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Michigan State University
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* John M. Staatz is professor of Agricultural Economics at Michigan State University. N. Nango Dembélé is a Malian doctoral candidate in the Department of Agricultural Economics, Michigan State University. From 1988-1991 he served as chief technical advisor to the Cereals Market Information System based at the Malian Cereals Marketing Board (OPAM).
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Introduction

Since the early 1980s, USAID/Mali has participated with other donors in supporting cereals market liberalization in Mali. These activities have largely taken place through the multi-donor-funded Cereals Market Restructuring Project, or PRMC, as it is known in French. USAID/Mali has played a key role in the PRMC in pushing for removal of restrictions on private marketing of grain and for reform of the role of the national grain board, OPAM. Over the past 10 years, OPAM has been transformed from a parastatal charged with maintaining an official state monopoly in the grain trade. It now is a food logistics agency that manages food aid and a national security stock, and provides market facilitating services to the private trade. ¹

In addition, USAID/Mali, through the Food Security in Africa Cooperative Agreement with Michigan State University, has greatly improved the level of knowledge about how cereals markets operate in Mali. Beginning in 1985, researchers working under the Cooperative Agreement, in collaboration with the Malian National Food Strategy Commission (CESA), carried out a series of studies aimed at improving the knowledge base for donors and Malian government officials on the structure and functioning of the cereals markets. These studies highlighted the need for an ongoing system to provide information to both the private and public sectors on the evolving structure and performance of cereals markets and on prices and other market conditions. Therefore, through both the Cooperative Agreement and the PRMC, USAID/Mali supported the establishment in mid 1988 of a public cereals market information system, based at OPAM. The market information system (or SIM, as it is known by its French acronym), collects weekly prices in over 80 markets in Mali. Since 1989, this information has been diffused through weekly radio and television broadcasts, newspaper articles, and written materials aimed at both the private trade and policy makers.

Evaluating the Impact of AID’s Investments in Market-Facilitating Services

In theory, one would expect the activities supported by AID to have at least three effects. First, improved market information and reduction on movement restrictions should lead to better market integration. Second, to the extent that transaction costs are reduced, the marketing

margin between farm and retail level should be reduced, for a given set of products. Third, and perhaps least quantifiable, the quality of public and private decision-making concerning grain marketing may increase as the result of better information. The quality of such decision making is critical in a poor country like Mali, where the price of food represents a major determinant of the real income of both low-income consumers and farmers.

Empirically measuring these effects is difficult in Mali for several reasons. First, the data base is not extensive. While the SIM provides an extensive set of data for grain markets starting in May, 1988, prior to that period (i.e., prior to AID's investment in the SIM), data are much more sparse. For this analysis, we have constructed a reliable and consistent data set for a few markets back to January, 1986. For other markets and for prior years, a consistent data series does not exist. (For more information on data sources, see below.)

Second, grain markets in Mali are by nature thin. A thin market is one in which only a small proportion of total production is traded. In Mali, roughly 80% of total grain production is consumed on the farm. Thus, a relatively small change in total production can result in wide fluctuations in marketed surplus, and hence price. Highly variable rainfall leads to wide swings in production. Prices therefore tend to be volatile. To the extent that marketing margins are influenced by price levels, they also become volatile. Other market disruptions, such as changes in import policies, arrivals of food aid, etc., also generate a lot of "noise" in the data, making it harder to isolate the effects of improved market information and other market-facilitating services.

Third, it is often difficult to identify the effects of research and better market information on improved policy making. The researchers may provide improved information, but it is sometimes difficult to trace the effects of that information on policy decisions.

Despite these difficulties, the evidence presented below supports the view that the market-facilitating activities supported by AID have had positive effects on market efficiency and food security in Mali.

The Data

To analyze the effects of the market-facilitating activities such as the SIM, we analyze the urban-rural marketing margins for coarse grains over the period January, 1986-April 1992. This covers two full years before the SIM began broadcasting market prices. During the period 1986-88, however, the other market reforms aimed at strengthening the private sector were beginning to take place.

