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CEREAL SALES BEHAVIOR AMONG FARM HOUSEHOLDS IN FOUR VILLAGES OF BURKINA FASO

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CHAPTER 1

INTRODUCTION

Research on cereal marketing behavior among farming households in West Africa is receiving increasing attention. Following the severe drought conditions of the early 1970s, the interplay of marketing policy and food security has been seen as an important issue.

A central question in cereal marketing research is the selling behavior of farm households. To formulate effective policy, it is necessary to develop an understanding of the determinants of cereal sales. Once these determinants are understood, policy can be designed which would encourage the augmentation of marketed surplus from farm production, and thereby increase food security.

Two economic variables which policy can attempt to influence are price and output. In order to affect the former, programs can be designed which influence the price producers receive for their output. The government of Burkina Faso already seeks to influence producer prices through the actions of the government marketing board. Attempts to influence producer prices, while at the same time trying to control the growth in consumer prices, often result in a cost to government. The necessity and effectiveness of these market interventions are important policy questions.

Policies which affect output can involve a combination of research and extension interventions. Investments in the development of agricultural technology are long term in nature and designed to provide a means to increase crop production. Extension programs generally seek to increase the adoption of existing, proven, output-increasing technologies in the short run.

To the extent that policies designed to affect price and output compete for the same government resources, both in fiscal terms and in terms of trained manpower, the two interventions are in competition. An understanding of the influence of both price and output on producer sales behavior could help to lead to a more efficient allocation of these limited resources.

The objective of this analysis[1] is to identify those factors which influence household cereal sales. This is the first step in developing policies which would help to increase the amount of cereal grains marketed by farmers in Burkina Faso.

The report is divided into four sections. The first provides an overview of the four villages in which research was conducted. The second section describes the methodology of data collection and the variables used in the analysis. A presentation of the results and discussion of the analysis follows, and is divided into two parts: an analysis of annual cereal sales behavior and an analysis of intraannual sales behavior. The fourth and final section focuses on conclusions and policy implications.

The Setting

The analysis presented here concerns four of the FSU/SAFGRAD study villages: Nedogo, Poedogo, Dissankuy, and Diapangou. These villages have been described extensively elsewhere as has the data set employed in this analysis (FSU/SAFGRAD 1982; Lang, et al. 1983; Ohm, Nagy, Pardy 1984). Descriptive information on each village will be presented briefly here.

Nedogo is located in the Central Plateau, approximately 30 km northwest of Ouagadougou. Because of high population pressure, fallow periods have become shortened, and soil fertility has deteriorated. Annual rainfall in Nedogo is between 700 to 800 mm. The cropping pattern is dominated by cereals, mainly millet (57% of the cropped area) and white sorghum (21%). The principle cash crop in Nedogo is peanuts (Lang, et al. 1983).

Poedogo is located in the southern part of the Central Plateau, near Manga, an active cereal grain market. This village generally receives between 800 and 900 mm of rain annually. As in Nedogo, cereal crops represent the largest amount of cropped area (92%), but sorghums, and especially white sorghum, are relatively more important. Peanuts represent the principle non-cereal crop.

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[1]The field research described in this report was undertaken by the Purdue University Farming Systems Research Unit of the Semi-Arid Food Grain Research and Development Program (FSU/SAFGRAD) and funded by the U.S. Agency for International Development (AFR-C-1472). The analysis was conducted at the University of Wisconsin office of International Agricultural Programs and funded under a subcontract of USAID contract (AFR-0243-C-00-2063-00) with the University of Michigan.

Dissankuy is located in the relatively fertile Volta Noire region, approximately 120 km north of Bobo-Dioulasso. Land in this area is less limiting than on the Cenral Plateau, and grain yields are higher (Lang 1984). Annual rainfall is between 800 to 900 mm, and cotton is produced on about 15 percent of the land (Lang, et al. 1983). Other non-cereal crops include peanuts and bambara nuts, although the former is more important than the latter (Lang 1984).

Diapangou receives annual rainfall in the 700 to 800 mm range and is located in a land abundant zone, east of Ouagadougou and approximately 25 km from Fada. Shifting cultivation is practiced in this village (FSU/SAFGRAD 1982). In Diapangou, millet and white sorghum are grown in an association which includes approximately 75 to 90 percent millet (Lang 1984). Peanuts are the most important non-cereal crop (Lang, et al. 1983).

CHAPTER 2

METHODOLOGY

The Study

In each of Nedogo, Poedogo, and Dissankuy, data were collected from 30 randomly selected households. In Diapangou, 30 households were randomly selected from those having animal traction. For the purposes of this study, a household is defined as a production/consumption unit. Each household head was interviewed on a monthly basis and asked to provide data on current cereal and animal stocks, as well as inflow and outflow transactions information for cereals and animals.

Data were collected from May 1983 to January 1985. The analysis presented here utilizes a subset of these data, and represents sales behavior from October 1983 to September 1984. From May to October both the households and enumerators had time to become accustomed to the survey, resulting in an increase in the quality of the data collected.

Interviews were conducted with the household head, and were based on recall. During the interviews, the household head was asked to provide information on the stocks and transactions of other household members. The latter were often interviewed if the household head could not provide adequate information, and as a check on information provided by the household head. Women were consulted about their stocks and transactions, and about household consumption. The degree to which women were interviewed depended on village mores relative to interviewing of female household members by male enumerators. The owners of personal stocks were interviewed about these stocks.

