HOUSEHOLD AND NATIONAL FOOD SECURITY IN SOUTHERN AFRICA

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FOREWORD

In 1985 the University of Zimbabwe and Michigan State University initiated a Food Security Research Network for Southern Africa. The objectives of the network are to conduct research that informs policymakers about food security issues and to help strengthen the regional capacity for food policy analyis. The underlying premise of the network is that building excellence in research capacity for national policy analysis comes through experience. In practice, this requires a long-term commitment to analytical capacity building, consistency in funding, and constant interaction between researchers and policymakers.

The network has sponsored four annual conferences for network researchers, policymakers, SADCC officials, and representative of international and donor agencies. The aim of the conference is to share research findings, identify new research themes, and provide an opportunity for policy dialogue between regional researchers, policymakers, and government officials.

The 1988 conference brought together 110 participants who deliberated on 28 papers. In the Official Opening, Vice-Chancellor W.J. Kamba of the Univesity of Zimbbawe highlighted the importance of including health related-issues as a component of food security; and Zimbabwe's Senior Minister of Finance, Economic Planning, and Development B.T.G. Chidzero outlined policy reform priorities for Southern Africa. Subsequent sessions focused on *SADCC's Food Security Programme, the Impact of Market Reform on Food Security, Food Security Policy Options, New Technology to Improve Food Security, Family Food Security Options in Low-Rainfall Areas, Expanding Agricultural Trade in the SADCC Region, Nutrition and Food Security, the Contribution of Small-Scale Rural Enterprises to Employment Generation and Food Security, and the Impact of Irrigation on Food Security.*

A highlight of the 1988 conference was the participation of five nutritionists from Zambia, Zimbabwe, Sweden, and the United States. The presence of the nutritionists stimulated formal and informal discussions on the food access side of the food security equation and drew attention to the need to initiate more research in this area.

A second highlight of the 1988 conference was the attention given to reducing barriers to expanded intraregional trade in the SADCC region. Results presented suggest that there appear to be substantial price and nonprice barriers to expanded trade. Nevertheless, there exist significant opportunities for expanding intraregional trade that can be realized through appropriate government initiatives.

This proceeding contains revised papers prepared under the sponsorship of the University of Zimbabwe/Michigan State University Food Security Research Project in Southern Africa and presented at the University of Zimbabwe's Fourth Annual Conference on Food Security Research in Southern Africa, held at the Holiday Inn, Harare, October 31-November 3, 1988.

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ACKNOWLEDGEMENTS

SELECTED RESEARCH FINDINGS FROM RWANDA THAT INFORM POLICY THEMES IN SOUTHERN AFRICA[1]

Scott Loveridge, Surge Rwamasirabo, and Michael T. Weber[2]

OVERVIEW AND BACKGROUND TO RWANDA FOOD SECURITY POLICY ISSUES

Paper overview and objective

Section I of this paper reviews recent events in Rwanda. In section II we identify principal research findings from Rwanda with the objective of helping inform five important food security themes in Southern Africa.

Food and agricultural policy foci in Rwanda

Rwanda faces tremendous challenges in its food and agricultural sectors. The landlocked country is struggling against high population density (the country is 90% rural) and poor links with seaports to improve the performance of its economy.

The Government of Rwanda's (GOR) main objectives in the agricultural sector have been to increase food self-sufficiency and rural incomes. In the past, the GOR's means of achieving these goals have been relatively successful. The country has focused on cropping previously unused land, maintaining soil fertility, improving some crop varieties, and trying to stabilize bean and sorghum prices. They also have tried to modestly increase prices paid to farmers for selected food crops while maintaining a buffer stock to attenuate consumer price increases when food supplies contract.

Recent improvements in information in Rwanda

In 1982 the GOR, with support from USAID and other donors, began a series of initiatives to improve understanding of the rural economy. The first was to begin the Agricultural Survey and Statistics Service (SESA) in the Ministry of Agriculture. SESA fields and analyzes annually national representative surveys on rural households. A second activity was to field a national rural and urban budget and consumption survey through the Ministry of Planning.

In 1985, Michigan State University began collaborating with the GOR in these initiatives through its Food Security in Africa Cooperative Agreement and its Rwandan Employment and Enterprise Policy Analysis Project. MSU researchers

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Scott Loveridge, Nicholas Minot, and Donald Mead have completed long-term assignments, working with Rwandan researchers to increase knowledge about the rural and urban economy. Among other things, these cooperative research programs have helped establish a series of research and policy working papers at SESA and another at the Ministry of Finance. These working papers and reports have been used to help institutionalize seminars and other more informal exchanges to inform policymakers on production, employment, and income issues in Rwanda. Much of the data and analysis in the present paper comes from various SESA working papers and the Ph.D. dissertation that the principal author, Scott Loveridge, has recently completed. It also benefits from the work of Nicholas Minot and colleagues in the Ministry of Plan who have analyzed the national budget and consumption survey.

Past and current performance of the Rwandan agricultural sector

Figure 1 indicates that caloric production from the eight major crops[3] kept pace with Rwanda's high population growth until about 1981. This large increase in total output is largely attributable to expansion in the area cropped. From 1981 onward, population appears to have begun to gradually grow faster than food output, reflecting reduced availability of new lands, decreased average soil fertility, and lower marginal productivity of additional labour in agricultural production. Figure 2 shows a decline in per capita sorghum production beginning well before the decline in per capita caloric production. Farmers appear to be shifting away from sorghum to beans and tubers. Tubers provide more calories per unit of land than sorghum, while beans provide much more protein than sorghum but roughly the same calories per unit of land.

It now appears that Rwanda may have a more severe chronic food security problem than earlier believed. Analysis by the Ministry of Plan of the 1983 rural budget and consumption survey displayed in Table 1 indicates that well over 40% of rural households are consuming less calories than the estimated 2,100 kcal/capita required for maintenance of good health. Table 1 also shows that the disparity between high and low kilocalorie consumption groups is not large compared to other countries, indicating a fairly even income distribution. On the other hand, Table 1 does show that a higher proportion of households with inadequate calorie consumption are concentrated in two regions of the country: the Southwest and South-central areas.

