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## RE-EDITION

### THE ROLE OF SMALL RICE MILLS IN THE RICE SUBSECTOR OF THE OFFICE DU NIGER, MALI

By

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**MINISTERE DE L'ECONOMIE, DES FINANCES ET DU PLAN**  
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**LE ROLE DES PETITES DECORTIQUEUSES DE RIZ A L'OFFICE DU NIGER, MALI**

**par**

**Salifou Bakary Diarra**

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Les points de vue ici exprimés ne doivent pas être interprétés comme une position officielle de l'OPAM, du SIM ou de l'USAID, néanmoins, l'auteur en assume l'entière responsabilité.

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**This thesis was prepared as part of a research project on food security and market information carried out under the auspices of the Market Information System (SIM) of the Office of Agricultural Products of Mali (OPAM). The research was conducted by the author, in conjunction with colleagues at the SIM and at Michigan State University (MSU). Funding for the research was provided by the Mali mission of the U.S. Agency for International Development (USAID), under the Food Security II Cooperative Agreement between USAID and MSU (no. AEP-5459-00-2041-00).**

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## ABSTRACT

### THE ROLE OF SMALL RICE MILLS IN THE RICE SUBSECTOR OF THE OFFICE DU NIGER, MALI

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The presence of the small rice mills in the Office du Niger zone has changed the structure of the rice subsector, helping to reduce concentration and changing marketing options of both farmers and retailers. Current proposals call for major initiative to liberalize the rice market further and to shift the principal role of the O.N. toward provision of water and extension. In this context, it is extremely important to investigate the role of small mills in the subsector, their relative costs, and the segments of the market they serve.

Budgeting techniques were used to analyze milling cost data. Price data were used to calculate both correlation coefficients and spatial marketing margins. The analyses of correlation and calculation of spatial margins provided indications on the performance of rice subsector in the Office du Niger zone.

The financial analyses revealed that the own-mill-sell or buy-mill-sell activity is far more profitable than the custom milling. Moreover, the analyses suggests that most of the millers sampled would be willing to buy paddy at a higher price than the O.N. support price of CFAF 70 per kg.

**To my dear brother, Mamadou Diarra - "may your soul  
rest in peace."**

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## **CHAPTER I. INTRODUCTION**

### **1.1 Problem Setting**

Two decades of official state monopoly over the cereals market combined with under-investment in agricultural research and demographic growth have led to inefficient structures of production, processing, and marketing of domestic production of cereals in Mali. The basic assumption underlying the policy of official monopoly was that private actors were seen by the socialist regime in power as "self-interest seeking individuals," who should not be involved in the marketing of "basic products."<sup>1</sup> However, many studies (e.g., Staatz et al., 1989; Dione, 1989) have shown that the parastatals performed cereals marketing activities poorly during the monopoly period. Indeed, Humphreys described the official monopoly of the Office des Produits Agricoles du Mali as "fictional," handling only an estimated 20-40% of total volumes marketed and 3-4% of total production (Gabre-Madhin, 1991).<sup>2</sup>

The poor performance of the state marketing system resulted in an accumulation in O.P.A.M. budget deficits in the late 1970's, and led to significant donor pressure for a restructuring of the cereals market. In response, the government of Mali agreed to a comprehensive and gradual cereal policy reform package in 1981 (Ibid., 1991).

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1 The Malian government's list of official designated products included: cereals (millet, sorghum, and maize), sugar, tea, milk (canned milk), soap and more. These products were considered as very strategic, whose shortage could led to social turmoil or riots.

2 The Office des Produits Agricoles du Mali is the Malian state cereals marketing board, known widely by its acronym, O.P.A.M.