The data were recorded by the enumerators directly on the questionnaires during the interviews. Quantities were reported in local units by the farmers and converted to kilograms based on average conversion factors determined by measurement at the beginning of the study. For purposes of estimating consumption, each household was asked to utilize a single measure when removing grain from storage. This lead to increased standardization in the consumption data. Farmers expressed interest in the study and cooperated enthusiastically because they felt it helped them to budget their cereal stocks.

In April 1984, several households judged to be non-cooperators were eliminated from the sample. For this analysis only those households who participated in the survey during the entire year (October 1983-September 1984) were included. At the analysis phase, households were removed if their sales were thought to reflect a trading enterprise rather than a farming enterprise.

The Variables

The data set was analyzed using both descriptive and regression techniques. The goal of the report was to determine those factors which explain the variation in cereal sales among households in the four villages studied. Sales can be thought of in two ways, as gross volume marketed by farm households, or as sales minus purchases, or net sales. Net sales measures the net contribution of cereals by a household to the market. Crops can be grown and subsequently sold to obtain cash which is used to purchase crops of a higher desirability for consumption. The net sales figure would take into account this behavior.

Independent variables related to net sales would, in fact, be explaining the difference between sales and purchases. Put another way, net sales figures take into account factors influencing both purchases and sales, and not pure sales behavior. Since this report attempts to identify only the factors affecting cereal sales, gross sales were chosen over net sales as the relevant dependent variable.

Gross cereal sales were defined as the total volume of millet, corn, rice, red sorghum and white sorghum marketed during the one-year period from October 1983 to September 1984. This time period corresponds to a marketing year as indicated by the variation in cereal stocks. Harvest of the major cereal crops takes place from September to December. As a result, stocks are highest in December and then decline until the following harvest. The analysis therefore models the disposition of the 1983 grain harvest during the following marketing year.

During the analysis, several independent variable were developed. Animal units were defined as the household endowment of sheep, goats and cattle, with cattle used as the base of the combined animal unit. Small ruminants were weighted using a factor of .06 derived from the relative value of each animal species based on sales observations. The 1983 cereal harvest was calculated using information on pre-harvest stocks, inflows, outflows and after harvest

stocks. Producer and consumer equivalents were calculated utilizing census information from April 1984 and conversion factors as noted in Appendix 1. Seasonal outmigration is important in Burkina Faso and household population can vary substantially over the year. April 1984 represents the start of the agricultural season, a time when those involved principally in agricultural activities would most likely be present. In any case, no data were available on changing household composition or population. The price variable represents the mean yearly price for all cereals based on observed transaction prices. The independent variable for cash hectarage included the total area devoted to peanuts and cotton during the 1983 cropping season.

Analysis was performed both on a village level, and by wealth groups. Wealth categories were created by dividing sample households into four groups based on the total value of their animal stocks at the end of the harvest (December 1983) and the value of their agricultural capital equipment in 1984.

CHAPTER 3

RESULTS AND DISCUSSION

Annual Cereal Sales

During the twelve-month period from October 1983 to September 1984, 79 percent of the sample households sold cereal grains. This represents an average household volume of 388 kg in yearly cereal sales. In terms of total volume, gross sales varied substantially across the four villages studied (Table 1). Diapangou accounted for the greatest volume of cereals sold during the year with 31 percent of the total over all four villages, followed by Poedogo (28%), Nedogo (26%), and Dissankuy (15%).

This ranking is modified when yearly cereal sales are expressed on a per household basis. In terms of sales per selling household, Poedogo is highest followed by Diapangou, Dissankuy, and Nedogo. When cereal sales are divided by total households, the ranking is Poedogo, Diapangou, Nedogo, and Dissankuy. Poedogo and Diapangou are also highest in terms of cereal sales per producer equivalents among all households and selling households. Dissankuy selling households marketed less than households in Poedogo and Diapangou, both on a per household or per producer unit basis. Dissankuy, located in the fertile Volta Noire region, ranked at the lower end of sales indicators among the more productive villages in the sample. These results may indicate that marketing policies have a relatively larger potential effect in fertile regions of Burkina Faso.

The findings for Dissankuy are interesting in terms of the effect of cotton growing on cereal sales. In this village, cotton production is an important cash crop activity: 78 percent of the sample farmers had cotton acreage in 1983. The data suggest that for the village as a whole, grain sales were lower, both in terms of total volume and on a per household basis than in non-cotton growing villages. In fact, of the total sample's 21 non-selling households, 14 were from Dissankuy (67%).

In order to test the hypothesis that cotton production in Dissankuy had an effect on yearly cereal sales behavior, the mean sales of cotton and non-cotton producing households were compared. Should cotton production in

Dissankuy be related to decreased household sales behavior, some households may in fact have zero cereal sales. Thus, the relevant data set would include all sample households in Dissankuy, including those that did not sell as well as those that did. Although the mean yearly cereal sales of the cotton producing households was larger than that of the non-cotton group, there was insufficient evidence to conclude that the means were significantly different (Table 2). This was primarily a result of the large standard deviation in mean cereal sales for the two groups, as well as the small number of observations.

To investigate further the effect of cash cropping on cereal sales, mean gross sales of cash crop and non-cash crop producing households were compared for all villages except Dissankuy. All the observations in the data set were combined across villages in order to increase the number of observations for the non-cash crop producing group. Cash crops were defined as peanuts and cotton, and since only one household produced cotton outside of Dissankuy (this household also produced peanuts), the mean yearly cereal sales of peanut and non-peanut producers are being compared.

The data indicate that mean yearly cereal sales of cash crop producing households were larger than for non-cash crop producing households, both for selling households and for the sample as a whole (Table 3). The results are significant.