Households at all levels of caloric intake allocate the vast majority of their total income[4] to food, as indicated in Table 2. Affordable food in the market is a critical element for the survival of the many rural households that do not produce enough food on their own farms. On the other hand, Table 3 indicates that agriculture provides over 60% of rural families' income. High prices might therefore help increase farm incomes. This presents a dilemma for Rwandan policymakers: raise

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[3]These account for over 95% of total caloric production.

[4]"Income" includes production of food, goods, and services that are consumed rather than marketed.
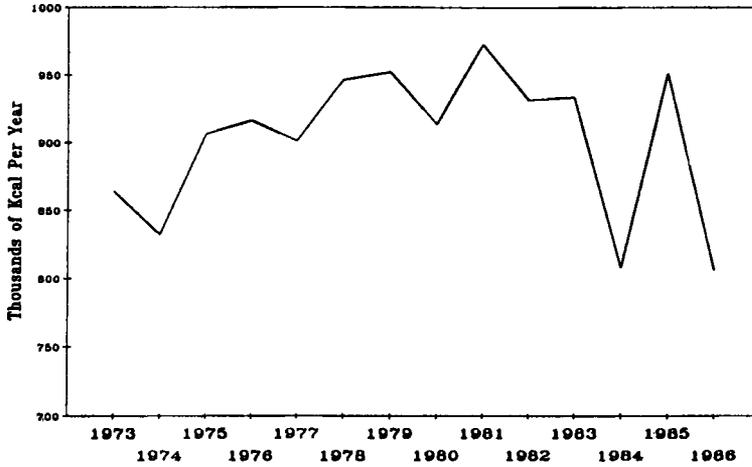
Figure 1. Per capita calorie production (8 major crops), Rwanda, 1973 to 1986.
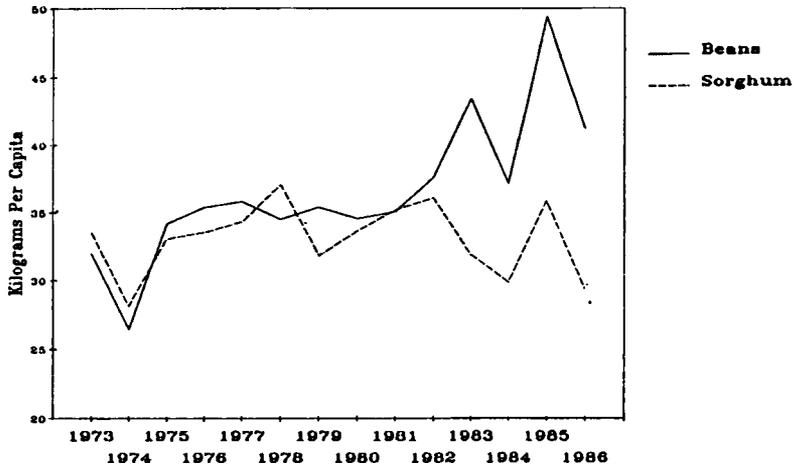
Figure 2. Per capita bean and sorghum production, Rwanda, 1973 to 1986.

Table 1. Characteristics of rural households by level of caloric consumption, Rwanda.

	Caloric consumption (quintiles of Kcal/ae/day)					
	1st	2nd	3rd	4th	5th	Rwanda
Average value of consumption (FRW/capita/yr)	8,069	9,698	11,784	13,327	15,979	11,763
Principle occupation (% of households)						
Agriculture	28.6	18.9	33.7	38.9	40.3	32.1
Agric./artisanry	40.3	51.0	38.8	30.4	26.4	37.4
Artisanry	2.1	7.4	13.1	10.2	10.8	8.7
Commerce	4.5	3.7	6.5	1.6	2.4	3.7
Salaried	4.7	6.2		5.3	5.5	4.4
Other	19.8	12.8	7.9	13.6	14.6	13.8
Total	100.0	100.0	100.0	100.0	100.0	100.0
Food self-sufficiency (%)	61.6	67.2	70.4	67.6	70.6	67.4
Caloric consumption (kcal/day/ae)[a]	1,458	1,896	2,292	2,743	3,838	2,443
Average farm size (ha)	1.2	1.4	1.5	1.2	1.2	1.3
Geographical zone (% of Households)						
Northwest	13.8	10.0	6.1	19.4	24.1	14.7
Southwest	24.6	16.8	15.2	14.8	8.9	16.1
North-central	18.8	21.9	22.5	26.5	23.7	22.7
South-central	28.1	29.7	25.7	13.0	10.7	21.4
East	14.7	21.6	30.5	26.3	32.5	25.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
Average household size (people)	5.7	5.7	5.2	4.5	3.6	4.9
Female-headed households (% of households)	27.0	12.3	19.2	14.8	29.9	20.6
Average age of household head (years)	48.9	49.3	48.2	46.5	48.3	48.2
Number of households surveyed	58	57	49	52	54	270
Weighted percentage of households	20.2	20.1	19.5	20.2	19.9	100.0

[a]ae is adult equivalent.

Table 2. Structure of rural final consumption by level of caloric consumption, Rwanda.