Since 1981, Mali has been involved in a market liberalization process, both for the cereals market and the broader economy. The liberalization of the broader economy led to the privatization and/or the restructuring of many parastatals. This restructuring led, on one hand, to many workers being either laid off or retiring early. On the other hand, the liberalization of the cereals market led to the removal of legal prohibitions to private trade in cereals (millet, sorghum, maize, and rice), with the objective of placing greater reliance on the market to allocate resources (Statz et al., 1989). Many jobs were created in the private sector, although it is difficult to quantify the net job gains. The initial objectives of this reform package, called Programme de Restructuration du Marché Céréalière were to increase producer prices, liberalize the cereals market by legalizing the participation of cereals traders, and reduce costly subsidies to the official cereals marketing system by gradually raising consumer prices to cover O.P.A.M.'s actual costs (Steffen 1992).<sup>3</sup>

The official price setting for coarse grains (millet, maize, and sorghum) was abandoned by the government in 1986/87 when, after two consecutive good harvests for coarse grains in 1985/86 and 1986/87, the state marketing board (O.P.A.M.) was unable to sustain budgetarily the producer prices. The World Bank (W.B.) and the International Monetary Fund (I.M.F.) programs restricted the government's spending at the broader economy level. In particular, the programs involved a reduction of subsidies to O.P.A.M. to cover its deficits and of

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<sup>3</sup> The Programme de Restructuration du Marche Cerealier is a multidonor-financed Cereals Market Restructuring Project, known by its French acronym, PRMC.

subsidies to the ODR's provided by the official price schedules.<sup>4</sup> Furthermore, the programs involved a drastic reduction in O.P.A.M.'s commercial role to one of holding a grain reserve against food emergencies and selling in certain remote and inaccessible districts.

Liberalization has, however, proceeded much farther for the coarse grains market (millet, sorghum, and maize) than for the rice market. Indeed, in 1987 the price support for millet, sorghum, and maize was abandoned and the role of O.P.A.M. was considerably reduced, while the Office du Niger (O.N.) continued to set a floor price for paddy rice, regardless of the quality supplied by farmers.<sup>5</sup> Between 1928 and 1959, a total of \$83 million was spent in developing irrigation infrastructure and in land reclamation in the O.N. zone. In 1983, more than \$10 million was spent in an intensification and rehabilitation program (Dembele, 1992). The financial involvement of the State in the O.N. led the government of Mali to abandon its policy of duty-free importation of rice in 1987 and introduce various measures to protect domestic production, including "twinning" of imports with domestic purchases<sup>6</sup>. "Twinning" was subsequently abandoned as part of a reform of import procedures adopted in 1989. The import reforms were one component of an IMF adjustment program.

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4 The Operations de Developpement Rural are the government's Rural Development Agencies created in early 1970s to provide extension services to farmers and infrastructure investment to promote agricultural development.

5 The Office du Niger is a parastatal enterprise set up in 1932 to provide irrigation in the area around Niono. See Figures 1.1 and 1.2.