In terms of wealth, agricultural households are an extremely heterogeneous group. As a result, cereal sales vary greatly among households, even within a given village. Households which have alternate sources of capital for liquidation, such as animals, can be expected to behave differently from those that do not. The resource endowment in agricultural equipment may affect a household's productivity, and hence the quantity of cereal available for sale. Households with like endowments of these wealth components could be expected to behave similarly.

As would be expected, the poorest and lower middle group were responsible for a smaller proportion of the total cereal sales than were the wealthier and upper middle group (Table 4). The relationship between wealth and sales volume, however, was not strictly linear. In fact, the wealthiest farmers were responsible for a smaller proportion of total yearly sales than were farmers in the upper middle wealth group (28% vs. 34%).

On a per household basis, however, the relationship between wealth and sales is a direct one. Households in the top wealth group sold more on average that did households in any other group, both when selling households or all wealthy households are considered. Among selling households, the wealthiest group had average sales which were more than 3.5 times greater than those of the poorest group. Policies designed to increase net sales may therefore affect wealthier farmers to a greater degree than those in the lower income group.

Interestingly, when the results are examined on a producer equivalent basis, the lower middle group sold a larger amount of cereal than did the upper middle group (Table 4). This was true both for selling households and for all sample households.

The ranking of villages with regard to gross sales is modified within wealth groups. On a volume basis, however, Dissankuy still accounts for the smallest proportion of cereal sales in three of the four wealth groups.

Each village represents a different region of the country and varying cropping patterns. Sales data (Table 5) reflect these differences. In Nedogo, located on the Central Plateau, millet accounted for the largest share of cereal sales during the ye representing 37 percent of the total in that village. Red and white sorghum were also important crops, accounting for 26 percent and 25 percent, respectively, of Nedogo cereal sales. In Dissankuy, white sorghum represented 83 percent of the cereal sold. Millet was the next most important commercial cereal crop sold in this village. In Diapangou, sorghum and millet are grown and harvested together, accounting for the importance of sales of this intercrop combination in that village.

In Nedogo, Dissankuy, and Diapangou, the crop mix of cereal sales reflects closely the 1983 harvest (Table 6). For example, in Nedogo, millet accounted for both the largest amount of sales and the greatest share of harvest, white sorghum represented 26 percent of harvest and a quarter of the cereal sold. Red sorghum accounted for 18 percent of the 1983 harvest and 26 percent of cereal sales. The relatively greater proportion of red sorghum in sales versus harvest can be explained by the fact that red sorghum is not an important food crop. Rice, a minor crop in terms of sales, was cultivated as a cash crop; 86 percent of the 1983 rice harvest was sold. In Dissankuy, white sorghum accounted for 83 percent of the cereal sales and 76 percent of

the harvest. Millet was the next most important crop in terms of both sales and harvest. Interestingly, a larger proportion of millet harvest was sold than was the case for white sorghum, again reflecting food preferences. In Diapangou the millet/sorghum association represented the largest share of both harvest and sales.

Poedogo followed the same pattern as the other three villages in terms of red sorghum sales: large harvest was associated with large sales volume. The pattern for rice, on the other hand, was different; in Poedogo rice accounted for a large share of cereal sales (43%), but represented only 10 percent of the 1983 harvest. In fact more rice was sold than was available for allocation from the 1983 harvest. As would be expected, rice did not represent a significant amount of cultivated area in Poedogo. Only three percent of the land cultivated by sample farmers was devoted to rice in 1983. Carry-over stocks of rice were insignificant; gross purchases for rice were high, accounting for 22 percent of total cereal purchases from October 1983 to September 1984 for selling households.

These findings indicate that rice may play a different role in the Poedogo economy than other cereal crops. The large ratio of rice sales to rice harvest supports the conclusion that rice sales activity depends as much on purchases as on own production.

Regression Analysis

The objective of this analysis was to explain the variation in yearly cereal sales among households. Several factors could be expected to influence the amount of grain that a household is able to sell. In farming households operating close to the margin, the amount of grain harvest would likely influence sales heavily. The amount of harvest in turn is directly related to the productive capacity of the farming unit. One measure of productive capacity is the number of producer units in the household. Because producer units and harvest are directly related, inclusion of both variables would have resulted in multicolinearity. This analysis attempts to study yearly sales in terms of grain allocation over time. For this reason, harvest was chosen over producer units for inclusion as an independent variable.

In multiple enterprise farming households, cereal sales are one option for cash generation. Sales of livestock are another. The stock of small

ruminants and cattle should be influential in predicting the amount of grain sold, although it is difficult to hypothesize on the direction of the association. Households with smaller stocks of animals may sell more cereal to provide for their cash needs. On the other hand, those households which are active in cereal commerce may rely on their animal sales to supplement this activity.

Sales of cash crops also represent an alternative to cereal sales for cash generation. Cash cropping was identified as a possible important factor in the previous section of the report. The regression analysis includes cash crop hectarage as an explanatory variable, a proxy for cash crop sales.

Price policy is one avenue open to the government of Burkina Faso in an attempt to increase the amount of surplus marketed by farmers. At present, the government marketing board attempts to provide a minimum purchase price for cereal producers. This analysis attempts to determine the effect of price on cereal sales.

Producer units affect a household's productive potential. Likewise, the number of consumers could be expected to influence the amount of cereal which is sold during the year. Consider two households with the same amount of cereal available for allocation, but with different numbers of consumers. After assuring consumption needs, the household with the smaller number of consumers would have a greater amount of cereal available for alternate uses. Thus, consumer units could be expected to be negatively related to sales.