Item	Caloric consumption (quintiles of Kcal/ae/day)					
	1st	2nd	3rd	4th	5th	Rwanda
Final consumption						
(% of total)	100.0	100.0	100.0	100.0	100.0	100.0
Food consumption	82.3	77.0	79.1	79.4	85.7	80.6
Cereals	3.1	2.4	3.0	3.7	4.3	3.3
Tubers/bananas	30.0	27.3	27.7	27.2	24.0	27.1
Legumes	19.1	21.2	20.7	20.6	24.7	21.3
Fruits/vegetables	4.3	2.6	4.0	3.3	2.7	3.3
Animal products	5.1	5.2	5.8	3.8	13.9	6.8
Beverages	17.1	23.0	20.9	20.6	14.3	19.4
Other foods	3.6	3.1	2.7	2.5	2.1	2.8
Non-food consumption	17.7	23.0	20.9	20.6	14.3	19.4
Clothing	6.3	6.0	8.4	7.7	4.6	6.6
Housing	4.1	8.7	4.1	6.6	3.7	5.5
Furnishings	1.3	2.5	2.3	1.4	1.7	1.9
Water/energy	1.1	1.1	0.9	1.1	1.0	1.0
Health/hygiene	2.2	1.6	1.4	1.5	1.5	1.6
Education	0.8	1.1	0.4	0.3	0.1	0.5
Transport	0.5	1.2	1.6	1.2	0.9	1.1
Tobacco	0.9	0.6	0.8	0.6	0.4	0.6
Leisure/services	0.6	0.2	1.0	0.2	0.4	0.5
Final consumption						
(FRW/household/year)	43,913	54,375	59,291	58,652	55,735	54,360

[a] ae is adult aquivalent

prices to increase incomes and output, or lower prices to help the rural poor?

Surveys and analysis to inform food security policy in Rwanda
In 1985 SESA was already collecting annual production statistics from a nationally representative 1000+ rural household sample. MSU collaborated with SESA in designing, fielding, and analyzing several additional surveys for the same sample to address critical policy questions on beans and sorghum. The additional national fielded surveys collected information on farm level bean and sorghum marketings, as well as several smaller surveys with merchants and farmers to investigate issues related as information on farmer production constraints. SESA and MSU also fielded smaller surveys with farmers and merchants to investigate issues related to beans and sorghum, for which SESA's national sample was inappropriate.

Table 3. Structure of value added in rural areas by level of caloric consumption, Rwanda.

Sector	Caloric consumption (quintiles of Kcal/ae/day)					
	1st	2nd	3rd	4th	5th	Rwanda
Value added (% of total)	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture	59.0	59.2	63.2	61.0	67.0	62.1
Crops	54.5	51.8	57.4	55.4	50.5	53.9
Livestock	4.5	7.4	5.9	5.6	16.4	8.2
Artisanry and services	23.7	24.6	24.5	25.3	20.5	23.7
Banana wine	17.6	17.0	14.9	14.6	11.0	14.8
Sorghum beer	1.8	2.1	2.4	3.7	3.0	2.7
Other	4.2	5.5	7.3	7.0	6.5	6.2
Commerce	5.0	5.6	10.1	4.9	1.5	5.4
Salary	12.4	10.6	2.1	8.8	11.0	8.7
Agricultural worker	8.3	3.1	1.5	6.2	1.9	4.0
Public sector	1.8	6.3	0.1	1.2	5.1	2.9
Other	2.2	1.2	0.5	1.4	4.0	1.8
Value added (FRW/household/year)	42,081	54,092	60,182	60,445	59,693	55,259

FINDINGS FROM RWANDA THAT HELP
INFORM SELECTED POLICY THEMES

Constraints to using price policy alone to increase agricultural output and farm income

As the SESA/MSU study progressed in 1986, it became clear that conventional beliefs about bean and sorghum market relationships were poorly informed. Prior to the SESA/MSU research, it was thought that Rwanda was essentially self-sufficient in beans and sorghum. As shown in Figure 3, farmers in the aggregate bought more beans than they sold in ten out of twelve months in the normal 1986 crop year.

Tables 4 and 5 show dry bean household net transaction categories derived from the production and transaction data. For beans (and sorghum) a small percentage of Rwandan households are large net sellers, and these households account for the vast majority of net sales for both crops. Net seller households tend to have relatively larger farms and higher per capita kilocalorie production than net buyers.

The majority of Rwandan rural households are net bean (and sorghum) buyers. In fact, some 30% of all rural families are purchasing an estimated 50% of their yearly bean utilization. In the short run, higher bean prices for these households, especially in light of their overall low per capita production of calories, would make them much worse off. Without significant improvements in farm and nonfarm productivity, higher prices would also make them worse off in the long run. In

Table 4. Net sales of dry beans by household net transaction category, November 1985-October 1986, Rwanda.

Household net transaction category	Number of H.H.	% of H.H.	Tons sold by class	% of sales	Farm size (ha)
Amount sold					
>60 Kg	72,224	7	13,977	82	2.0
30-59 Kg	39,913	4	1,738	10	1.6
<30 Kg	123,471	11	1,399	8	1.6
No net transactions	51,499	5	na	na	1.4
Amount bought[a]					
<30 Kg	265,475	24	-4,295	- 8	1.0
30-59 Kg	202,991	18	-8,847	-16	1.0
>60 Kg	341,518	31	-41,379	-76	1.1
Total	1,097,091	100	na	na	na

[a]Negative numbers indicate purchases.
na = not applicable

Table 5. Per capita availability of dry beans by household net transaction category, November 1985-October 1986, Rwanda.

Household net transaction category	% of H.H.	Kg beans produced per capita	Kg beans transferred per capita[a]	Kg beans available per capita	Total Kcal/cap produced
Amount sold					
>60 Kg	7	136	48	88	4,658
30-59 Kg	4	83	13	70	3,442
<30 Kg	11	73	5	68	3,072
No Net Transactions	5	49	0	49	2,600
Amount bought					
<30 Kg	24	34	-5	39	1,966
30-59 kg	18	30	-11	40	1,773
>60 Kg	31	24	-24	48	1,781
Total	100	na	na	na	na