6 Twinning consists of obliging those private traders wishing to import rice to buy an equal quantity from the O.N.

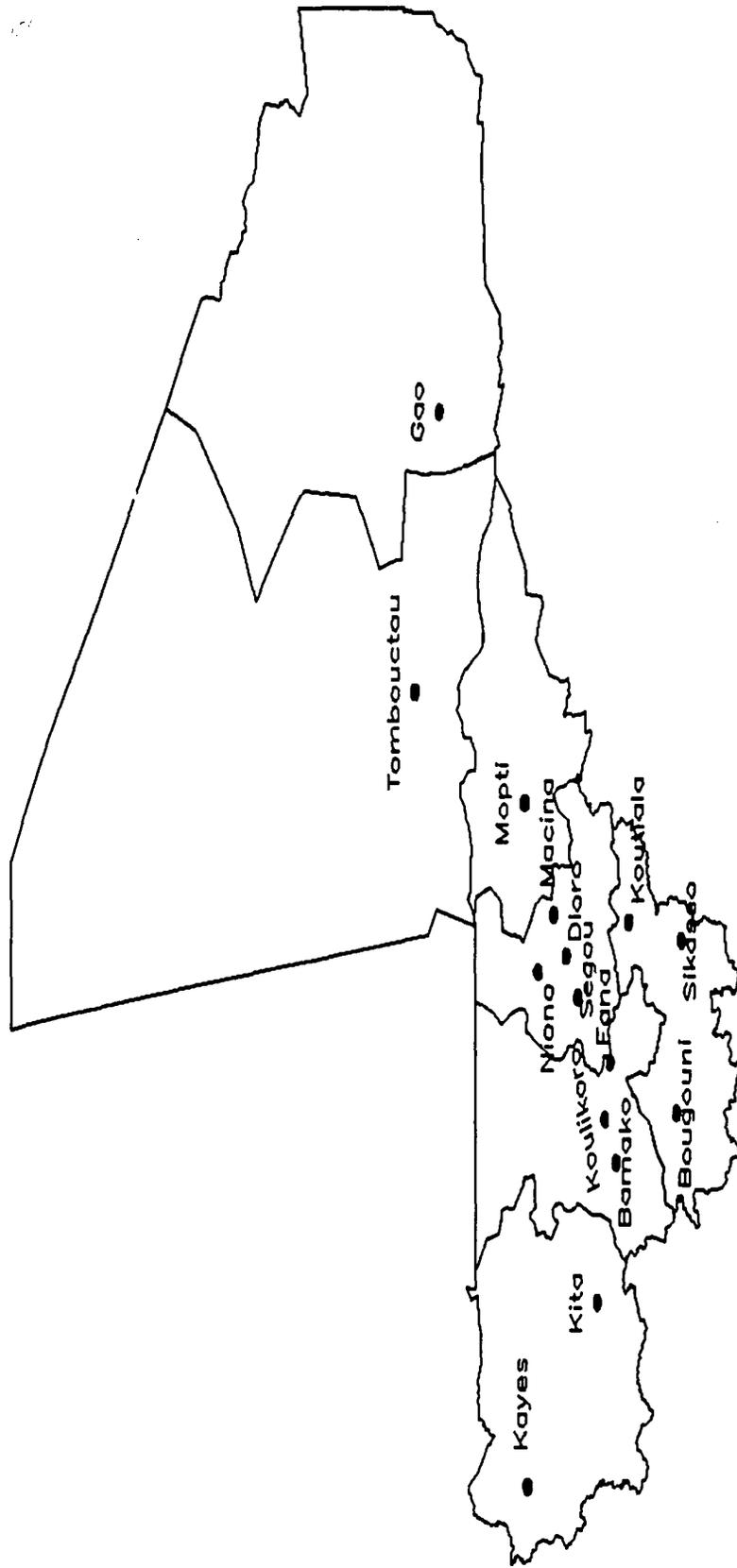


Figure 1.1 Map of Mali



During the 1985/86 to 1991/92 period, the country experienced a structural deficit in maize and rice production (Table 1.1)<sup>7</sup>. Although maize is easily substitutable with millet or sorghum, rice is not. Moreover, rice represents 23.6% of total per capita cereal consumption, and 6.4% in the total expenses of Malian households (Enquête Budget Consommation des Menages, DNSI 1988/89). Rice is considered to be a very strategic product, whose shortage could lead to social turmoil or riots, especially in urban areas where rice consumption is more important. Indeed, the TUFTS/DNSI/AID study of urban food consumption in 1989 shows that the share of rice in urban consumption baskets varies between 15.4% of total expenditures in Kayes and 25.5% in Mopti. The share of rice in cereals expenditures varies between 59.7% in Kayes and 62% in Mopti (Rogers and Lowdermilk, 1988). The urban populations are more organized politically, and rice is a more politically sensitive crop than coarse grains. Therefore, imports have played an important role in the rice subsector.

Rice imports in Mali have been highly concentrated in the hands of the four largest traders, who in 1988 were responsible for three-quarters of recorded rice imports (Coelo, 1990). The coarse grain subsector, on the other hand, appears less

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<sup>7</sup> The consumption figures cited in Table 1.1 should be treated cautiously, because the estimated per capita consumption for both maize and rice appear to many observers to be over-inflated.

