

**NOTES ON THE IMPLICATIONS OF FARM-LEVEL  
TRANSACTIONS DATA FOR  
THE PRMC CREDIT PROGRAM**

by

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### **INTRODUCTION**

In June 1989 USAID/Bamako commissioned an evaluation of the PRMC credit programs for grain traders and village cooperatives as part of its annual PRMC evaluation. The objective of the evaluation is "to assess the impact of grain storage credit on farmers' and traders' storage and income and make recommendations for the future of such programs." Included in the description of work for this evaluation is the assessment of the impact of the credit program on prices, the impact of price changes or price stability on farmers and farm income, the sustainability of grain trader credit programs in terms of trader profits and risks, and the sustainability of the cooperative credit programs in terms of village cooperative profit and risk.

This paper presents quantitative analysis of the coarse grain (millet, sorghum, and maize) marketing patterns of approximately 185 randomly selected farmers in the CMDT and OHV zones of Mali during the period 1985-1988. The analysis was designed to address issues related to the impact of the PRMC credit program on farmers and traders. The data used in the analysis are monthly quantities and prices for coarse grain sales and purchases made by individual farmers in the sample during the three-year data collection period. The data were collected under the CESA-MSU Food Security Project.<sup>1</sup> (For background on the CESA-MSU Food Security Project and the sampling procedures used, see Dione, 1989.)

The first section of this paper outlines the data and methods used in this analysis, including the typology of farmers developed in order to carry the analysis out. The second section discusses the results of the analysis of farmers' transactions patterns for coarse grains. This section highlights the characteristics and standard operating procedures of different groups of farmers in different years. The third section presents the results of two simulation exercises which, under different sets of assumptions, attempt to trace the impact of a credit program on smallholder coarse grain revenues and expenditures. The fourth section discusses the implications of these findings for coarse grain marketing and credit programs.

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<sup>1</sup> Farmers who also were grain traders (e.g., village grain assemblers) were excluded from this analysis.

## **I DATA AND METHODS**

The data used in the analysis covered a period of three very different production years. The first year, 1985-86, was a good production year following a bad production year. The second year, 1986-87, was a very good production year following a good production year. The third year, 1987-88, was a poor production year following a very good production year.

The sample of 185 farm households is divided between two institutional zones, the CMDT and the OHV. Previous analysis (e.g., Dione, 1989) has shown that the CMDT is a grain-exporting zone and the OHV is a grain-importing zone.

Using aggregated monthly transactions data, the sample was further divided into four transactions groups for each of the three years. Farmers not involved in the market as buyers or sellers were classified as having no transactions. Farmers who only bought on the coarse grains market were classified as "buy-only." Farmers who only sold on the coarse grains market were classified as "sell-only." Finally, farmers who both bought and sold coarse grains were classified as "both."

Within each transactions group there was a further division of the observations according to the magnitude of households' purchases and/or sales.

The following statistics were computed for each transactions group in each zone for all three years:

- a. number of households
- b. quantities of coarse grains purchased and/or sold (aggregate and per household)
- c. percent of annual purchases and/or sales made in different quarters of the year
- d. average weighted producer sale and purchase prices (per year and per season)
- e. revenues and expenditures from sales and/or purchases of coarse grains (aggregate and per household)

This last set of statistics was computed in a slightly different manner from the others. For the expenditure and revenue figures, 1987-88 was used as a benchmark year, and the same households that fell into each transactions group for that year were used in the computation of expenditure and revenue information for all three years. This was done so that coarse grain revenue and expenditure patterns for the same farmers could be compared across all three years.

## **II PATTERNS OF MARKET TRANSACTIONS FOR DIFFERENT GROUPS OF FARMERS**

The figures discussed in this section are presented at the end of this document in Tables 1-7.

## **CMDT and OHV**

Overall, the analysis supports the classification of the CMDT as an exporting zone and the OHV as an importing zone.

For the CMDT sample farmers, aggregate coarse grain sales were greater than aggregate coarse grain purchases, except during the third year (1987-88) when they were almost equal. The magnitude of the difference between aggregate sales and purchases was a close reflection of the type of production year. In 1986-87, the CMDT sample farmers exported almost 22 tons of coarse grains, whereas in 1985-86, net exports of the sample farmers were about 3.6 tons; and in 1987-88, net exports of these farmers were -.3 tons.

For the OHV, aggregate coarse grain sales of the sample farmers were always less than aggregate coarse grain purchases. To a certain extent the magnitude of the difference reflected the type of production year. In 1987-88, the worst production year during the three-year period, net imports of the sample totaled over 20 tons. Although the previous two years had been relatively good production years, net imports were still high. In 1986-87 the OHV sample farmers imported 16 tons and in 1985-86 they imported about 10.5 tons.

## **CMDT Buy-only**

This group of farmers appeared to be involved in the market to make up for deficits in their own production. The number of households buying grain and the volume purchased increased in poor production years relative to good production years.

### Participation

The number of farmers who were only buyers in the coarse grain market fluctuated inversely with the type of production year. In 1987-88, the worst production year, these farmers represented 29% of CMDT sample farmers (Table 1). In 1986-87, the best production year, these farmers represented only 15% of the CMDT sample farmers, the lowest point in the three year period (Table 2).