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2It is important that the comparison over time be for the same set of products. For example, for a given set of grain products, the set of services embodied in those goods (such as processing, storage, etc.) should be the same over the period of comparison. Over time, the total price spread between consumer and producer may increase if consumers demand more services be incorporated in the products they buy (such as pre-processing). An increase in the marketing margin, if accompanied by an increase in such services, does not necessarily represent a reduction in the efficiency of the marketing system. Indeed, it may reflect that the system is responsive to consumer demands.
The only reliable retail price series for this entire period is for Bamako. The data for January, 1986-April, 1988 were collected in Bamako by OPAM agents. This price collection activity was merged into the SIM beginning in May, 1988. After that date, we rely on the SIM data. For rural prices, we focus on two major rural collection markets: Zangasso, in the cotton zone of southern Mali; and Sirakorala, in the OHV zone north of Bamako. Data for January, 1986-April, 1988 come from the CESA/MSU studies. After May, 1988, this observation system was merged into the SIM and we rely on the continuing SIM price series. Because the OPAM and CESA/MSU data collection efforts were incorporated into the SIM system, the data series we constructed was collected using a consistent methodology.

The following analysis focuses on sorghum for the southern market of Zangasso, and millet for the northern market of Sirakorala. Sorghum is the most widely sold coarse grain in Mali, especially in the south. The price of millet, produced in more arid areas, generally is very close to that of sorghum. We focus our analysis on the following markets:

**Bamako:** The capital is the largest urban consumption center in the country, as well as a major transshipment point for grain to deficit areas in western Mali. We use Bamako retail prices in this analysis.

**Zangasso:** Zangasso is the largest rural collection market for millet and sorghum in the southern CMDT zone, which is the main grain-surplus region of southern Mali. The prices we use for Zangasso are farmer-first-handler prices--i.e., the price the farmer receives when he/she brings grain to market to sell to a rural assembler. The Zangasso price therefore represents the "farm price" in the main surplus-producing zone.

**Sirakorala:** Sirakorala is a major rural market in the northern OHV zone, an area north of Bamako that has a net deficit in grain production. Therefore, while grain sales from farmers to traders do take place there year-round, in parts of the year grain is also flowing back into the area. Like Zangasso, the price used here is the farmer-first-handler price.

We focus on these two farm markets in Mali’s grain belt based on the hypothesis that if the market liberalization had an effect on marketing margins, it should be felt here, where markets are most developed. The monthly data used are un-inflated--i.e., they are not corrected for the effects of inflation. Inflation during this period was low; to the extent that it had an effect, it would have tended to widen marketing margins. Therefore, any reduction in marketing margins found in this analysis is a lower bound on the reduction in real costs.

**Results**

**Price Levels and Stability**

Figure 1 shows the evolution of sorghum prices in Bamako and Zangasso over the period 1986-92. Figure 2 shows similar figures for millet in Bamako and Sirakorala. The figures illustrate several points:
First, prices are volatile from one year to another, depending on the size of the harvest. Furthermore, prices in the rural areas are more volatile than in urban areas, in relative terms, due to the relatively constant marketing margin. This volatility is seen by comparing post-harvest prices of sorghum in 1989, a year of good harvests, with hungry-season (pre-harvest) prices in 1991, a year of average rainfall. (Note that the sorghum prices for Sirakorala are not shown on in Figure 2.)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamako</td>
<td>62</td>
<td>141</td>
<td>227</td>
</tr>
<tr>
<td>Zangasso</td>
<td>26</td>
<td>109</td>
<td>419</td>
</tr>
<tr>
<td>Sirakorala</td>
<td>31</td>
<td>132</td>
<td>426</td>
</tr>
</tbody>
</table>

**SOURCE:** OPAM/SIM data base

Over this 20-month period prices more than doubled in Bamako and more than quadrupled in the rural areas. Furthermore, figures 1 and 2 show that such wide year-to-year price swings are not rare. This price volatility makes relying on grain markets either as an outlet for production (the case of grain-surplus farmers) or as a source of grain supply (for consumers in both rural and urban areas) risky in Mali, particularly in grain-deficit rural regions such as Sirakorala. A corollary is that grain marketing as a profession is also risky. One would therefore expect traders to incorporate a significant risk premium in their marketing margin. Hence, efforts to improve market functioning have a high potential payoff in terms of stabilizing access to food by consumers, driving down the cost of food (by reducing risk premia) and creating a reliable output for farmers’ products.

