannot get credit to buy the quantities of fertilizer they need. Production decisions in such an environment are inevitably suboptimal.

One policy option to redress these problems is to adopt credit policies that facilitate the use of implements and draft animals by the plurality of the farming population. Another is to get market information to farmers well before they need inputs. Providing market information is a key function of the public agricultural service sector.

OTHER CONSTRAINTS AND POLICY OPTIONS

Two issues warrant careful examination and discourse: the policy of privatization and the issue of which institutions should serve the agricultural sector.

Privatization and the Public Sector

Since the adoption of policies to liberalize trade and decontrol prices, it has become commonplace to assume a priori the need to "divest government from all functions that can be assumed by the private sector." Although agreeable to many in principle, this assumption has had mixed results. It lacks a clear framework of principles and guidelines for implementation, and it underestimates the time needed for adjustment. For this reason, the following are imperative to keep in mind:

- The scarcity of resources (both material and human);
- The positive, past experience of government services in the agricultural sector;
- The absence of a functioning rural financial market to finance much of the anticipated business activity; and
- The decline of private sector involvement in a number of commercial agricultural activities because of business opportunities outside agriculture.

Given these underlying factors of the local agricultural economic environment, public policy in the agricultural sector should be limited to providing the following:

- Economic incentives and environment for private sector initiative by, for example, removing subsidies, distortions, and monopsony powers;
- Clear messages and regulations that apply to all parties concerned;
- Infrastructure (such as roads and storage to stimulate private sector involvement);
- Credit to finance private sector initiative; and
- Competition in the market place to encourage economic efficiency.

Institutions That Serve the Agricultural Sector

At present, the major players in the agricultural sector trading commodities and providing services are government institutions and nongovernment organizations (NGOs). Only a few farmer organizations are financially viable, and there is little private sector involvement. Moreover, the role and extent of the involvement of these parties are often unclear. Agricultural policy objectives are sometimes implemented in ways that yield divergent results. For example, the agricultural credit policies being pursued by government institutions in many instances differ directly from those pursued by the nongovernmental organizations. Another cloudy area is agricultural extension and research, whose efforts are often duplicated, and not seldom conflicting results are advocated to farmers. The need is great to reconcile these activities and to recognize the following:

- The government's scarce financial and manpower resources;
- The positive financial and material support of private agencies.

The need is clearly to map out areas of work by location, subject matter, or commodity in order to avoid the wasteful duplication of activities. This need is underscored by the objective of privatization, which will be rendered useless if all parties do not adhere to the policy objective in practice.

Moreover, government projects should be kept in line with stated policies to avoid isolated project management and implementation. Projects often take upon themselves activities already being executed by other agencies, either private or public, which creates unnecessary duplication. In principle, individual projects should be clearly linked to a national strategy and not to localized efforts. This would allow them to be integrated with policy and would reduce the friction between policy and project. Projects are frequently run on a semiautonomous regime, which requires manpower resources often beyond the country's capacity. This means either further depletion of strained government professional and technical manpower or substantial technical assistance. National programs rather than local projects would capitalize better on scarce skills. A clear policy that places projects within the policy of existing government and private institutions would go a long way toward remedying this situation.

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