### Quantities

The quantities purchased by these buy-only farmers also reflected the type of production year: the quantities purchased in the relatively poor year was far greater than the quantities purchased in the relatively good years. In 1987-88, these sample farmers purchased a total of 15 tons (or 555 kg/household), whereas in 1986-87, these farmers purchased just over 4 tons (or 310 kg/household). In 1985-86 these buy-only farmers in the sample purchased a total of 10 tons (or 627 kg/household).<sup>2</sup>

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<sup>2</sup> The quantities purchased per household do not show the same year-to-year pattern of variation as the total quantities purchased because the number of households falling into the "buy-only" category varied from one year to the next.

### Seasonality

Seasonal trends in coarse grain purchases by this group varied from year to year (Tables 1-3). Overall, however, these farmers' seasonal buying patterns appeared to reflect the type of production year and how long household stocks were likely to carry the family. The second and third year analyses indicate that only 4% and 3% of coarse grain purchases were made in the first quarter (November-February) when prices are at an annual low. Therefore, this group of farmers was not purchasing grain at the most favorable period of the year (Tables 4-6).

In 1985-86, in contrast, 53% of the coarse grain purchases by these farmers were made in the first quarter (November-February). One might hypothesize that this was an attempt by farmers to augment depleted stocks of cereals after several poor harvest years.

In 1986-87, 70% of annual purchases by this group were made in the fourth quarter (August-October). Farmers probably had been able to delay purchases until the end of the year due to the good harvest of 1986. However, purchases were eventually necessary and occurred during the hungry season when prices were at their annual peak.

In 1987-88, 54% of annual purchases were made in the third quarter (May-August) and 28% in the second quarter. This probably reflects the relatively poor harvest of 1987, which did not provide this group of farmers adequate levels of home production for home consumption. This group probably purchased cereals during the second and third quarters because stocks were already running low at that time.

### Expenditures and Revenues

In 1987-88, this group of sample farmers spent 1.2 million CFAF on coarse grains purchases (45,000 CFAF/household).

In 1986-87, the most favorable production year of the three-year period, the same farmers were involved in both selling and buying coarse grains. The balance of expenditures and revenues for this group indicates that there were net cash out-flows for coarse grains of 96,000 CFAF, or 3,500 CFAF per household (only 8% of the 1987-88 total cash out-flows).

In 1985-86, the same farmers were again involved in both sales and purchases of coarse grains. Expenditures dominated revenues again, and the balance was 648,000 CFAF of cash out-flows for this group, or 24,000 CFAF per household (about 53% of the 1987-88 total cash out-flows).

The above pattern indicates the extent to which the coarse grain cash-flow situation of this group of farmers is linked with the production and price cycle. From a very good year to a bad year the same group of farmers' expenditures on coarse grains increased more than 12 times. From a good year to a very good year the same group of farmers' expenditures fell by more than 6 times.

### **CMDT Sell-only**

In absolute terms, the number of sample farmers in the CMDT who were only sellers in the coarse grain market and the quantities they sold were far more important than the buy-only group in all three years. In fact, this sample group is consistently responsible for moving the most grain in the CMDT. These farmers appeared to respond to the type of production year. In relatively good production years their involvement in the market, both in terms of the number of households and quantities sold, was higher than in relatively poor production years. Thus, it would appear likely that these farmers are selling to unload surplus production rather than because they are forced to sell in order to meet cash requirements. This is consistent with Dione's (1989) finding that most grain-surplus households in the CMDT meet their immediate post-harvest cash needs, such as tax payments, through cotton revenues rather than through coarse grain sales.

#### Participation

The number of sample farmers who were only sellers in the coarse grain market in 1987-88 represented 46% of CMDT sample farmers. In 1986-87 these farmers represented 60%, and in 1985-86 they were 45% of CMDT sample farmers.

#### Quantities

In terms of aggregate quantities sold, a similar pattern emerges. In 1987-88 this sample group sold a total of 17 tons of coarse grain (402 kg/household), in 1986-87 they sold 28.5 tons (509 kg/household), and in 1985-86 they sold almost 18 tons (413 kg/household).

#### Seasonality

Seasonal patterns appear to indicate that this group of farmers sold most of their coarse grains in the third and fourth quarters (except in 1985-86) and thus were able to take advantage of seasonal price increases occurring later in the year. In 1986-87, 70% of annual coarse grain sales were made after May; in 1987-88, the figure was 57%. In 1986-87, only 15% of annual coarse grain sales were made in the immediate post-harvest period when prices are at an annual low. In 1987-88, the figure was 17%.

In the first year, sales of coarse grains were fairly evenly distributed across the year. This was a year in which heavy OPAM purchases early in the season boosted prices at the beginning of the marketing year and distorted the normal seasonal pattern of prices, possibly inducing farmers to sell grain earlier in the year than normal (Staatz, Dioné, and Dembélé, 1989, Dioné and Dembélé, 1986).

#### Expenditures and Revenues

In 1987-88, this group of sample farmers received 1.3 million CFAF from coarse grains sales, or 29,000 CFAF per household.

In 1986-87, the most favorable production year of the three-year period, the same farmers were mostly involved in selling, although there was some buying of coarse grains as well. The balance of expenditures and revenues indicates that there were net cash in-flows for

coarse grains of 731,000 CFAF or 17,000 CFAF per household (about 58% of the 1987-88 total cash in-flows).