[a]Transfers include purchases, sales, gifts given and gifts received. Availability includes seed and storage losses. Total per capita Kcal production is based on the eight major crops in SESAs production survey.
na = not applicable
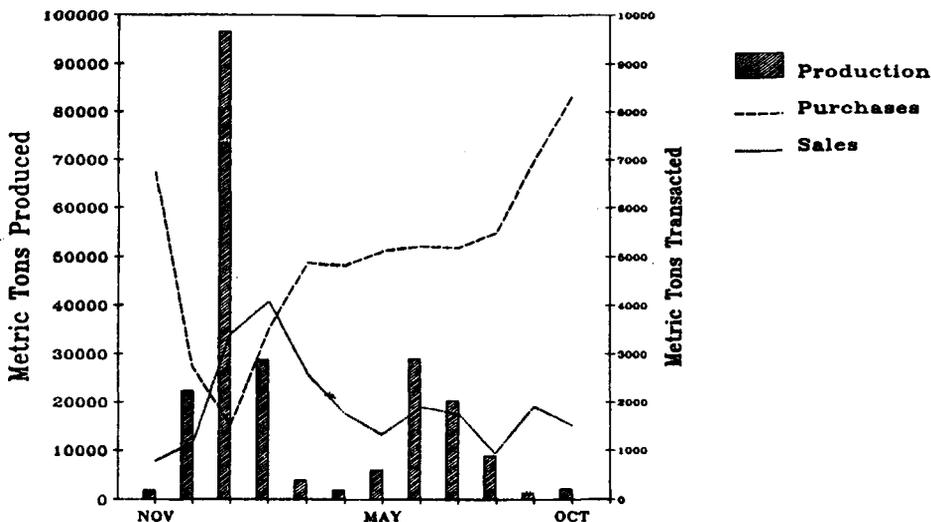
Figure 3. Monthly rural dry bean production, purchases, and sales, Rwanda, 1986 Agricultural Year.

contrast, higher prices would benefit the few seller households who are already producing the most calories per capita.

Perceived production constraints are quite different for the different transaction groups (Table 6) and tell us something about whether higher output prices alone might call forth additional output. Sellers mention drought and labour problems most frequently, while buyer households cite land shortage and low soil fertility most frequently. Resource and technology constraints thus appear to be more binding than low prices under current circumstances, although some net sellers did mention price.

Utilizing a net informal import identity and estimates from the national level production and transaction survey, selected market/trade indicators were developed (Table 7). Among other things, these show that the rural areas of Rwanda are importing some 14% of rural dry bean (20% for sorghum) utilization. These are informal imports previously unreported in official statistics, and are quite significant when compared to the value of all official commercial and food aid imports. These are of approximately equal value, and each are equal to roughly 5% of the value of

Table 6. Biggest production constraints by household net bean transaction category, Rwanda.

Principal constraint	Net household bean transaction category							
	Net dry bean sellers who sold:			No net trans- actions	Net dry bean buyers who bought:			
	>60 kg	30-59 kg	<30 kg		<30 kg	30-59 kg	>60 kg	Rwanda
Fertilizer /soil fert.	16.2	25.7	27.5	22.1	28.2	33.9	37.2	30.8
Surface area	17.8	15.1	18.6	17.1	37.9	32.2	29.3	28.9
Labor	29.4	9.5	24.1	24.1	14.0	16.6	8.7	15.3
Drought	27.5	39.5	16.6	27.4	12.4	12.6	14.3	16.2
Too much rain	3.9	6.4	8.7	4.6	3.0	2.7	6.8	5.0
Seed	0.0	0.0	0.0	0.0	1.0	0.0	1.5	0.7
Lack of pesticides	0.0	0.8	0.0	0.0	0.0	0.0	0.1	0.0
Low food prices	4.4	3.9	0.0	0.0	0.0	0.4	0.3	0.6
Other	0.9	0.0	3.7	4.0	3.4	1.7	1.7	2.3
No response	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0

Table 7. Assumptions and realities about beans and sorghum in Rwanda.

Selected market/trade indicators (Percentage)	Traditional ·assumption	SESA/MSU estimate
Dry bean production marketed	30	10
Rural self-sufficiency in dry beans	100	86
Rural dry bean purchases coming from imports	0	60
Sorghum production marketed	35	21
Rural self-sufficiency in sorghum	100	80
Rural sorghum purchases coming from imports	0	50

national production of the eight major Rwandan food crops.

Had the government been successful in 1986 in trying to implement a country wide floor price for beans of 35 FRW/kg (a price significantly above the prevailing open market price to farmers of about 23 FRW/kg), major additional imports would have been encouraged. In addition, only a small percentage of Rwandan farm households would have benefitted at the expense of a large number of rural and urban consuming households, assuming the higher floor price to farmers would have raised the retail price to these consumers.

IMPORTANCE OF PRIVATE MERCHANTS IN SUPPLYING PURCHASED FOOD TO RURAL AS WELL AS URBAN CONSUMERS

The vast majority of rural food purchases in Rwanda are from private merchants, generally fixed place merchants and/or rural market vendors (farmer to farmer sales are also important in certain crops). Several tests of market competition indicate that these private merchants are functioning reasonably well, given the underlying level of economic development in Rwanda. In various tests of market integration, bean prices behave better than other commodities, and indicate that both urban and rural markets are well connected. Rural bean markets appear to react more to the rest of Rwanda as a whole than to price changes in a particular market. Accounting for seasonal changes in the direction of product flow also improves results from models of market integration.

Overall, it is not collusive merchant behavior, but thin markets, product specific characteristics, high assembly costs and spatial production patterns which hamper market integration. High transport and transaction costs appear to be the principal barriers to better market integration in Rwanda. Reducing transaction costs will be difficult because they are related to the low levels of marketable surplus produced by the typical farm enterprise.

During the most recent significant drought (1984) farmers indicated that they mostly pursued a strategy of buying food from the market to supplement inadequate home production (Table 8) These results highlight the importance of effective private markets in times of food crises.