Based on these variables, three different regression models were used to explain the variation in yearly cereal sales among households (Table 7). The first model is simple, relating yearly sales to animal units, harvest and consumer units. The second model adds price, while the third adds both cash crop hectarage and price. Because the variables were not normally distributed, all variables were transformed to natural logarithms. Using the ordinary least squares technique, these three models were regressed on the total amount of cereal sales during the October 1983-September 1984 period. The regressions were performed on both a wealth group and village basis, with each household contributing one observation to the regression.

When the regressions were performed utilizing the first and second models on household observations within wealth groupings, no statistically significant results were obtained. The third model was able to explain a

statistically significant amount of variation in gross sales only for one of the twelve combinations of models and wealth groups. When regressions were performed by wealth groups using the three models modified to include dummy variables for village effects, the results were similar: the regression procedure did not explain a statistically significant amount of the variation in yearly cereal sales. These findings do not support the initial hypothesis that selling behavior was more homogeneous among wealth groupings than across villages. It appears that the differences between villages overpower any similarity in sales behavior caused by similarities in wealth.

Based on the results of the wealth group-level analysis, each model was re-estimated by village. For Nedogo (Table 8), all three models resulted in statistically significant regressions at the .05 probability level. Inclusion of the price in the second model, and price and cash hectares in the third, did not result in a significant improvement in the explanatory power of either of these models over the base model. The explanatory power of the base model in Nedogo was fairly high, resulting in an R^2 of 51 percent.

The results for Dissankuy were statistically significant, at the .05 level, for all three of the models used (Table 9). The R^2 obtained in each model was 77, 78 and 80, respectively. The reduction in error obtained by using the second model, however, was not sufficient to conclude that it had greater explanatory power than the first, nor did the results support the conclusion that the third model explained more of the variation than did the second.

The results for both Poedogo and Diapangou were puzzling. None of the models resulted in a statistically significant regression (Tables 10 and 11). In Poedogo, the third model resulted in the largest F ratio, indicating that the price and cash hectarage variables may be important in explaining cereal sales. The small number of observations in the Poedogo data undoubtedly makes estimation of a regression equation difficult. For the Diapangou data, the first model came the closest to explaining a significant amount of the variation in sales resulting in an F statistic of .2385. All of the Diapangou households had animal traction, which may affect their sales behavior in some way not taken into account by the models.

For Nedogo and Dissankuy, the regression results indicate that between 51 and 77 percent of yearly cereal sales could be explained by the regression

model based on animal stocks, harvest and consumer units. In Nedogo, of those variables tested, only the 1983 harvest was seen to have a statistically significant coefficient. The regression equation thus reduces to include only this variable. Of the four villages studied, Nedogo was located in the least productive area. In 1983, Nedogo households harvested the smallest amount of cereals of all five villages. Nedogo is located on the heavily populated Central Plateau, receives the least rainfall, and has the least fertile soils. The regression results indicate, that in the Nedogo situation, cereal sales are seen to be highly dependent on output.

In Dissankuy, both the animal and harvest variables had significant and positive coefficients. Dissankuy households with larger stocks of animals were characterized as having a greater amount of cereal sales. This finding supports the hypothesis that high levels of cereal selling and animal stocks are complementary. The consumer unit variable was also significant in Dissankuy and had a negative coefficient; in this village, households which were more likely to sell had a smaller number of mouths to feed. This result supports the hypothesis that households with larger consumption requirements are less able to sell then those whose consumption requirements are more limited, at least in the Dissankuy context. In situations where agricultural conditions are better, output considerations are important, but so are decisions as to the relative number of consumers to be satisfied.

Cotton production is an important activity in Dissankuy. For the sample as a whole 16 percent of the cropped area in 1983 was devoted to the production of cotton. It is surprising that the cotton hectarage variable did not result in a significant coefficient. An alternative formulation may have yielded a different result. Cotton sales may be important as an alternative source of cash income. Use of the value of cotton sales rather than cotton hectares in a regression model may be more useful in explaining the cereal sales. This issue needs further research.

The descriptive analysis of Poedogo sales data indicated that more rice was sold during 1984 than was harvested in 1983. Rice was also an important crop in terms of sales volume. In order to investigate the role of rice in Poedogo sales, the regression models were re-estimated for rice sales, and for grain sales of all cereals except rice. The harvest and price dependent

variables were recalculated to take into account only those crops which contributed sales data to the dependent variable.

For rice sales, the base model did not predict a statistically significant amount of the variation in sales (Table 12). Both the second and third models produced statistically significant regressions of rice sales (at the .05 level), although there was not sufficient evidence to conclude that the third model explained a greater amount of variation than the second.

Utilization of the second model, which includes price, yielded an R^2 of 84 percent. The intercept term, as well as the price, harvest and consumer equivalent terms all had significant coefficients. Since such a large share of rice harvest is marketed, it is not surprising that the coefficient on price should be significant and positive. The positive coefficient on the harvest variable indicates that large rice harvests are associated with large rice sales. This is both an obvious and important conclusion. As in Nedogo and Dissankuy, harvest is an important variable for explaining rice sales (in Poedogo).

It has been argued by Haessel that in self-sufficient villages the question of price endogeneity is important to a model of marketed surplus. Inclusion of both output and prices as exogenous variables, could lead to biased ordinary least squares estimates. A re-estimation of his model using two stage least squares shows that some of the results differ substantially (Haessel 1975). Both price and output were retained as explanatory variables using ordinary least squares procedures in the model. Further analysis would suggest the use of two stage least squares procedures. Since the rice harvest was smaller than rice sales, however, the price of rice may be exogenous to some degree.