**Table 1.1: Balance Sheet for Maize and Rice in Mali, 1985-1986 - 1991-1992**

	1985/86		1986/87		1987/88		1988/89		1989/90		1990/91		1991/92	
	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice
Gross Production ('000 ton)	196.5	209.5	225.5	222.5	179.0	237.0	214.0	288.0	225.4	337.7	196.6	282.4	225.9	444.5
Net Production ('000 ton)	167.0	115.2	191.7	122.4	152.2	130.4	182.0	158.4	191.6	185.8	167.1	155.3	192.0	244.5
Population ('000 people)	7560.0	7560.0	7696.0	7696.0	7836.0	7836.0	7977.0	7977	8122	8122	8369	8259	8420	8420
Consumption ('000 tons)	156.3	242.6	208.8	247.0	212.6	251.5	216.4	256.0	220.3	260.6	224.3	265.3	228.4	270.2
Deficit/Surplus ('000 Ton)	+10.7	-127.4	-17.1	-124.6	-60.4	-121.1	-34.4	-97.6	-28.7	-74.8	-57.2	-110	-36.4	-25.7

Source: DNS/DNA

<sup>1</sup> The conversion coefficient from gross to net production is given as follows (Source: PADEM):

Maize = 0.85

Rice = 0.55

The reduction includes: losses during harvest, retention for seed, and by products resulting from paddy milling

concentrated than the rice subsector. Indeed, Mehta found that the four largest coarse grain wholesalers in Bamako traded 42% of the total volume sold in 1987/88 (Mehta, 1989).

Since 1987, the paddy market has been liberalized. Farmers have been given the option of selling to the O.N., selling paddy on the open market, or processing the paddy themselves and selling the milled rice at higher prices to private traders. The liberalization has been accompanied by the rapid spread of small mills in the Office du Niger zone, up from 18 mills in 1987/88 to 383 by July 1992 (Rapid Reconnaissance).

The presence of the small mills has changed the structure of the subsector, helping to reduce concentration, and changing the marketing options of both farmers and retailers.

Current proposals (under PRMC IV) call for a major initiative to liberalize the rice market further and to shift the principal role of the O.N. toward provision of water and extension. Many argue for the privatization of the O.N.'s large mills. In this context, it is extremely important to investigate the role of small mills in the subsector, their relative costs, and what segments of the market they serve. Such information is currently lacking, and thus presents the major justification for this study.

Given the preceding background, the objectives of the study are as follows:

1. To assess the importance of recent changes in the rice subsector due to the introduction of the small mills, in terms of the efficiency of marketing rice in the O.N. zone;

2. To analyze the financial profitability of the small mills in the Office zone;
3. To develop a survey design for in-depth research on the economic profitability of small mills and their role in the rice marketing system in the Office zone.

In order to fulfill the above objectives, the following hypotheses are proposed:

**Hypotheses for Objective 1:**

1. The itinerant traders and semi-wholesalers are likely to be the major clients of small mills.
2. The rapid spread of small mills in the Office zone is likely to contribute to a higher value of paddy on the open market than has ever existed before.

**Hypotheses for Objective 2:**

1. Capacity utilization is likely to be a major determinant of the profitability of the rice mills.
2. Milling one's own paddy or buying others' paddy for resale as milled rice is likely to be more profitable than custom milling if the small mills pay the same price for paddy as does the O.N.

**1.2 Organization of the Thesis**

This paper is organized as follows: Chapter 1 presents the problem setting, the justification of the study, and the research objectives. Chapter 2 describes the environment of Malian agriculture and briefly discusses the rice subsector.

Chapter 3 presents the research methodology, including the Structure-Conduct-Performance paradigm used to analyze the performance of the subsector, the rapid reconnaissance survey, and the methodology used to collect the SIM's (System d'Information du Marche Cerealier) data.

The application of the S-C-P paradigm to the rice subsector in the O.N. zone, presented in the following chapters, will show that increased competition in the milling industry was made possible principally by the changes in the "rules of the game" that allowed both private mills and private traders to enter the rice marketing system. Chapter 4 will scrutinize the impact of private milling on the rice marketing system in the O.N. zone. Chapter 5 analyses the financial profitability of different milling alternatives. These alternatives include custom milling, milling one's own paddy production, and purchasing paddy for milling and sale of milled rice. Many people interviewed in the O.N. zone believed that own paddy milling and the purchase of paddy for milling and sale are likely to be the most profitable alternative use of the small mills. However, to decide which of the technologies is more economically profitable, and therefore sustainable, we need to go beyond the financial analysis.

Lastly, chapter 6 will summarize the general conclusions and address some of the unanswered questions that are raised in the thesis.