Second, both figures 1 and 2 show the seasonality of grain prices, with prices generally peaking in the pre-harvest period of June-August and falling around harvest (October-December).

Third, the fluctuations in prices in the different markets coincide with each other, indicating a good degree of market integration. Below we test whether the degree of market integration increased over this period.

**Marketing Margins and Market Integration**

Figures 3 and 4 present the gross marketing margins for sorghum and millet for the markets studied. For a given month, these margins simply represent the difference between the Bamako retail price and the rural market price. A few observations are in order:

First, the margins show strong seasonal variation. For both millet and sorghum, the margin tends to jump early in the harvest period, when prices have begun to fall in rural areas but have not yet fallen in urban areas. In Sirakorala, the margin also shows a pronounced drop during the hungry season (*soudure*) of July and August. During this period, very little grain is being
traded between Bamako and Sirakorala. The Sirakorala area, being net deficit in grain, is actually receiving inflows of grain from surrounding rural areas. The higher prices in Sirakorala reflect this reversal of flow of grain back into the region.

Second, the marketing margins are more volatile for Bamako-Sirakorala than for Bamako-Zangasso. Again, this is expected. Zangasso-Bamako represents a major trade route on which grain is flowing in one direction all year round. Sirakorala ships grain out towards Bamako soon after harvest, but then receives grain back into the region from surrounding areas in the hungry season.

Third, there seems to be some downward trend in the Bamako-Zangasso margin over time. Indeed, when the period before SIM radio broadcasts (January, 1986-December, 1987) is compared with the period after broadcasts, marketing margins and market integration (as measured by price correlations) appear to have improved for both areas.

Table 2. Indicators of Market Performance before and after the SIM

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Zangasso (Sorghum)</th>
<th>Sirakorala (Millet)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean Gross Marketing Margin (CFAF/kg)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan. 1986-Dec. 1988</td>
<td>40.4</td>
<td>35.1</td>
</tr>
<tr>
<td><strong>Correlation Coeff. of Prices with Bamako Retail Prices</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 indicates that average marketing margins were roughly 10% lower in the period after SIM began broadcasting prices than in the earlier period. The degree of market integration, as indicated by the correlation coefficient among market prices, also increased slightly. The largest improvement in market integration was between Sirakorala and Bamako, where integration was poorest to start with.

**Econometric Analysis: Have Margins Really Gone Down?**

Although Table 2 shows that average marketing margins were lower during the period after SIM broadcasts began, two questions remain. Is this difference statistically significant? And could it be attributed to other factors, such as changes in the overall level of prices?

To test these hypothesis, we developed some simple econometric models to examine the behavior of the gross marketing margins. These models posit that the marketing margin is a function of seasonal factors, the overall level of prices, and time. The critical test for our analysis is whether there is a significant negative trend in the margins over time independent of the seasonal and price factors. Such a downward trend is consistent with the hypothesis that the
market-facilitating actions supported by AID and other donors have helped reduce marketing margins over time.³

The estimated econometric results are shown in Table 3. The essential results are as follows:

For both market channels examined (Bamako-Sirakorala for millet and Bamako-Zangasso for sorghum), margins fell over time. For Bamako-Zangasso, this decline is highly significant statistically (p < .01). Over this route, holding other factors constant, the marketing margin fell by approximately 1.44 FCFA/kg per year throughout the period (12 x .12). Over the 6-year period 1986-91, this represented a decline of 8.6 CFAF/kg, or 21% in the marketing margin when other factors are held constant. For the Bamako-Sirakorala route, the decline is smaller and is significant only at the .90 level of confidence (p < .10). For this circuit, the margin dropped roughly 1 CFAF/kg over the 6-year period, or 17%, when other factors are held constant.

The other significant determinants of the marketing margin were seasonality (margins rising significantly at harvest and, for Bamako-Sirakorala, dropping in the hungry season), and the level of the retail price in Bamako. When retail prices increased, the margin tended to widen. This may reflect that it sometimes takes rural prices a few weeks to adjust to price increases in Bamako. It may also reflect merchants' earning higher per-unit margins in years of short crops, when the total volume of market transactions is less. In years of heavy marketings, cereals traders may make less per kg but make up for it by handling a higher volume. All the non-trend variables shown in Table 3 were significant at at least the .95 level.