Regressing yearly cereal sales for crops other than rice did not result in a significant regression for any of the three models. As was the case when total sales were the dependent variable, the model containing price and cash hectarage resulted in the largest F value. Poedogo is located in a fertile area, often called the dolo capital of Burkina Faso because of the importance sorghum beer production as a commercial activity. Poedogo is also located near an active market. For these reasons, it is likely that price plays a greater part in the determination of cereal sales than in the other villages. The largest share of non-rice sales was accounted for by red sorghum, it is

logical to assume that sales behavior for red sorghum contains elements which were not contained in any of the regression models. One possibility is that the data may not be adequately reflecting the use of red sorghum in beer production. The sample size may also be a problem limiting the usefulness of the models.

In an attempt to explain cereal sales behavior in Diapangou and Poedogo, the observations for these two villages were combined and the three models re-estimated for non-rice sales. The results indicated that neither the first or second models were able to explain a significant amount of the variation in yearly non-rice cereal sales. Surprisingly, use of the third model resulted in a significant regression, with a significant and positive coefficient for cash crop hectares (Table 13). The resultant R^2 of 27 percent indicated that the explanatory power of the model was moderately high. These results provide additional evidence to reject the hypothesis that cash crop hectarage (and by proxy, cash crop sales) are negatively associated with cereal sales. This seems in contradiction to the descriptive statistics on cereal sales in Dissankuy. The explanation may relate to the different roles of cotton and peanuts as cash crops.

Intra-annual Behavior

The cereal grain market in Burkina Faso is highly seasonal. Changing prices could be expected to have an impact on seller behavior. This section seeks to describe the intra-annual behavior of the farming households studied. Rainfall patterns in Burkina Faso result in distinct dry and wet seasons. Harvest of cereal grains generally takes place from October through December. From then on, cereal stocks fall, reaching their pre-harvest low during the soudure or "hungry period" of July-September. Despite efforts to stabilize prices by the government marketing board, prices fluctuate widely within a given agricultural year, in response to the periodicity of rainfall,

and the resultant effects of supply and demand in the marketplace. Based on these patterns, the agricultural year can be divided into four periods. These are the harvest, dry, hot, and wet seasons corresponding to the periods October-December, January-March, April-June, and July-September, respectively. This division follows that of Sherman (1984).

Observed patterns of selling behavior differed for the four villages studied (Table 14). In Nedogo, the largest volume of cereals were sold during the January-March period, representing 40 percent of the total sold for that village. The July-September period accounted for the largest amount of cereal sales on a per selling household basis. This period had lower sales volume but resulted in a larger per household figure due to a smaller number of selling households. The pattern in Diapangou was similar to that in Nedogo. In these villages, fewer households sold in the hungry period (July - September), but each sold a larger amount than in any other period. This finding suggests that few households sell when prices are most favorable. Those households that can sell during the favorable price period, however, market a larger quantity than that sold on average during the rest of the year.

In Poedogo, the largest sales took place during the 1983 harvest period. These sales represented 48 percent of the yearly total. In terms of selling households, the harvest period also accounted for the largest share of sales, although only slightly less was marketed from July-September. The data from Dissankuy present more of a mixed picture. Slightly less cereal was sold during the July-September period than from January to March (1,599 kg vs. 1,640 kg), but the same number of households sold cereal grains in both periods, resulting in similar volume per selling household. As in Poedogo, the largest amount of cereal sales per selling household took place during the October to December period.

Dry period sales in Dissankuy could be influenced by the timing of payments for cotton production. Should these payments be late, cereal sales would represent an alternative for cash generation. The data do show that seven of the nine dry season sellers were also cotton producers. Without data on expenditures and cotton remittances, however, no definitive test of this hypothesis is possible.

The timing of a given household's cereal sales could be expected to be influenced by that household's wealth position. Wealth represents alternative resources available to answer cash needs. Wealthier households may be better able to take advantage of fluctuations in market prices. For all four wealth groups, the greatest number of households sold during the January-March period (Table 15). Except for the wealthiest group, the harvest period represented the second most likely time for a household to sell. Although the greatest proportion of selling households were active January-March, this period accounted for the largest volume of cereal sold only for the poor and wealthiest groups. The lower middle group sold both the largest volume of cereals and the largest volume per selling household during the low-price October-December period, but sold only slightly less (197 kg. vs. 216 kg.) per selling household from July-September than in the harvest period. The data indicate that although fewer households in the lower middle and upper middle wealth groups sold in the July-September period the size of the sale was relatively larger than during other periods of the year.

With regard to the higher price periods, there is some indication that the wealthier households were more active sellers than the poorest households. During the April-June period, the wealthiest group was responsible for the largest amount of cereal sales, both in terms of volume as well as on a per selling household basis. Although the upper middle wealth group sold a smaller volume than the lower middle group, the average amount sold was higher. The April-June period was also the time in which the second largest proportion of wealthiest households were selling.

In July-September when prices were highest, the upper middle wealth group had the greatest number of households able to sell and sold more than any other wealth group. The upper middle group sold both the greatest volume and the largest amount per selling household during the high-price July-September period than at any other time of the year. It seems significant that for all but the poorest group, at least 30 percent of the households (who sold at some time in the year) were involved in marketing activity during the high-price July-September period. It is also interesting that the upper middle group had

the largest proportion of sellers active from July-September. This observation, along with the fact that this group sold the largest volume and amount per household in the July-September period, identifies the upper middle group as being the most able to take advantage of price fluctuations.

The lower middle wealth group appears to have the greatest frequency of sales. In this group, 56 percent of the selling households had sales in three of the four time periods studied, compared with 46 percent and 38 percent for the upper middle and wealthiest groups, respectively. This finding indicates that households in the lower and upper middle groups were active in a greater number of periods than the wealthiest group. This is a strategy consistent with the need for higher turnover, perhaps related to these households lower wealth position.