## **CHAPTER II. ENVIRONMENT OF MALIAN AGRICULTURE**

### **Introduction**

Mali is a landlocked country where about 85% of the total population, an estimated 8,420,000 people, derive most of their living from agriculture and livestock. Malian agriculture is, however, highly vulnerable to a semi-arid climate, poor soils, stagnant technology, and a limited range of production alternatives.<sup>8</sup> Millet, sorghum, maize, and rice are the staple food crops. Millet and sorghum cover the largest areas and are produced throughout the country, whereas maize is produced in higher rainfall areas. Rice production, on the other hand, is more concentrated in irrigated areas. While Mali has historically been self-sufficient in cereals, its production continues to fluctuate from one year to another, depending largely on the vagaries of the weather. Cereals production within the last eight years has varied from 1.7 million tons in 1985/86 to 2.4 million tons in 1991/92 (Table 2.1).

### **2.1 Trend in Cereals Production**

Cereals (millet/sorghum/maize and rice) production nearly doubled between 1980/81-1984/85 and 1985/86-1991/92, from 1.1 million tons to 2.0 million tons. The largest percentage increases occurred for maize (up 147% over the period) and paddy rice (up by 101%) (Table 2.1). These increases in production have heightened pressure on the cereals marketing system, which already suffers from limited capacity to adjust, over time and space, grain supplies

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<sup>8</sup> Most farmers still use the hoe to cultivate their farms.

to meet consumption needs and exports. Between 1985 and 1991, paddy rice production expanded from 209,500 tons to 444,500 tons, to the point that the country is now approaching self-sufficiency in rice.

## **2.2 Paddy Production Nationwide**

Paddy production (18% of total cereals production in 1991/92) grew at about 14.3% per year over the period 1980/81-1991/92. The paddy production growth has increased even more rapidly (27%/year) over 1985/86 and 1991/92 period (Table 2.1), corresponding to a relative normalization of the rainfall. Many other factors have played major roles in accomplishing this rapid growth in production. These include rehabilitation of infrastructure in the Office zone, reorganization of management of perimeters, and liberalization of marketing (particularly in the O.N. zone).

Paddy rice is produced both as a food crop and a cash crop. Paddy production is more concentrated than coarse grain production. The production takes place in various parts of the Niger valley and at the Office du Niger irrigation project around Niono. Paddy rice is also produced around small river valleys, especially in the southern region of Mali, and in several smaller irrigation perimeters (Operation Riz Segou, Operation Riz Mopti, and the like).

The production of paddy in the Office zone is by far the most important both in terms of percentage of total production (Table 2.2) and the amount of investment as well.

**Table 2.1: Cereal Production in Mali, 1980-1992 (in thousands of tons)**

Year\Cereals	Millet/Sorg	Maize	Paddy	Total
1980 - 81	694.5	62.5	143.5	900.5
1981 - 82	931.0	68.5	155.0	1154.5
1982 - 83	938.0	92.5	141.5	1172.0
1983 - 84	911.0	109.5	172.5	1193.0
1984 - 85	711.0	88.5	106.0	905.5
1985 - 86	1262.0	196.5	209.5	1668.0
1986 - 87	1305.0	222.5	222.5	1750.0
1987 - 88	1222.0	179.0	237.0	1638.0
1988 - 89	1693.0	214.0	288.0	2195.0
1989 - 90	1798.1	225.4	337.7	2361.2
1990 - 91	1465.0	196.6	282.4	1944.0
1991 - 92	1747.3	225.9	444.5	2417.7

Source: DNA/DNSI as reported by Deme (1992).

### **2.2.1 Location**

The nationwide rice production system can be classified into three sub-systems: 1) the rainfed system of production in the Mali-South zone, 2) the system of production that is under a controlled system of irrigation (Office du Niger, Baguineda, Selingue, and other village-level irrigation systems), and 3) the system of production partially free of rainfall dependency, relying partially on flood irrigation (Operation Riz Segou, the Operation Riz Mopti, and the operation Sikasso).