Table 8. Farmer Methods of Food Acquisition in 1984, Rwanda

Response[a]	Percentage
Buy food/sell labour	70.7
Eat more tubers	37.7
Eat more bananas	5.8
Gifts from neighbour	2.2
Government aid	0.7
Not applicable	1.8
Other	5.1
Total	124.0

[a]Multiple responses possible

IMPORTANCE OF STRATEGIC PUBLIC SECTOR ACTIONS TO FACILITATE THE GROWTH OF PRIVATE SECTOR ACTIVITIES

Rwanda has invested heavily to improve its basic road system, especially those routes connecting major urban centers. As shown in Table 9, the completion of a paved road between major markets is associated with increased market integration as measured by the market-pair regression model for testing market integration. These results highlight the importance of basic public investments in facilitating the movement of goods and improved performance of basic marketing functions.

Throughout most of recent history, the GOR has operated under a system of "indicative" prices for beans and other basic food commodities. Yet merchants, for the most part, have been allowed to openly buy and sell at any price, while the parastatal OPROVIA would try to move market prices towards its "target" price through modest market purchases and sales of beans and sorghum. This willingness to tolerate private commerce and to keep parastatal actions in relative proportion has helped to slowly develop a much more vigorous private sector in Rwanda.

The Ministry of Plan has collected market clearing retail prices in major towns for at least the past 18 years. Although they have not actively utilized this information for on-going market analysis or diffusion to potential public and private users, they have at least tried to keep the data base up to date. This price information has been extremely useful in SESA/MSU analysis of market performance, and is a fundamental building block in the development of more informed market policy.

During most, if not all, past transitory food insecurity problems in Rwanda the GOR has not used massive quantities of food aid. One of the benefits of such actions is the freedom from large and unpredictable negative effects on private merchants' business environment. Certainly Rwanda is constrained through

Table 9. Market-pair regressions on detrended urban retail dry bean prices before and after paved roads, Rwanda[a].

Market pair	Construction years	Prior to paving		After paving	
		Adj R^2	No. obs.	Adj R^2	No. obs.
Ruhengeri-Gisenyi	1974-1977	-.03	24	.35	52
Kigali-Kibungo	1974-1977	-.07	12	.45	71
Kigali-Gitarama	1978-1983	.51	48	.83	45
Kigali-Butare	1978-1983	.48	47	.80	38

[a]The analysis covers MINIPLAN data from the years 1971 through 1987. Construction years are excluded from both regressions for each market pair. Detrending was accomplished using the BNR consumer price index.

difficult transport in accessing food aid, but the lesson for Southern African countries is to try to reduce the disruptive effects of food aid, not just on farmers but also on the longer-run viability of private merchants serving the effective food and consumer good demand of rural consumers.

In Rwanda, as in many other African countries, some market observers argue that seasonal price increases (generally in the hungry season) are caused by private merchant speculation that exploits rural and urban households purchasing relatively greater quantities during these periods. This is obviously an empirical question, but our study in Rwanda--and most other studies in Africa--find that seasonal price trends in open markets are not out of line with seasonal transfer costs. Studies frequently also find high costs and very risky returns to investment in storage. For example, in Rwanda over the 17-year period from 1971 to 1987, bean prices increased seasonally 11 times, went down 2 times and stayed about the same 4 times. The important conclusion is not to blame price increases on merchant speculation without careful analysis of costs and risks associated with spatial and temporal arbitrage. High costs may be present but are frequently not easily lowered without strategic public good investments in infrastructure, information, etc.

When price increases are in line with costs and normal profits required to encourage private agents to invest, the dynamic opportunity is to further encourage private agents, not make them into scapegoats. If government marketing organizations decide to try to keep prices from increasing seasonally and spatially, it must be recognized that taxpayer resources are being used to cover the real costs involved. Given limited public investment budgets, this means fewer resources will be available to invest in more essential public goods such as improved roads and agricultural research, which are investments that private agents generally find unattractive. The long-run solution for households who cannot afford to maintain required food purchases during seasonally high price periods is to find ways to raise household income and/or entitlements, perhaps through careful use of food aid. Yet over the longer run, a reliable rural market for purchased food and other inputs is needed to help contribute to increases in productivity by giving households more opportunity to specialize, rather than trying to produce themselves all needed food and other inputs. Rural households in Rwanda seem to find the private market quite reliable, even in times of scarcity. Research on the effects of market changes in Mali by Dione and Staatz (reported at this conference in 1987) found that rural households were most pleased with the improved rural market for purchased food. Farmers especially liked not having to incur high uncertainty as well as search and waiting costs for needed food items.

THE IMPORTANCE OF STRENGTHENING DIVERSIFIED INCOME SOURCES OF RURAL HOUSEHOLD

Rural households in the SESA/MSU sample were asked to indicate their principal sources of cash revenue and expenditure. These responses are listed in Tables 10 and 11, according to the same net bean transaction categories used earlier in this paper. Note that this information does not refer to percentage of revenue or

Table 10. Largest source of revenue by household net dry bean transaction category, Rwanda[a].

Revenue source	Household net dry bean transaction category							Rwanda
	Net dry bean sellers who sold:			No net trans-actions	Net dry bean buyers who bought:			
	>60 kg	30-59	<30 kg		<30 kg	30-59	>60 kg	
	Percentage of households							
Alcoholic beverages	37.2	48.6	50.1	40.0	35.2	38.2	28.2	36.1
Foodcrop sales	41.7	35.2	18.6	20.4	13.5	16.1	12.4	17.2
Industrial crops	9.2	10.7	15.0	15.0	17.3	16.9	19.3	16.7
Field hand	2.0	1.9	7.3	5.9	14.6	11.1	18.1	12.5
Work at a project	0.0	0.0	0.0	0.0	3.3	2.1	3.0	2.1
Salary	5.5	0.0	2.0	1.9	2.3	2.1	3.8	2.8
Livestock sales	0.7	0.0	3.2	2.8	0.7	2.6	1.8	1.8
Artisanry	2.3	0.0	1.0	1.7	3.5	2.9	5.4	3.4
Commerce	1.5	3.7	1.2	3.1	3.4	3.3	4.1	3.2
Gifts from relatives	0.0	0.0	0.6	4.8	1.3	0.7	0.0	0.7
Renting fields	0.0	0.0	0.0	0.0	0.5	1.4	0.6	0.6
Other	0.0	0.0	0.0	1.9	2.6	2.6	2.8	2.1
No response	0.0	0.0	0.9	2.4	1.6	0.0	0.3	0.7

[a]The figure in each cell represents the percentage of households mentioning the item as their largest source of income, not the percentage of income.

expenses. It is the percent of the respondents who said the various items were their principal source of revenue or expenses.