In 1985-86, the same farmers were again involved in both sales and purchases of coarse grains. Revenues dominated expenditures again, and the balance was 538,000 CFAF of cash in-flows for this group, or 13,000 CFAF per household (about 42% of the 1987-88 total cash in-flows).

The above pattern shows a steady increase in coarse grain revenues for this same group of farmers over the three-year period. While initially (1985-86) these farmers were both buying and selling, the buying behavior saw a dramatic drop in the subsequent year, and then was left off entirely in the third year. The very high revenues in the third year were in large part due to the doubling of the average annual price received by these farmers from the second to the third year (from 36 CFAF/kg to 73 CFAF/kg) even though quantity sold fell by 37% (cf. Tables 4 and 5). Coarse grain revenues improved dramatically over the three-year period.

### **CMDT Buy and Sell**

Overall, this group of sample farmers appears to purchase to make up for deficits in own production (purchases are negatively correlated with production) and does not sell more when production improves (sales are also negatively correlated with production). The fact that both sales and purchases fall when production improves seems to imply that this group of sample farmers is involuntarily active in the market in poor years. In other words, in poor years these farmers are perhaps engaging in forced sales early in the year (to meet tax, ceremonial and other expenses) and then making purchases later in the year to meet consumption needs. This hypothesis appears to be confirmed by the seasonal analysis discussed below. In terms of quantities, this sample group moves the least grain in the CMDT.

#### Participation

In 1987-88, 16% of CMDT farmers in our sample were active in both buying and selling coarse grains on the market. In 1986-87, participation in buying and selling coarse grains involved only 5% of the CMDT sample; and in 1985-86, farmers both buying and selling coarse grains accounted for 21% of the CMDT farmers in the sample.

#### Quantities

Quantities of grains both sold and bought also followed swings in production. In 1987-88, this group of sample farmers sold 3.4 tons (230 kg/household) and bought 6 tons (402 kg/household). In 1986-87 they sold .3 tons (60 kg/household) and bought 2.7 tons (538 kg/household). In 1985-86, they sold 3.6 tons (183 kg/household) and bought 7.7 tons (385 kg/household).

### Seasonality

The seasonal purchasing behavior of this group of sample farmers indicates that the bulk of annual purchases tended to fall towards the end of the year (in quarters 3 and 4), when prices were relatively high. The exception to this was in the first year, 1985-86, when purchasing by this group was spread fairly evenly across the four seasons.

The seasonal selling behavior of this group indicates that sales were made relatively early in the year (quarters 1 and 2), when prices were at an annual low. In all three years, sales fell off as the year progressed. Fourth quarter sales never exceeded 12% of the total during the three-year period.

### Expenditures and Revenues

In 1987-88, this group of farmers' spent, in net terms, 228,000 CFAF on coarse grain purchases (15,000 CFAF per household).

In 1986-87, the most favorable production year of the three year period, the same farmers were mostly involved in selling, although there was some buying of coarse grains as well. The balance of expenditures and revenues indicates that there were net cash in-flows for coarse grains of 223,000 CFAF (15,000 CFAF per household) -- a complete reversal of the following year.

In 1985-86, the same farmers were again involved in both sales and purchases of coarse grains. Revenues dominated expenditures again, and the balance was 94,000 CFAF of cash in-flows for this group (6,000 CFAF per household).

This pattern of coarse grain cash flows mirrors changes in coarse grain production. In the first good year (1985-86) after several bad years, the net cash balance was positive for this group. In the following very good year (1986-87), the cash balance was even more strongly positive for this group. However, in the third year, when production fell, the cash balance turned negative.

### **OHV Buy only**

Relative to the other sample groups in the OHV, the buy-only group was important both in terms of number of households and quantities purchased. Across the three year period, these farmers represented at least one-third of OHV farmers. Over the same period, the quantities imported by this group represented 59% to 64% of aggregate OHV imports.

### Participation

The number of farmers classified as buy-only farmers was fairly consistent over the three-year period, except for a slight drop in 1986-87. In 1987-88, 37% of OHV sample farmers only bought on the coarse grain market; in 1986-87, 32% of OHV sample farmers only bought; and in 1985-86, 36% of sample farmers only bought.

### Quantities

The quantities purchased by this group of sample farmers increased steadily across the three years from 11 tons in 1985-86 (351 kg/household) to 16.6 tons in 1986-87 (572 kg/household) to 20 tons in 1987-88 (590 kg/household).

### Seasonality

Seasonal buying patterns for this group suggest that buying occurs more or less evenly across the year. Although each year of data indicates a slightly different concentration of purchases across the year, there appears to be no significant seasonal pattern to this group's coarse grain buying.

### Expenditures and Revenues

In 1987-88 this group of farmers spent a total of 1.8 million CFAF on coarse grain purchases (52,000 CFAF per household).

In 1986-87, the most favorable production year of the three year period, the same farmers were mostly involved in buying although there was some selling of coarse grains as well. The balance of expenditures and revenues indicates that there were net cash out-flows for coarse grains of 748,000 CFAF, or 22,000 CFAF per household (42% of 1987-88 total cash out-flows).

In 1985-86, the same farmers were again involved in both sales and purchases of coarse grains. Expenditures dominated revenues again, and the balance was 423,000 CFAF of cash out-flows for this group, or 12,000 CFAF per household (about 24% of the 1987-88 cash out-flows).