**Table 2.2: Paddy Production in the O.N. compared to the total paddy production, 1980 - 1992 (in thousands of tons)**

Year\Prod.	Total Production	O.N. Production	O.N. as % of total
1980 / 81	143.5	69.3	48.3
1981 / 82	155.0	62.8	40.5
1982 / 83	141.5	56.5	40.0
1983 / 84	172.5	64.7	37.5
1984 / 85	106.0	64.1	60.5
1985 / 86	209.5	83.0	39.6
1986 / 87	222.5	88.0	39.6
1987 / 88	237.0	98.2	41.4
1988 / 89	288.0	97.8	34.0
1989 / 90	337.7	106.6	31.6
1990 / 91	282.4	143.9	51.0
1991 / 92	444.5	180.9	40.7

Source: DNA/DNSI as reported in PRISAS/INSAH

### 2.2.1.1 Rainfed Paddy Production in Zones Diffuses of Southern Mali

Paddy is produced in small river valleys, especially in the southern region of Mali. In these zones, called zones diffuses (as opposed to the zones covered by extension services), paddy production is undertaken as a secondary task to the major crop cultivation (either millet, sorghum, or maize)<sup>9</sup>. The area under cultivation per farm is very low, about 0.10 to 0.25 ha per family. Likewise, the

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<sup>9</sup> Paddy is the main crop along the Niger river in the Timbuctu and Gao regions, and, to a lesser extent, in the Mopti region.

yield in this system (1 to 2.5 tons/ha) is very low compared to the Office du Niger and the Selingue zones (DNA, June, 1993). The paddy production under this production system is estimated to be about 28% of the total national production<sup>10</sup>.

Production in these zones is more dependent on the vagaries of the weather than in zones under pump irrigation systems, especially in the Office du Niger zone. Production increases in this system are more likely to be dependent on area expansion than in the Office du Niger, where increases in production have resulted primarily from yield increases (Table 2.3). Most of the production under the zones diffuses system moves through home-consumption, and reliable information is lacking on marketed surplus of paddy coming from it. However, one would expect that the regularity in the rainfall, since the 1985/86 and 1986/87 period, would open new opportunity for more production, and therefore more marketable surpluses in the zones diffuses. How much of this production goes through commercial distribution channels is a big question. The aim of this paper is not to answer this question, but instead to stress the impact that it may have on the whole subsector (about one third of paddy production comes from this system).

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<sup>10</sup> In 1990 the paddy production was estimated at 80,237 tons (Source: Thenevin, 1990) in the zones diffuses. The nationwide production figure for the same period was 282,400 tons.

**Table 2.3: Paddy marketing through the O.N. and private processing in the O.N. zone, 1977/78 - 1991/92**

	Production (x1000 T)	Yield T/ha	Sales through the O.N. (x1000 T)	O.N. Sales as a % of Production	Cumulative no. of private mills
1977/78	101.0	2.7	58.0	57.4	1
1978/79	95.0	2.6	52.3	55.1	1
1979/80	62.3	1.8	50.8	81.5	1
1980/81	69.3	2.0	50.7	73.2	1
1981/82	62.8	1.8	47.5	75.6	1
1982/83	56.5	1.6	43.8	77.5	1
1983/84	64.7	1.8	43.1	66.6	2
1984/85	64.1	1.7	45.6	71.1	3
1985/86	83.0	2.1	54.1	65.2	5
1986/87	88.0	2.2	49.7	56.5	6
1987/88	98.2	2.3	47.5	48.4	18
1988/89	97.8	2.3	64.3	65.7	58
1989/90	106.6	2.4	50.8	47.7	142
1990/91	143.9	3.3	18.2	12.6	194
1991/92	180.9	4.1	41.5	22.9	383

Source: PRISAS/INSAH, IER

#### **2.2.1.2 Production under the Fully Controlled Irrigation System (O.N., Selingue, and Baguineda)**

The paddy production in this system is less vulnerable to rainfall shortage than in the zones diffuses. The areas with controlled irrigation include the Office du Niger, the Baguineda zone, the Selingue zone, and the paddy production

systems in small villages that are irrigated from small motorized irrigation pumps. This production system accounts for about 32.7% of national production, and the yield varies from 2.4 to 5 tons/ha (DNA, June, 1993). This system of production is characterized by two harvests a year. Moreover, this system uses more improved seed than other systems. Non-labor input costs of paddy production in the Office zone accounts for 20 to 25% of the total costs of production (Ibid, 1993).