In summary, these results provide some evidence to support the conclusion that wealth is associated with selling in higher price periods. It was not clear, however, that the wealthiest households were consistently selling greater aggregate volumes or greater volumes per selling households during the higher price periods. The measure of wealth used in this analysis was determined to a large degree by animal stocks. The behavior of the wealthiest group may reflect to a greater extent the influence of the animal market than that of the cereal grain market. In addition, it should be remembered that while differences exist in wealth position among households, huge discrepancies in wealth status are somewhat rare.

CHAPTER 4

CONCLUSIONS AND POLICY IMPLICATIONS

Analysis of yearly cereal sales for the October 1983-September 1984 period revealed that although nearly 80 percent of sample households sold, absolute levels are low. In addition, large variations exist across households. This data set contains a small number of observations and, therefore, is very sensitive to the influence of individual household observations. The variation was decreased somewhat by the elimination of extreme outliers.

The analysis of cereal sales revealed two interesting and potentially important issues. The first is the effect of harvest or output on cereal sales. In Nedogo, located on the Central Plateau, harvest was found to be the primary determinant of cereal sales. Of the four villages, Nedogo has the least favorable rainfall and soil fertility conditions. In such a situation, output is probably the most limiting factor in the quantity of cereal sold. This conclusion is basic but also potentially significant. It suggests that in marginal conditions, output may need to be increased before any significant increase in sales can be accomplished.

In Dissankuy, which is characterized by more productive conditions of soil fertility and rainfall, output was also seen to be a major determinant of cereal sales. In this village, a large proportion of the cultivated area was devoted to the production of cash crops. Faced with a given endowment of labor and land, a household which devotes resources to cash cropping will have a lesser ability to produce cereal crops. Sales of cereal grains may therefore depend heavily on the harvest, once consumption needs of the household are taken into account. This may explain the importance of the consumer unit variable in the Dissankuy results. For Dissankuy, the results suggest a hypothesis for further study: what is the influence of cotton production on cereal sales? In this analysis, it was not possible to make a definitive determination. Indications from the combined Poedogo-Diapangou results indicate that peanut sales are directly related to cereal sales. It

appears that different cash crops are affecting cereal sales differently. Once the relationship of cash cropping to cereal sales is established, policy makers will be faced with the issue of how to best influence the allocation of fertile land between cash and food crop production.

The results for Poedogo are important in terms of their implications for price policy. Price and output were seen to be important variables in explaining the variation in rice sales among farming households. Analysis also indicated that rice sales exceeded rice harvest. Thus price was seen to be important when a large share of output is marketed.

Price may very well be a determinant of the decision of how much to sell for crops which have similar proportion of sales to own production, and in areas which have similar commercial opportunities to those found in Poedogo. Price policy would represent a potential area for government intervention designed to increase the amount of cereal sales in this case. It remains to be seen, however, whether the functioning of the market does not produce prices which are higher than those the government is able to support. In addition, the influence of price on output should be further explored.

Considerable differences in sales behavior were found across villages. In as much as the four villages studied are representative of regions and regional sales behavior in Burkina Faso, these differences need to be taken into account in the formulation and implementation of marketing policy.

A brief descriptive analysis of intra-annual behavior indicated that there are considerable differences in the volume of cereal sales within a given year. Policies which take into account the intra-annual variations in price and supply would be more effective in achieving their objective than those that do not.

Table 1. Yearly gross cereal sales by village.

Village	Gross Sales				
	Sellers			Sample	
	Sum (kg)	Per Household	Per Producer Equivalent	Per Household	Per Producer Equivalent
Nedogo	8,033	286.89	42.76	277.00	42.13
Poedogo	8,799	488.83	82.70	419.00	71.42
Dissankuy	4,859	373.77	72.31	179.96	39.47
Diapangou	9,765	443.86	79.98	390.60	71.49
Total	31,456	388.35		308.39	

Table 2. Dissankuy: mean yearly gross cereal sales of cotton and non-cotton crop producing households.

	Sellers				Sample			
Group	N	Mean	Standard Deviation	T Statistic	N	Mean	Standard Deviation	T Statistic
Cotton	10	426.40	286.50	1.5526[1]	21	203.05	290.78	1.1158[1]
Non-cotton	3	198.33	200.27		6	99.17	166.87	

[1]No significant difference at .10 level.

Table 3. Nedogo, Poedogo, and Diapangou: mean yearly gross cereal sales of cash and non-cash crop producing households.

	Sellers				Sample			
Group	N	Mean	Standard Deviation	T Statistic	N	Mean	Standard Deviation	T Statistic
Cash-crop	62	412.10	434.71	2.7254***	69	370.29	430.38	2.3015***
Non-cash crop	6	174.50	165.27		6	174.50	165.27	

***Significant at .05 level.

Table 4. Yearly gross cereal sales by wealth group.

Village	Sellers			Sample	
Wealth	Sum (kg)	Per Household	Per Producer Equivalent	Per Household	Per Producer Equivalent
Poorest	2,147	153.36	29.90	89.46	19.87
Lower Middle	9,851	394.04	73.24	328.37	60.92
Upper Middle	10,755	413.65	65.36	370.86	60.22
Wealthiest	8,703	543.94	77.22	458.05	69.51
Total	31,456	388.35		308.39	

Table 5. Yearly gross cereal sales disaggregated by crop for four villages in Burkina Faso.