The coarse grain cash-flow pattern of this group of farmers shows a steady increase in coarse grain expenditures over the three year period. Expenditures almost doubled from the first year to the second year, and more than doubled from the second year to the third year.

### **OHV Sell Only**

Excluding those farmers who did not participate at all in the market, this group of sample farmers was the least important in the OHV in terms of the number of households and quantities of grain traded.

### Participation

In contrast to the CMDT, the number of sample farmers in this category was negatively correlated with production: in 1986-87, only 15% of farmers in the OHV were only involved with selling coarse grains, as opposed to 22% in 1985-86 and 19% in 1987-88.

### Quantities

In terms of quantities, in each of the first two years this group of sample farmers sold 4 tons of coarse grains (211 kg/household in 1985-86 and 293 kg/household in 1986-87).

In the third year, it sold only 2.6 tons (157 kg/household). This decline in quantity sold in the third year reflects a certain ability to respond to production shortfalls. Because of this ability to curb sales when production falls, this group might be considered relatively well-off. However, these quantities are marginal in comparison with other groups in the OHV and with the sell-only group in the CMDT.

#### Seasonality

Seasonal patterns indicate that farmers in this group concentrated their sales in the quarter 1 and quarter 2, when prices were relatively low. Dione's (1989) analysis suggests that these sales may have been made to meet immediate post-harvest cash needs, especially tax payments.

#### Expenditures and Revenues

In 1987-88, this group of sample farmers received about 200,000 CFAF from coarse grains sales, or 12,000 CFAF per household.

In 1986-87, the most favorable production year of the three year period, the same farmers were mostly involved in selling, although there was some buying of coarse grains as well. The balance of expenditures and revenues indicates that there were net cash in-flows for coarse grains of 41,000 CFAF, or 2,000 CFAF per household (about 21% of the 1987-88 cash in-flows).

In 1985-86, the same farmers were more heavily involved in both sales and purchases of coarse grains than in any other year. Expenditures barely dominated revenues, and the balance was 17,000 CFAF of cash out-flows for this group, or 1,000 CFAF per household.

Most striking about the coarse grain cash-flow pattern for this group is the relatively small amounts of money involved. Although the cash balance steadily improved for this group of farmers, turning from slightly negative to positive over the three-year period, the absolute amounts were not nearly so important as the CMDT sell-only group. For that matter, the absolute amounts were the least important of any group in the OHV.

### **OHV Buy and Sell**

This sample group is second in size in the OHV after the buy-only group. In terms of quantities sold and purchased, this group was moving the greatest amount of grain in the OHV sample.

#### Participation

Participation in buying and selling among sample farmers in the OHV was inversely correlated with the production year. In the worst year, 1987-88, 36% of OHV sample farmers were buying and selling coarse grains. In the best year, 1986-87, 25% of OHV sample farmers were in this group.

### Quantities

In all three years, these farmers were purchasing more cereals than they were selling. Purchases for the sample group held steady at 9 tons in the first two years (309 kg/household in 1985-86 and 410 kg/household in 1986-87) and then went up to 12.2 tons in the third year (369 kg/household). Sales went steadily up from 4.4 tons (152 kg/household) in 1985-86 to 5.9 tons (258 kg/household) in 1986-87 to 9.2 tons (278 kg/household) in 1987-88. That sales and purchases were at an all time high in the poorest production year suggests that farmers in this group are relatively worse-off than farmers in the other groups, i.e., that they were forced to increase sales in poor production years to meet their cash needs. This is confirmed in the following section, where seasonal selling and purchasing patterns indicate that the sales of these farmers are typically made early in the year, when prices are at their annual lows and that purchases by these farmers tend to be made later in the year at annual price highs (Tables 1-6).

### Seasonality

Seasonal analysis indicates that, with the exception of the first year, this group of farmers concentrated purchases towards the end of the year when prices were typically high. In 1985-86 the bulk of purchases were made in the first and third quarters.

The seasonal sales patterns indicated that the majority of sales were made very early in the year in the post-harvest low-price period. Between 50-73% of annual sales were made in quarter 1. In 1985-86, 95% of sales were made in the first half of the marketing year. In 1986-87, the figure was 73%, and in 1987-88, it was 91%.

### Expenditures and Revenues

In 1987-88, this group of sample farmers spent, on balance, a net amount of 771,000 CFAF on coarse grains, or 23,000 CFAF per household.

In 1986-87, the most favorable production year of the three-year period, the same farmers were mostly involved in buying, although there was some selling of coarse grains as well. The balance of expenditures and revenues indicates that there were net cash out-flows for coarse grains of 312,000 CFAF, or 9,000 CFAF per household (40% of 1987-88 net expenditures).

In 1985-86, the same farmers were again involved in both sales and purchases of coarse grains. Expenditures dominated revenues again, and the balance was 456,000 CFAF of cash out-flows for this group, or 14,000 CFAF per household (59% of 1987-88 net expenditures).

The coarse grain cash-flow pattern for this group of farmers over the three-year period shows that expenditures on coarse grains consistently dominated revenues. The coarse grain cash flow pattern does appear to be associated with production swings in that expenditures were the highest in 1987-88 (the worst production year) and the lowest in 1986-87 (the best production year).