The rice production system in these areas is the most vulnerable of the three systems to market conditions, because most of the marketable surpluses are derived from it, and because it is most heavily dependent on purchased inputs. The substantial production increases in these zones due to yield increases, combined with the proliferation of small mills, have contributed to change the landscape of the rice subsector in Mali. To what extent these changes have occurred is an empirical question that will be addressed in this paper.

#### **2.2.1.3 The System of Irrigated Production with Partial Water Control**

This system accounts for 60% of the total irrigated area in Mali. It is the most important system in terms of area cultivated in rice because this type of irrigation structure is cheaper to implement (CFAF 100,000 to 300,000/ha) compared to a full water control system (CFAF 900,000 to 1,000,000 per ha), and easy to maintain (DNA, 1993). Indeed, there is no need to construct a dam when implementing this type of structure. The efficiency of this type of irrigation system depends, however, on the level of water in the main reservoir (river or stream). These systems revealed major weaknesses during years of drought when

river levels dropped. The average yield per hectare in "normal" years is estimated to be 1.5 to 2.5 tons/ha (Ibid., 1993).

Given the high vulnerability of such systems to drought, it is very difficult to predict in advance what level of production can be expected from them. Any policy designed to match supply and demand of rice in time and space should take into account this uncertainty and the possible use of trade to help offset it. On the one hand, this system of production is more vulnerable to drought. On the other hand, however, it appears to be less vulnerable to market conditions, because most of the production is home-consumed. Since the rainfall returned to normal levels in 1985/86, however, domestic rice production has grown so rapidly that rice commercialization has become the major policy issue in Mali, even for farmers using this system of irrigation (Ibid, 1993).