As shown in Table 10, a large proportion of households buying the largest quantities of beans depend on the sale of: a) industrial crops (coffee and tea); b) labour to other farmers; and c) various other sources of off-farm wage and/or salary employment. A high proportion of households selling the largest quantities of beans obtain revenue from the sale of banana and sorghum beer, and the sale of other food crops. Recall that seller households have relatively larger farm sizes and are able to produce surpluses for sale or to process into products to be sold (beer).

Households buying the most beans list food as their principal expenditure item most frequently, while those selling beans list labour and clothing most frequently (Table 11).

Sources of revenue are significantly more diversified for net purchasers than for net sellers. We also know these households are ones with the least land to farm, and with perhaps the greatest soil fertility problems because they have been forced to reduce fallow and grow more root crops to maximize the availability of calories for household consumption.

Table 11. Largest expenditure by household net bean transaction category, Rwanda[a].

Revenue source	Household net dry bean transaction category							Rwanda
	Net dry bean sellers who sold:			No Net trans- actions	Net dry bean buyers who bought:			
	>60 kg	30-59	<30 kg		<30 kg	30-59	>60 kg	
	Percentage of households							
Food	10.3	41.2	29.9	34.7	55.8	60.3	74.5	55.1
Clothing	22.2	14.2	19.6	21.7	11.2	12.8	7.7	12.7
Labour	35.2	20.9	11.1	4.0	3.5	1.0	3.1	6.5
Medicines	9.4	5.2	5.9	13.0	6.7	4.7	4.3	5.9
Taxes	0.0	0.0	1.1	0.0	2.7	3.9	3.4	2.6
School fees	3.7	1.9	4.0	1.0	2.8	2.0	1.1	2.2
Kerosene	6.8	4.4	4.0	5.2	4.1	0.7	0.9	2.7
Alcoholic beverages	1.1	6.8	3.5	0.0	3.2	2.8	0.7	2.2
Soap	0.9	3.2	4.4	0.0	0.7	1.6	0.8	1.4
Kitchen ware	4.5	0.9	2.3	11.8	2.1	2.0	1.2	2.4
Renting fields	1.5	0.0	4.1	1.7	2.4	1.8	1.0	1.9
Seed	0.0	0.0	1.5	0.0	2.5	2.0	0.2	1.2
Tools	3.9	0.0	4.2	2.8	1.1	2.9	0.0	1.7
Other	0.5	1.3	3.4	1.9	0.9	1.4	1.0	1.4
No Response	0.0	0.0	0.9	2.3	0.4	0.0	0.0	0.3

[a]The figure in each cell represents the percentage of households mentioning the item as their largest expense, not the percentage of expenses.

The Ministry of Plan's budget and expenditure survey measured quantities of revenue and expenditures, including the estimated value of household food production that is consumed. Results show that households depending on agriculture for the majority of their revenue are consuming significantly less than households depending on non-agricultural income (Table 12). Households not selling beans and getting a majority of their income from agriculture have the lowest value of consumption per capita. The relatively few (15%) who are able to obtain significant nonfarm employment opportunities are better off from a value of consumption standpoint.

The challenge facing Rwanda, and increasingly for many countries in Southern Africa, is how to expand both on- and off-farm income-generating opportunities for people living on very small farms. Agricultural technology development for these households will need to focus on yield enhancements and other features that complement the households' need to also allocate labour to other nonfarm and off-farm employment activities. With such small farm sizes it appears highly unlikely that farming will provide adequate levels of living. Yet in the short-to-medium term, it likewise does not seem feasible to generate sufficient off-farm jobs for such large segments of the rural population. For this reason technological improvements for

Table 12. Value of consumption of rural households by gross quantity of beans sold and importance of agriculture in revenue-generating activities, Rwanda[a].

	Importance of agriculture in revenue					
	Less than 50%			More than 50%		
Gross qty. of beans sold[b]	% of families	Value (FRW) of consump. per capita	Ave. farm size (ha)	% of families	Value (FRW) of consump. per capita	Ave. farm size (ha)
0 kg	15.0	14,691	0.64	49.6	11,914	1.23
1-100 kg	3.8	12,846	1.61	25.9	13,297	1.48
> 100kg	1.1	18,807	0.57	4.5	16,801	1.86
Total	19.9	14,756	0.82	80.1	12,632	1.34

[a]MINIPLAN defines value of consumption as cash expenditure on goods destined for own use plus probable acquisition cost of food consumed from own production plus the value of goods received through gifts or barter. [b]Kg/family/year
Source: Personal communication, Nicholas Minot, National Budget and Consumption Survey, MINI-PLAN.

crop and livestock enterprises on very small farms are necessary, while simultaneously improving technology for households with more land resources.

At the same time that household level research is helping identify critical needs of the smallest of smallholders, agricultural research and development investment should not focus exclusively on these farmers. From a food security standpoint, output increases by the smallest and by the relatively larger smallholders are needed. This will help first to better satisfy own household food needs of the most at risk nutritionally, but second to increase employment opportunities and marketed surplus on farms with more resources available. The latter, in turn, will help expand off-farm income of the smallest rural households and keep aggregate food prices relatively low for the benefit of urban and rural consumers who must still purchase from the market. Both household and national, and supply and demand dimensions of food security are important. The research and policy challenge is to strike an effective balance among these.