### III SIMULATION EXERCISES: THE POTENTIAL IMPACT OF THE CREDIT PROGRAMS

Two very simple scenarios were constructed to model the effects on smallholder revenues and expenditures from coarse grain transactions of a credit program for traders and associations villageoises (AVs). The scenarios are carried out for two different types of years: a mediocre production year, as exemplified by 1987-88; and a good production year (1986-87). The data analyzed in the preceding section were taken to represent the "before-PRMC credit program" scenario, as the data were taken from villages not participating in the program during the 1986-87 and 1987-88 agricultural seasons.

The first scenario is based on the following assumptions:

1. The implementation of a credit program would increase the first quarter post-harvest price for grain by 20% because of increased competition for grain to be held in commercial (trader and AV) stocks.
2. The higher level of commercial stocks would moderate the seasonal price rise, resulting in a fourth quarter pre-harvest price 20% below that which would occur without the credit program.
3. The quantities of grain both sold and purchased would remain constant for all transactions groups.
4. Second and third quarter prices would remain unchanged from the pre-credit situation.
5. For the category of farmers who both bought and sold grain, two separate analyses were made. The first assumed, as mentioned above, that the quantities of grain both sold and purchased remained unchanged. The second analysis was based on the hypothesis that this group sold grain early in the season because of pressing cash needs and bought grain back late in the season because these early "forced" sales had worsened the family's food situation. It was therefore assumed in the second analysis these farmers had a target cash income level for the post-harvest period. Therefore, if the credit program led to higher prices at harvest, these farmers would decrease the quantity they sold in this period to the point where they obtained the same revenue as before the credit program. It was further assumed that these farmers would attempt to maintain the same level of grain consumption as before the credit program. Consequently, they would lower their late-season fourth quarter purchases of grain by the same amount that they had reduced their first-quarter sales.<sup>3</sup>

The second scenario refined the first scenario by allowing the dampened price cycle to be spread between the third and fourth quarters. The second scenario is based on the following assumptions:

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<sup>3</sup> This last assumption was made to allow us to see the net effect of the credit program on the farmers' cash income. In reality, the farmers would probably spend some of their higher income on increased grain consumption.

1. The implementation of a credit program would increase the first quarter post-harvest price for grain by 20% because of increased competition for grain.
2. As in scenario 1, the larger commercial stocks would reduce the seasonal price rise. In this scenario, it was assumed that prices in the third and fourth quarters would each be 15% below those that would obtain without the credit program.
3. The quantities of grain both sold and purchased would remain constant for all transactions groups.
4. Second quarter prices would remain unchanged from the pre-credit situation.
5. The same type of additional analysis as in scenario 1 was carried out for the "Both" category of farmers. The only difference was that in this scenario, the reduction in sales in the first quarter was offset by reduced purchases in both the third and fourth quarters. (The decrease in purchases was divided evenly between the third and fourth quarters.)

The simulation exercises are presented in Tables 8-15. The results are summarized in Tables 16 and 17.

The most striking result is that, almost without exception, the group of farmers most positively affected by a credit program in both years under both scenarios is the "Both" group. Under the first scenario in 1987-88 (the year of mediocre production), the "Both" group saw an increase in net revenues of 17-18% in the CMDT and of 16-23% in the OHV (depending on varying assumptions). This was much higher than the "Buy-onlys" and "Sell-onlys," neither of which saw a change in either direction of more than 3%. However, in absolute terms, the "Buy-onlys" did see increases in net revenue of around 1,300 CFAF/household in both zones. Increases for the "Boths" were of the magnitude of 2,500-5,400 CFAF/household.

Under the second scenario for the same year (1987-88), the positive effect on net revenues for the "Buy-onlys" and "Both" groups were even more marked. The "Buy-onlys" saw increases in net revenues of 11% in the CMDT and 8% in the OHV (about 4,900 CFAF and 4,300 CFAF/household, respectively). The "Boths" saw increases of 21-22% in the CMDT and 26-33% in the OHV (3,100-3,300 CFAF and 6,100-7,700 CFAF/household, respectively). Given that this second scenario was perhaps more realistic in that it allowed the seasonal price rise to be moderated in the third quarter as well as the fourth quarter as a result of the credit program, the results indicate that the program would have the desired positive impact on the relatively "worse-off" groups of farmers in the sample. As seen earlier, many of these farmers make heavy purchases in the third quarter. The "Sell-onlys" would suffer a net revenue loss of 7% in both the CMDT and OHV under this scenario (about 2,000 CFAF and 850 CFAF/household respectively).

For 1986-87, a surplus production year, the results were slightly different. Under the first scenario, the groups most benefitting from the price changes brought on by the credit program were the "Buy-onlys" in the CMDT (an increase in net revenues of 14%, or about 1,800 CFAF/household) and the "Boths" in the OHV (an increase of 19-20%, or 2,600-2,700 CFAF/household). The "Boths" in the CMDT saw increases of only 3% (around 500 CFAF/household). The "Sell-onlys" in the OHV also saw an increase in revenues of 9%, or 890

CFAF/household. In fact, in this year, under this scenario, the only group in both zones that did not see an increase in net revenue is the "Sell-only" group in the CMDT, which suffered a fall of 3% in revenue, or 570 CFAF/household. Given that this group is very clearly the best-off group in the entire sample and that this decline in revenue is slight, the result is not alarming. Overall, the results suggest that the impact of the credit program on net revenues for farmers would be positive, although of a lesser magnitude than the impact in a poor production year such as 1987-88.