Village	Crop						Total
	Red Sorghum	White Sorghum	Millet	Rice	Maize	Millet/ Sorghum[1]	
Nedogo	2,059[2]	2,022	2,984	433	535	--	8,033
	25.63[3]	25.17	37.15	5.39	6.66	--	100
Poedogo	3,812	1,204	--	3,783	--	--	8,799
	43.32	13.68	--	42.99	--	--	100
Dissankuy	--	4,030	789	--	40	--	4,859
	--	82.94	16.24	--	.82	--	100
Diapangou	--	439	--	97	--	9,229	9,765
	--	4.50	--	.99	--	94.51	100

[1]Millet/sorghum association
[2]Sum in kg.
[3]Percent of total.

Table 6. Cereal harvest for four villages in Burkina Faso, 1983.

Village	Crop						Total
	Red Sorghum	White Sorghum	Millet	Rice	Maize	Millet/ Sorghum[1]	
Nedogo	7,005[2]	10,281	19,632	502	1,453	--	38,873
	18.02[3]	26.45	50.50	1.29	3.74	--	100
Poedogo	22,762	3,233	5,255	3,641	464	--	35,355
	64.38	9.14	14.86	10.30	1.31	--	100
Dissankuy	--	25,052	7,577	--	180	--	32,809
	--	76.36	23.09	--	.55	--	100
Diapangou	--	1,592	--	582	1,530	42,096	45,800
	--	3.48	--	1.27	3.34	91.91	100

[1]Millet/sorghum association.
[2]Sum in Kg.
[3]Percent of total.

Table 7. Regression models used to explain variation in yearly cereal sales.

Model		
First	Second	Third
LANUNITS[1]	LANUNITS	LANUNITS
LHARVEST[2]	LHARVEST	LHARVEST
LCONSUMERS[3]	LCONSUMERS	LCONSUMERS
	LPRICE[4]	LCASHA[5]
		LPRICE

[1]Natural logarithm of stock of goats, sheep and cattle in December 1983. Goats and sheep converted to an equivalent based on a factor of .06 of cattle derived from sales data.
[2]Natural logarithm of total cereal harvest in 1983, calculated from carry-over, inflows, outflows and December 1983 stocks.
[3]Natural logarithm of consumer equivalents calculated using 1984 census information and conversion factors as shown in Appendix 1.
[4]Natural logarithm of mean yearly cereal price.
[5]Natural logarithm of peanuts and cotton hectarage from 1983 cropping season.

Table 8. Nedogo: regression results of three models used to explain variation in yearly cereal sales.

Model 1

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	3	20.7265	6.9088	8.233***	.5072
Error	24	20.1394	.8391		
Total	27	40.8659			

PARAMETER ESTIMATES

Variable	Parameter Estimate	Standard Error	T Statistic
Intercept	-4.6103	3.0632	-1.505
LANUNITS	.0324	.1453	.223
LHARVEST	1.3643	.3746	3.642***
LCONSUMERS	-.0027	.5008	-.005

Model 2

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	4	20.7938	5.1984	5.957***	.5088
Error	23	20.0721	.8727		
Total	27	40.8659			

PARAMETER ESTIMATES

Variable	Parameter Estimate	Standard Error	T Statistic
Intercept	-7.2976	10.1708	-.717
LANUNITS	.0081	.1720	.047
LHARVEST	1.3383	.3933	3.402***
LCONSUMERS	.0145	.5145	.028
LPRICE	.6179	2.2257	.278

Table 8. (Continued)

Model 3

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	5	20.7939	4.1588	4.558***	.5088
Error	22	20.0720	.9124		
Total	27	40.8659			

PARAMETER ESTIMATES

Variable	Parameter Estimate	Standard Error	T Statistic
Intercept	-7.2880	10.4273	-.699
LANUNITS	.0081	.1758	.046
LHARVEST	1.3359	.4437	3.011***
LCONSUMERS	.0130	.5395	.024
LCASH	.0031	.2492	.013
LPRICE	.6190	2.2773	.272

***significant at .05 level.

Table 9. Dissankuy: regression results of three models used to explain variation in yearly cereal sales.

Model 1

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	3	13.3971	4.4657	10.133***	.7716
Error	9	3.9663	.4407		
Total	12	17.3634			

PARAMETER ESTIMATES

Variable	Parameter Estimate	Standard Error	T Statistic
Intercept	1.8202	3.3354	.546
LANUNITS	.2768	.1159	2.387***
LHARVEST	1.5545	.4527	3.434***
LCONSUMERS	-1.5685	.5581	-2.810***

Model 2

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	4	13.4910	3.3727	6.968***	.7770
Error	8	3.8725	.4841		
Total	12	17.3634			

PARAMETER ESTIMATES

Variable	Parameter Estimate	Standard Error	T Statistic
Intercept	3.7033	5.5232	.671
LANUNITS	.3012	.1335	2.255**
LHARVEST	1.6054	.4884	3.287***
LCONSUMERS	-1.6491	.6129	-2.691***
LPRICE	-.4249	.9649	-.440

Table 9. (Continued)

Model 3

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	5	13.8211	2.7642	5.462***	.7960
Error	7	3.5423	.5060		
Total	12	17.3634			

PARAMETER ESTIMATES

Variable	Parameter Estimate	Standard Error	T Statistic
Intercept	3.4516	5.6558	.610
LANUNITS	.2459	.1527	1.610
LHARVEST	1.6180	.4996	3.239***
LCONSUMERS	-1.7529	.6397	-2.740***
LCASH	.2057	.2546	.808
LPRICE	-.3810	.9881	-.386

** and *** indicate a level of significance of .10 and .05, respectively.

Table 10. Poedogo: regression results of three models used to explain variation in yearly cereal sales.