³Alternatively, one could test whether there was a one-time drop in the marketing margin that corresponded with the beginning of SIM radio broadcasts of market information. However, because other market-facilitating actions were under way prior to the initiation of SIM broadcasts, it was felt that a specification involving a trend variable throughout the period was more representative of reality. Nonetheless, the specification of the model with a one-time drop in prices was also tested (along with specifications including various interactions between a one-time drop and an on-going trend). The model specifying a one-time drop in prices did show statistically significant results, but its explanatory power was lower than the model presented below that incorporates an on-going trend variable.
Table 3. Econometric Analysis of the Determinants of Farm-Retail Gross Marketing Margins for Millet and Sorghum in Southern Mali, 1986-92

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependent Variable = Gross Marketing Margin (CFAF/kg)</th>
<th>Coefficients:</th>
<th>Bamako-Zangasso (sorghum)</th>
<th>Bamako-Sirakorala (millet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>27.05</td>
<td>25.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bamako Retail Price</td>
<td>.16</td>
<td>.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t-ratio)</td>
<td>(5.05)</td>
<td>(1.91)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct.-Nov. dummy</td>
<td>9.65</td>
<td>18.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t-ratio)</td>
<td>(4.88)</td>
<td>(5.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July-Aug. dummy</td>
<td>--</td>
<td>-12.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t-ratio)</td>
<td></td>
<td>(3.50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>trend (month)</td>
<td>-.12</td>
<td>-.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t-ratio)</td>
<td>(3.53)</td>
<td>(1.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>.43</td>
<td>.43</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusions

The econometric analysis indicates that farm-retail marketing margins for millet and sorghum over the two major trade routes examined were roughly 20% lower in 1992 than they would have been had the 1986 pattern of margins continued unchanged. This statistical relationship does not prove that the investments in market-facilitating services such as the SIM caused the reduction in margins. But it is consistent with that hypothesis. The data also indicate that market integration, as measured by inter-market price correlations, also increased over this period, particularly for the Bamako-Sirakorala route where integration was initially weakest.

The reduction in the marketing margin for sorghum over the Bamako-Zangasso route was equivalent to roughly 10% of the average retail price of the grain in Bamako during the study period. Assuming that the reduction in marketing margin was evenly split between consumers and farmers, this would imply that retail prices in Bamako were 5% lower in early 1992 than they would have been had the 1986 pattern continued. A budget-consumption study in the late 1980s indicated that Bamako consumers spent approximately 23% of their total income on millet and sorghum. Therefore, if marketing margins along other routes supplying Bamako with

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grain fell by roughly the same magnitude, this analysis suggests that the reduction in marketing margins raised the real incomes of Bamako consumers by roughly 1% (5% x 23%).

In addition to the reduction in marketing margins and increased market integration described above, there is also evidence that the investment in the market information system in Mali has strengthened the quality of food policy decision making in the country. These impacts are described in a companion document. Clearly, the type of analysis we have carried out here would not have been possible without the SIM data base. In addition, through its investments in the SIM, AID has helped develop a cadre of market analysts in Mali that contribute to the ongoing process of food policy analysis in that country.

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FIGURE 1
Sorghum Prices in Mali
January, 1986-April 1992

Month/year

FCFA/kg

Bamako retail
Zangasso Farm Price
FIGURE 2
Millet Prices in Mali
January, 1986-April 1992

FCFA/kg

Month/year

Bamako retail  Sirakorala Farm Pr.
FIGURE 3
Gross Marketing Margins for Sorghum
Southern Mali, January, 1986-April 1992

Month/year

J86 Jun  J87 Jun  J88 Jun  J89 Jun  J90 Jun  J91 Jun  J92

FCFA/kg

20  25  30  35  40  45  50  55  60  65  70

Bamako-Zangasso
FIGURE 4
Millet Marketing Margins in Mali
January, 1986-April, 1992

FCFA/kg

Month/year

J86 Jun  J87 Jun  J88 Jun  J89 Jun  J90 Jun  J91 Jun  J92

Bamako-Sirakorala