For 1986-87, the results under the second scenario are similar although more marked. The "Boths" in both the CMDT and the OHV are the farmers that see the largest absolute and percentage increase in net revenues. In the CMDT, the increase was of the order of 16% (around 2,500 CFAF/household) and in the OHV the increase was 28-30%, or 3,900-4,100 CFAF/household. The "Buy-onlys" in the CMDT also benefitted, with a 13% increase in net revenues (1,600 CFAF/household), as did the same group in the OHV with a 4% increase (about 1,300 CFAF/household). The "Sell-onlys" in the OHV also benefitted from the credit program, with a net revenue increase of 7% (700 CFAF/household). Again, the only group that did not benefit financially from the credit program in 1986-87 under scenario 2 was the "Sell-only" group in the CMDT, which saw an 8% decline in net coarse grain revenues (about 1,500 CFAF/household).

#### **IV ISSUES FOR THE DESIGN OF TRADER AND VILLAGE COOPERATIVE CREDIT PROGRAMS**

##### **Who benefits and who loses?**

Which actors in the grain market system gain and which lose with the implementation of a credit program such as that of the PRMC depends largely on the assumptions one makes concerning the impact of the program on seasonal price fluctuations, long-term storage strategies, etc.

If we assume that the credit program increases competition for coarse grains by providing traders and village cooperatives with liquidity in the post-harvest period, then we would expect to see an increase in the post-harvest price. Consequently, farmers who traditionally must sell early will benefit.

The impact of increasing the post-harvest price farmers receive for their grains is most likely to be felt by the "worst-off" category of sellers: those who cannot wait for seasonal price increases to sell their grain. Post-harvest sales tend to be involuntary sales stimulated by pressing cash needs such as taxes, ceremonies, etc. If we assume that farmers have a post-harvest target income to meet these needs, higher post-harvest prices mean that these farmers must sell less grain to obtain the same level of income. Because of this, these farmers retain more of their grain for home consumption and therefore must buy back less later in the year. Overall then, for these farmers revenues from cereals sales will increase and expenditures on cereals will decrease. There will be a net positive effect on income. Tables 16 and 17 indicate the direction and magnitude of this effect on net incomes from coarse grain transactions. The simulation exercises corroborate what

is suggested above: the greatest positive impact of the credit program will indeed be felt by farmers who are involved in both selling and buying cereals.

An increased post-harvest coarse grain price will mean an income loss for those who buy coarse grains early, including those who are able to buy soon after harvest for future consumption. The simulation exercises presented in Tables 16 and 17 suggest that very few, if any, of the sample farmers would suffer a significant income loss from early buying. In fact, the simulation exercise indicates that the only income losses from a credit program in a poor production year would be by those in the CMDT who are only involved in selling grain. In a good production year it is the same group of sellers in both the CMDT and OHV that suffers any revenue loss from coarse grain transactions.

If we assume that the increase in the post-harvest price for coarse grain tempers the seasonal price increase, then farmers who tend to buy coarse grains later in the year because of insufficient stocks benefit. Their expenditures on coarse grains will fall. It is the buyers who are presumably in the most difficult situation (who don't have the resources to buy early in the year in anticipation of food shortages later in the year), who will face lower "hungry season" grain prices resulting from a credit program. The summary of the simulation results presented in Tables 16 and 17 suggests that the "buy only" groups of farmers in both zones, in both years, under both scenarios benefit financially from changes in the price cycle that a credit program might stimulate.

A credit program reduces gross returns to storage because the injection of liquidity in the coarse grain market encourages increases in inventory, which lead to higher post-harvest prices and temper the normal seasonal rise. In effect, traders compete with farmers to carry inventory and this puts downward pressure on seasonal price increases, which means that those currently involved in storage may see their storage margins decline. However, although traders and farmers who are big sellers may see a fall in gross income, if they obtain subsidized storage credit their cost of capital also would fall so the loss in storage profits would be mitigated. Again, the simulation exercises show that it is the "sell only" group in both zones in 1987-88 and in the CMDT in 1986-87 that would lose from the reduction in price fluctuations that a credit program might cause.

### **Design Issues**

1. As it is currently designed, the PRMC credit program, by specifying that the Village Associations buy coarse grains from their members, sell it on the open market, and rebate the profits to the members, assumes that villages on the whole are net exporters of grain. While this may be true in the post-harvest period (and even then, not all villages fit this description) the analysis of the CESA-MSU data indicate extreme degrees of heterogeneity among households within a village, villages within a zone, and zones within the country. There are surplus and deficit villages and zones, not just surplus and deficit households. What this means is that some villages will be annual net exporters of grain, but others will be annual net importers of grain (although they may be exporters during the post-harvest period). There are not always enough sellers within a Village Association to make the PRMC credit program function as it is designed.

This suggests that there needs to added flexibility in the rules governing the purchase and sale of coarse grain by the Village Associations. In some instances (villages that are grain exporting throughout the year) the AV may want to function according to the PRMC model: use credit to buy early from its members, sell later on the market, rebate profits to members. In other instances (deficit villages) the AV may want to use credit to buy on the open market or from surplus villages or surplus zones in the post-harvest period, store the grain in a cereals bank, and sell this grain to its members throughout the year.