Model 1

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	3	4.3118	1.4373	.871[1]	.1573
Error	14	23.0960	1.6497		
Total	17	27.4078			

Model 2

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	4	10.2306	2.5577	1.936[1]	.3733
Error	13	17.1772	1.3213		
Total	17	27.4078			

Model 3

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	5	12.5925	2.5185	2.040[1]	.4594
Error	12	14.8154	1.2346		
Total	17	27.4078			

[1]Not significant at .10 level

Table 11. Diapangou: regression results of three models used to explain variation in yearly cereal sales.

Model 1

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	3	3.2457	1.0819	1.540[1]	.2042
Error	18	12.6472	.7026		
Total	21	15.8929			

Model 2

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	4	3.4732	.8683	1.189[1]	.2185
Error	17	12.4197	.7306		
Total	21	15.8929			

Model 3

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	5	3.5619	.7124	.924[1]	.2241
Error	16	12.3310	.7707		
Total	21	15.8929			

[1]Not significant at .10 level.

Table 12. Peodogo: regression results of three models used to explain variation in yearly rice sales.

Model 1

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	3	6.0093	2.0031	2.790[1]	.4819
Error	9	6.4619	.7180		
Total	12	12.4713			

Model 2

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	4	10.4976	2.6244	10.637***	.8417
Error	8	1.9737	.2467		
Total	12	12.4713			

PARAMETER ESTIMATES

Variable	Parameter Estimate	Standard Error	T Statistic
Intercept	-31.5684	7.4922	-4.214***
LANUNITS	-.0581	.2030	-.286
LHARVEST	.2173	.0669	3.249***
LCONSUMERS	2.0071	.5556	3.613***
LPRICE	5.0840	1.1920	4.265***

Table 12. (Continued)

Model 3

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	5	10.5059	2.1012	7.484***	.8424
Error	7	1.9654	.2808		
Total	12	12.4713			

PARAMETER ESTIMATES

Variable	Parameter Estimate	Standard Error	T Statistic
Intercept	-31.3062	8.1369	-3.847***
LANUNITS	-.0681	.2243	-.304
LHARVEST	.2118	.0782	2.708***
LCONSUMERS	2.0052	.5928	3.383***
LCASH	-.0198	.1154	.172
LPRICE	5.0340	1.3045	3.859***

[1]Not significant at .10 level.
** significance at .05, respectively.

Table 13. Peodogo and Diapangou: regression results of three models used to explain variation in yearly non-rice sales.

Model 1

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	3	4.8358	1.6120	1.196[1]	.1038
Error	31	41.7658	1.3473		
Total	34	46.6016			

Model 2

ANALYSIS OF VARIANCE

Source	DF	Sum of Squares	Mean Square	F Value	R^2
Model	4	5.9054	1.4763	1.088[1]	.1267
Error	30	40.6962	1.3565		
Total	34	46.6016			

Table 14. Gross cereal sales disaggregated by quarters for four villages in Burkina Faso.

Village	Quarter				Yearly Total[1]
	October-December	January-March	April-June	July-September	
Nedogo	20[2]	27	18	10	
	1,749[3]	3,216	1,420	1,648	8,033
	21.77[4]	40.03	17.68	20.52	100
	87.45[5]	119.11	78.89	164.80	107.11
Poedogo	17	15	11	7	
	4,204	2,091	868	1,636	8,799
	47.78	23.76	9.86	18.59	100
	247.29	139.40	78.91	233.71	175.98
Dissankuy	4	9	6	9	
	790	1,640	830	1,599	4,859
	16.26	33.75	17.08	32.91	100
	197.50	182.22	138.[illegible]	177.67	173.54
Diapangou	7	20	5	7	
	1,024	5,196	845	2,700	9,765
	10.49	53.21	8.65	27.65	100
	146.29	259.80	169.00	385.71	250.38

[1]October 1983-September 1984
[2]Number of households selling in period.
[3]Sum in kg.
[4]Percent of yearly total.
[5]Gross sales per selling household in kg.

Table 15. Gross cereal sales disaggregated by quarters for each wealth group.

Village	Quarter				Yearly Total[1]
	October-December	January-March	April-June	July-September	
Poorest	8[2]	13	4	4	
	448[3]	1,206	85	408	2,147
	20.87[4]	56.17	3.96	19.00	100
	56.00[5]	92.77	21.25	102.00	74.03
Lower Middle	18	21	16	9	
	3,896	2,962	1,224	1,769	9,851
	39.55	30.07	12.43	17.96	100
	216.44	141.05	76.50	196.56	153.92
Upper Middle	17	21	12	14	
	2,150	3,583	1,008	4,014	10,755
	19.99	33.31	9.37	37.32	100.00
	126.47	170.62	84.00	286.71	168.05
Wealthiest	5	16	8	6	
	1,273	4,392	1,646	1,392	8,703
	14.63	50.47	18.91	15.99	100
	254.60	274.50	205.75	232.00	248.66

[1]October 1983-September 1984.
[2]Number of households selling in period.
[3]Sum in kg.
[4]Percent of yearly total.
[5]Gross sales per selling household in kg.

Appendix 1: Conversion factors used to calculate producer and consumer equivalents.

Age	Producer		Consumer	
	Male	Female	Male	Female
Years				
0 - 4	0	0	.20	.20
5 - 9	.25	.25	.50	.50
10 - 15	.80	.50	.75	.70
16 - 55	1.00	.80	1.00	.75
56 +	.70	.50	1.00	.75

Source: Matlon, Peter J. 1977. "The size distribution, structure, and determinants of personal income among farmers in the north of Nigeria." Ph.D. dissertation, Cornell University.

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