THE IMPORTANCE OF UNDERSTANDING INFORMAL BORDER TRADE TO HELP INFORM DOMESTIC PRODUCTION AND MARKETING POLICIES

As indicated by the data in Table 13, rural Rwandan households buying the most beans and with the least land resources available have clearly shifted their cropping patterns towards those crops producing the most calories per unit of cultivated area: tubers, especially sweet and irish potatoes.

We have already shown that Rwanda has significant informal bean (and sorghum) imports from neighboring countries. Figures 4 and 5 reveal the geographical importance of the informal imports, and that even with imports, rural households in Southwestern prefectures of Rwanda have significantly lower per capita bean utilization.

Importantly, from real price information displayed in Figure 6 (in 1987 FRW/kg) observe that long-run average consumer prices for dry beans in Rwanda have shifted downward during the 1980s, although it is not entirely clear why this has happened (reduced regional transfer costs, civil unrest in Uganda in the 1980s expanding Ugandan sales to Rwanda and expanded per capita production in Rwanda may all have contributed to the lower prices).

It is tempting to say that it makes good economic sense for Rwanda to further specialize and rely on neighboring countries for beans and sorghum under these circumstances, but the picture revealed in Figure 6 suggests that market instability is not to be forgotten, among other things. For example, during the two most recent serious droughts in Rwanda (1974 and 1984) bean prices increased significantly in the precise period when consumers need to purchase larger quantities. Also, in both of these periods high prices persisted for at least six months (longer in 1974). The good news in Figure 6 is that high prices seem to always go away (including 1988, with current retail prices around 40 FRW/kg), and a reasonable seasonal price increase is present in "typical" years, such as 1983, when prices dropped in the first quarter of the year with Rwanda's principal harvest and increased through the marketing year in accordance with normal seasonal transfer costs. Some bad news for Rwandan "sellers" in this review of historical prices is that there are years (such

Table 13. Average proportion of kilocalories from each crop by household net dry bean transactions category, 1986, Rwanda[a].

Household net transactions category	Proportion of per capita kilocalorie production in:							
	Beans	Peas	Sorghum	Maize	Sweet pot.	Manioc	Potatoes	Bananas
Sold								
< 60 kg	.27	.01	.24	.06	.10	.08	.01	.22
30-59 kg	.24	.02	.15	.10	.14	.06	.01	.27
< 30 kg	.23	.01	.15	.08	.23	.10	.01	.19
No net transactions	.21	.02	.11	.13	.18	.08	.01	.27
Bought								
< 30 kg	.20	.02	.10	.13	.27	.08	.03	.18
30-59 kg	.19	.01	.10	.12	.28	.10	.04	.16
> 60 kg	.18	.01	.11	.08	.30	.09	.05	.18
Rwanda	.20	.01	.12	.10	.26	.09	.03	.19

[a]Averages computed from household level per capita values.
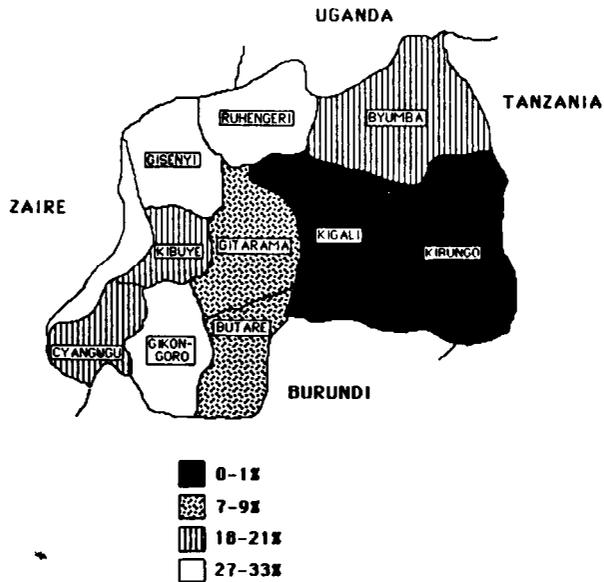
**Figure 4. Percentage of dry bean availability coming from imports, by prefecture in Rwanda, 1986 Agricultural year.**
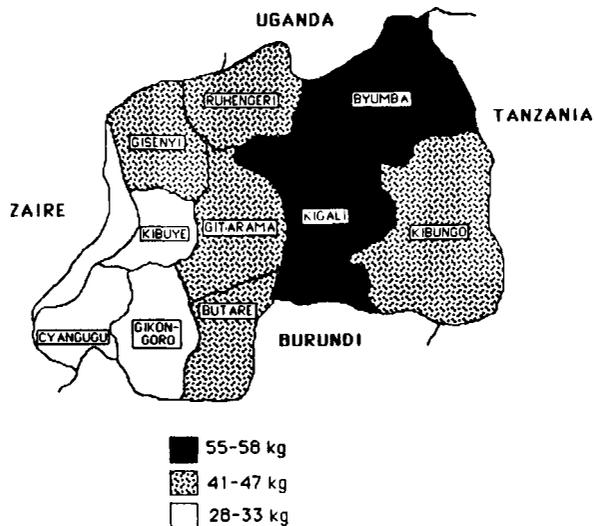
Figure 5. Per capita dry bean availability in rural Rwanda 1986 Agricultural year (gifts included).

as 1973, 1980, 1981, and 1986) when prices remain low throughout the marketing year.

The overall hypothesis is that weather drives shifts in regional supply, and simultaneous offsetting shifts in demand for beans, yielding highly variable open market price behavior. Therefore, it is virtually impossible for the Rwandan parastatal to try to either raise or lower the market-clearing price within Rwanda alone. An important question to be further studied in Rwanda is whether joint action with neighboring countries to predict shortfalls and improve trade flows is a feasible and desirable alternative to national buffer stocks?