In other words, a credit program should allow AVs to buy from wherever there is a surplus (its own members, another village, another zone) and sell wherever there is a deficit (on the open market, within the village, in another village, in another zone). The rules should be designed to allow grain to move freely both spatially and temporally. It is unlikely that the same credit program model will fit the needs of all villages because not all villages are grain surplus and not all farmers have problems just selling coarse grains.

2. In addition to the diversity at the village-level, there are important considerations at the regional level as well. The analysis indicates that in net importing zones such as the OHV there is a movement of cheap grain out of the zone immediately after the harvest and a reverse flow of expensive grain (due to higher seasonal prices plus transportation costs) back into the zone later in the year. Buyers in importing zones face higher prices overall due to the movement of grain out of the zone after harvest and then back into the zone during the hungry season. A concern for areas such as these is how to retain coarse grains in the zone in order to avoid this problem of cheap exports and expensive imports.

An associated issue for the net importing zones is the need to strengthen traders' capacity to carry inventory locally. There is a need for more semi-wholesalers with trucks, information, etc. to keep locally produced grain in the region, and when necessary bring imported grain into the region quickly. This is an area in which the trader credit program could play an important role.

3. In the exporting zones, such as the CMDT, there is a need to assure the competitiveness of the system to enable farmers to receive fair prices for their grain. For these areas, it is important for a trader credit program to stimulate new entry. One way this might be done is to make the size requirement for access to merchant credit less stringent.

The subsidized rate of interest charged on PRMC loans may also have impacts on the competitiveness of the trade. Numerous studies throughout the world, many undertaken by researchers at Ohio State University under an AID-financed cooperative agreement, have shown that subsidized interest rates generate excess demand for loans. Lenders generally attempt to deal with this excess demand by rationing the loans to larger clients having more collateral (Adams and Graham, 1984). This concentrates income and may restrict the competition and entry in the trade. The general policy prescription that flows out of such analyses is that governments should take actions to help assure widespread availability of credit, but at unsubsidized interest rates.

4. The issue of re-financing loans from one year to the next is critical to the success of a credit program in a country such as Mali. Because of interannual production and price fluctuations, there needs to be some flexibility in repayment schedules in order for AVs and traders to stay solvent and to decrease the number of loan defaults. Re-financing of loans is especially important in good harvest years when prices may remain depressed throughout the year. There must be a mechanism to enable AVs and traders to carry inventory over a multi-year period, if necessary, to avoid bankruptcy. (See the more detailed discussion of this topic in the appendix.)
5. Improved market information is critical to the long-run success of a village and trader credit program. Market information makes the market more transparent by making available to the public knowledge about current price trends, grain volume movement, government decisions affecting the market (such as changes in the regulatory environment, changes in international trade policy), etc. This information must be available to AVs and traders so that their buy-sell decisions can be made more accurately. However, it is not enough to simply provide such information. The credit program should work at training village association members and traders in the interpretation and use of this information.

An additional role for the market information system might be the eventual development of market outlook services. Again, this service would enable village associations and traders to make their decisions under more favorable circumstances.

6. For any improvement in the design of the trader credit program it is important to know how the trader credit program affects the structure of trade and the evolution of new firms. Here, on-going monitoring of the evolution of the wholesale trade is needed. This could also be an eventual task for the market information system.
7. Finally, a broader issue that the credit program's designers must consider is where in the system the bulk of the coarse grain inventory should be held: at the household level, village level, or merchant level. An associated food-security issue for the government of Mali is the need to be able to monitor the level of that inventory in order to make import, export, and food aid decisions.

**Problems with current design:**

1. The current design, where farmer sell to AVs early in the year and the AV then sells on the market later in the year, provides the farmer with needed post-harvest cash but does not provide the farmer any guarantee that he can buy cereals from the AV later in the year should it become necessary. In other words, there is still more security in holding cereals at the household level for those farmers who can afford to postpone early sales. A way around this problem would be to allow AVs to function as cereals banks.

On the other hand, if the AV credit program required AVs to function more along the lines of cereals banks then there would be a disincentive for big sellers to sell to the AV because profits would be forfeited for the sake of the food security interests of the village. In other

words, these sellers would make more money by selling on the open market than by selling to the AV.

2. Another current design problem is how profits are rebated. Do AV profits go to a common village fund to use on community projects? Or are profits rebated to members in the form of cash in the pre-harvest period? How the rebate function is carried out will make an important difference in terms of incentives and disincentives for farmer participation in the credit program.

**Possible roles for AV credit program:**

1. The AV credit program could provide the funds to enable certain AVs to organize cereals banks, where the AV would buy coarse grains from its members, other AVs, the market, etc. in the relatively inexpensive post-harvest period and then sell to its members at a lower-than-market price throughout the year. While the cereals banks would need to specify a price that would ensure that the loan (principal plus interest) would be paid back, they would not necessarily need to charge a price that would guarantee a profit. In effect, the AVs would become consumer cooperatives by taking over the buying function for their members. As a collective buyer with post-harvest liquidity, the AV would be able to take advantage of relatively low coarse grain prices because it could buy immediately after the harvest, and buy in bulk. Such a scheme would be especially appropriate for deficit villages and regions that tend to be annual net importers of coarse grain. In this scenario the AV assumes the role of ensuring local food security.
2. Another role for the AV credit program is to provide the liquidity for AVs to buy and sell coarse grains to make a profit for their members (the way the program is currently designed). The benefit to engaging in arbitrage would be the profits rebated to members later in the year. This sort of scheme is most appropriate to annual net exporting zones and villages.
3. Another possible role for the AV credit program is to provide the capital to AVs to establish a sort of credit bank that would loan money to individual members to buy coarse grains (in other words, consumption credit). This scheme would be especially useful in exporting zones (such as the CMDT), where within a village or region there are food-deficit households as well as food-surplus households. This plan would permit the targeting assistance to food-deficit households located in food-surplus villages.

## APPENDIX:

### PRICE VOLATILITY AND THE PROBLEM OF REFINANCING LOANS

Producer-level coarse grain prices are extremely volatile in Mali, both intra-and inter-annually. For example, the wholesale price of millet in Zangasso, a major farm assembly market in southern CMDT (the major surplus zone for coarse grains), quadrupled from 25 CFAF/kg in March 1987 to 100 CFAF/kg in June 1988 (Staatz, Dioné, and Dembélé, 1989, p.704). The volatility stems from the thinness of the market for coarse grains, highly variable production due to fluctuations in rainfall, and a lack of accurate information on the part of producers and traders about the forces affecting the evolution of supply and demand. Price volatility makes grain marketing very risky, whether it is handled by the public or private sector.

Within-year price volatility can pose special problems for credit programs for grain marketing, particularly when the price does not follow the expected seasonal pattern (rising from a post-harvest low to a season-high price just before the following harvest). The PRMC credit programs are predicated upon such a "normal" seasonal pattern. They also assume that private traders and village cooperatives (AVs), most of whom have no experience in long-term storage, can accurately predict the seasonal evolution in prices in order to make their purchase and storage decisions. If merchants or AVs pay "too much" for grain at harvest (i.e., if prices don't rise enough during the season to cover storage costs), then the recipient of the loan is forced to sell at a loss, often a substantial loss, unless mechanisms exist to refinance the loan and carry the inventory over into the following year. While long-term storage may, on average, be a profitable proposition over a number of years, many of the participants in the PRMC credit programs lack the liquidity to survive one bad year without going bankrupt.

Failure of market prices to follow the "normal" seasonal pattern has, in the last few years, been related to unanticipated changes in government policy. For example, during the 1985-86 marketing year, OPAM intervened heavily in the market during the early part of the marketing year in an effort to defend the official producer price of 55 CFAF/kg.<sup>4</sup> Due to the very large size of the harvest and OPAM's limited budget, the grain board was unable to buy all the cereal offered it, and after three and a half months withdrew from the market because its funds were exhausted. During the period of OPAM intervention, December 1985-March 1986, prices in Zangasso held steady at between 50 and 52 CFAF/kg, but then slid to 42 CFAF/kg by June before recovering to 46 CFAF/kg in September, 1986, shortly before the new harvest (Staatz, Dioné, and Dembélé, 1989). Because OPAM was constrained to sell the grain it had purchased at the official consumer price, which was below the open-market price, all OPAM's working capital (which had been provided by the PRMC) was locked up in unsold grain stocks (Dioné and Dembélé, 1986).

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<sup>4</sup> In Mali, the marketing year for coarse grains runs from November, when the main harvest of millet and sorghum begins, to the following October.

Lacking working capital, the grain board was unable to intervene substantially in the market the following year, which was also a year of heavy production. Consequently, the producer price continued to fall, reaching 25 CFAF/kg in Zangasso in January - March, 1987. OPAM's earlier intervention had also distorted the normal seasonal pattern of prices during 1985-86, reducing private incentives to store grain.

In part in reaction to the experience of 1985-86, the PRMC launched its program of seasonal credit for private merchants and village cooperatives, in an attempt to shift more of the storage function from OPAM to the private sector. Yet the same problem of price volatility remains. The 1988-89 campaign illustrates the problem. This was a year of record coarse-grain production, and it was widely anticipated that producer-level prices would collapse at harvest time, as they had in 1986-87. But the prospect of exporting grain clandestinely to Mauritania, Senegal, and Côte d'Ivoire (where production had faltered), combined with the liquidity provided by the widespread availability of the PRMC credit, led private merchants and AVs to bid heavily for grain, holding the producer price in Zangasso at 43-49 CFAF/kg in November-December, 1988. Sizeable illegal exports reportedly took place in the months immediately following the harvest. (During this period exports were legal only with special authorization from the Ministry of Finance and Commerce.) In late March, the government authorized official exports, but at the same time cracked down on clandestine exports, seizing vehicles and confiscating grain of illegal exporters. (The move to suppress illegal exports apparently was partly in response to IMF pressure to increase government revenues through collection of export taxes.) Because the procedure to get official authorization to export was long and cumbersome, the net effect was to reduce total demand in the market, leading to a slide in prices (OPAM, 1989). By March, 1989 prices in Zangasso stood at 36 CFAF/kg and reportedly had fallen even farther by the end of May, when the first tranche of reimbursement of PRMC loans were due. (Contact OPAM/SIM for current prices). Faced with the need to repay the first tranche of their loan, traders and AVs were forced to dump their inventory onto the market, further depressing prices. The unexpected change in export policy, combined with the inability to refinance the loans, was putting the private trade in much the same position that OPAM had been in during the 1985-86 campaign. By forcing traders and AVs to take large losses, the system was also souring many market participants on the credit program, even though over the long run such a program may be socially useful.

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