A difficult question is what can Rwanda do to specialize, taking advantage of its labor supply, without subjecting itself to undue instability. Over the longer run, what can Rwanda produce and market competitively to its neighbors in return for food? What role can technological, institutional, and policy changes play in improving the competitive advantage of selected activities in Rwanda? At a minimum, it appears that highest priority should go towards research to increase the productivity of sweet potatoes and perhaps manioc. Investment in these certainly appears to be much more self-selecting for the poor, compared to maize or sorghum for example. Sweet potatoes would also appear to give a better nutritive balance, assuming households will be able to earn sufficient income to purchase beans and sorghum from the market.
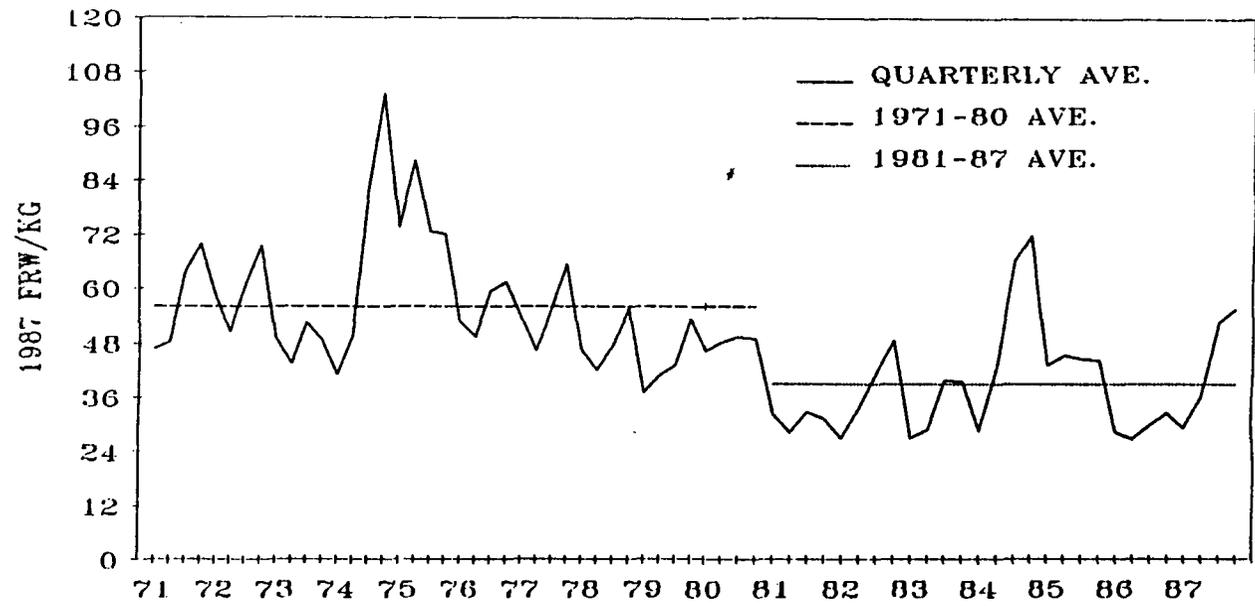
Figure 6. Quarterly average urban dry bean prices 1971-87.

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RWANDA STUDY - PUBLICATIONS

Bylenga, Sharon, and Scott Loveridge. *Intégration régionale des prix alimentaires au Rwanda*, 1970-1986.

Bylenga, Sharon, and Scott Loveridge. 1987. *Regional integration of food prices in Rwanda*, 1970-1986, May.

Dejaehger, Yvan, and Ngarambe Octavien. 1987. *La production de certaines cultures vivriers: la sécheresse 1984 comparée à une année normale (1986), la répartition mensuelle de la production agricole et son impact possible sur la stratégie alimentaire*, 27 May.

Loveridge, Scott, Yvan Dejaegher, and Serge Rwamasirabo. *Problematique du niveau des transactions du haricot au rwanda: résultats de six mois d'observations.*

Loveridge, Scott, and Michael T. Weber. *Relationships between food production, marketing, and farmer perceptions in five prefectures of rwanda.*

Loveridge, Scott, and J. Leonard Ngirumwami. *Caracteristiques descriptives des commerçants des produits vivriers operant sur des places fixes dans cinq préfectures du rwanda.*

Loveridge, Scott, et. al. *1988. Results of a survey on farm level sorghum marketings*, (English draft version of a working paper in French, presented in Kigali, April 5).

Loveridge, Scott, et. al. *1988. Résultats d'une enquête sur le niveau de commercialisation du sorgho a l'echelon du producteur*, Kigali, April 5.

Loveridge, Scott, with Krista C. Dessert. *Relationships between bean marketings and bean production techniques: a study of fifteen farms in the prefecture of Kigali.*

Mukezangango, J. Chrysostome. *Enquêtes sur les prix: description des séries des prix déjà existants.*

Rwamasirabo, Serge, Kampayana Théobald, and Scott Loveridge. 1897. *Résultats d'une enquête sur le niveau de commercialisation du haricot a l'echelon du producteur*, May 1987.

SESA/MSU Research Team. 1987. *Observations on price support and research programs for beans in Rwanda*. March.

SESA/MSU Research Team. 1987. *Quelques observations sur les programmes de fixation du prix plancher et recherche sur le haricot au Rwanda*. March.

SESA/MSU Research Team. *Production, markets, prices and food security relationships among selected commodities in rwanda: a research program overview*.

SESA/MSU Research Team. *Rélations entre la production, la commercialisation, les prix et la securité alimentaire de certains produits vivriers stockables au Rwanda*.

Kampayana, Théobald. 1987. *Attitudes, experiences, conditions, et stratégies des exploitants: distributions de fréquence résultant d'une enquête ponctuelle auprès des ménages ruraux*.

République Rwandaise, Ministère du Plan. *Enquête nationale sur le budget et la consommation des ménages-Milieu rural* (Nov. 1982 - Dec. 1983).

--------. Volume 1, Nov. 1986: *Présentation méthodologique de l echantillon et de la collecte en milieu rural*.

--------. Volume 2, Nov. 1986: *Structure du budget des ménages*.

--------. Volume 3, Mai 1988: *La consommation finale et les sources de revenu des ménages ruraux*.

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