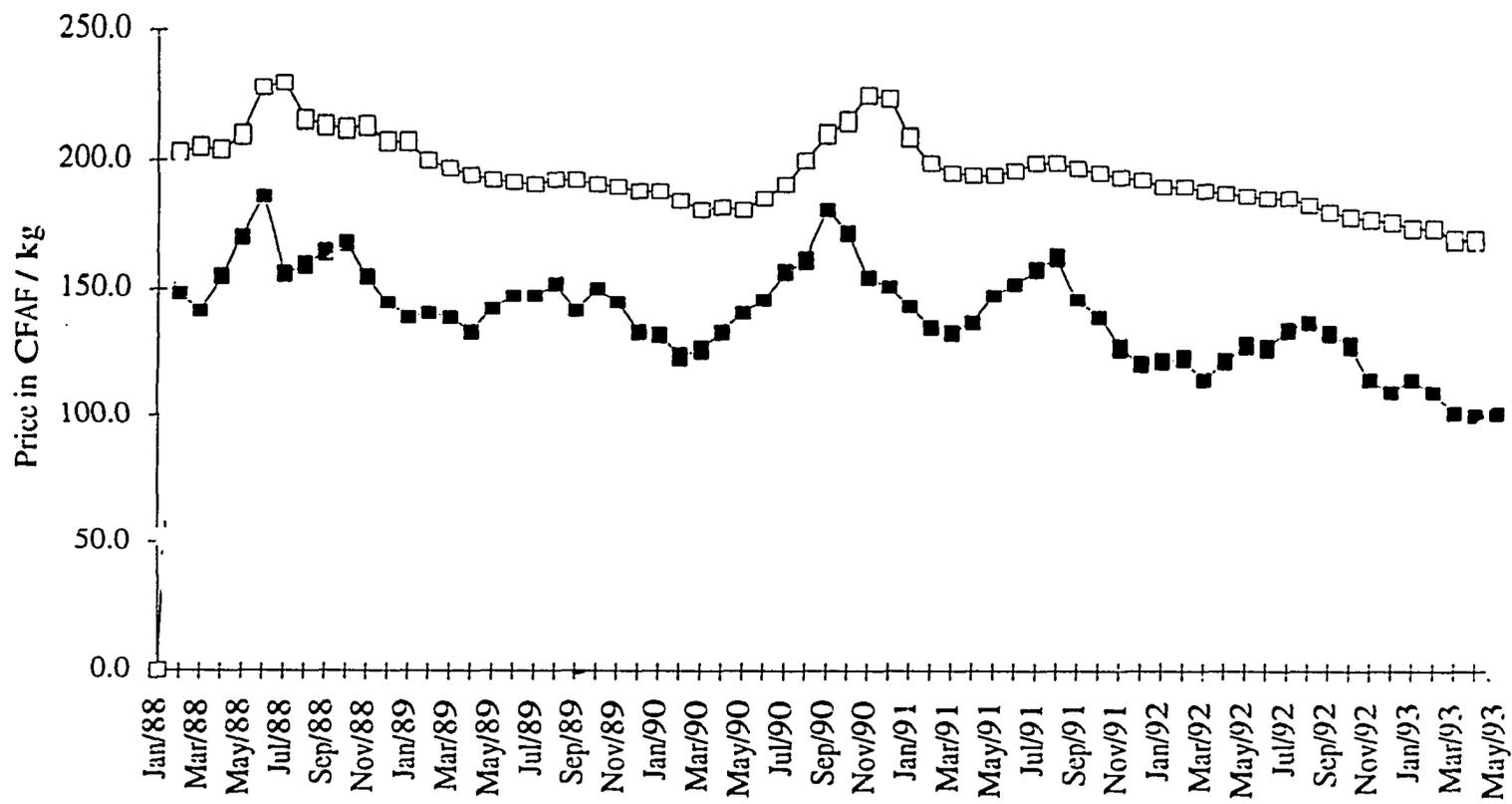
### **2.3 Rice Imports in Mali**

Until the great drought of 1972-1974, Mali was basically self-sufficient in cereals. From the 1970's to mid-1980's, with the exception of 1976 and 1977, Mali became a large importer of food and a perennial recipient of food aid. Commercial rice imports have fluctuated between 37,000 tons in 1987 and 130,000 tons in 1984 (Coelo, 1990, and DNAE, 1991).

The domestic price of rice has been unstable over time. Indeed, Figure 2.1 and Appendix Table II.1 show that both the retail price and farm price of rice have been fluctuating over the 1988-1993 period.

This price instability seems to be related to erratic import policies that the country experienced since 1981. Indeed, the private sector was first allowed to

**Figure 2.1**     **Producer Price of Rice in Niono and Retail Price of Rice in Bamako (broken 40% rice) 1988-1993**



undertake rice imports in 1981. The cereals market liberalization and the government concern to ensure the food security of a country, which witnessed successive years of cereal deficits, led to the removal of nearly all rice import duties and taxes in 1981 (Barry, 1993).

In 1986, the government adopted new measures to protect domestic rice production, which had increased in response to high rainfall level. Import duties increased from 5 percent to 32 percent of the border price, but they did not induce an increase in the domestic price of rice because of the relatively low world price of rice (Ibid., 1993). Despite these high import duties, the Office du Niger was unable to sell its stock of rice, which forced the government to ban rice imports in October 1987. Such a restricted policy led to high cereals prices until June 1988. A similar policy undertaken by the government in 1990 induced again high retail prices during the second half of the year 1990 (Figure 2.1).

Notwithstanding the rapid growth in domestic production (refer to table 2.1), until the January 1994 devaluation, white rice could be obtained more cheaply on the international market for urban markets like Bamako, and there was therefore a strong incentive for importing it illegally. During the 1989/90 crop season, CIF prices in West African ports varied between CFAF 62 and 73 per kg for whole rice and CFAF 48 and 73 per kg for broken rice (Coulter et al., 1993). Meanwhile, the import parity price of rice in Bamako was CFAF 153 per kg (Appendix Table II.2).

Likewise, in April 1992, Anema and Diallo (1992) found the financial price of paddy in Niono to be CFAF 78,000 per ton, and the economic price to be

CFAF 66,906 per ton (Anema et al., 1992). These cost prices of paddy are far above the cost of production of paddy in the O.N. Indeed, in 1991/92 the costs of paddy production varied between CFAF 30,140 and CFAF 37,960, including labor costs, but excluding the financial costs (Ibid 1992). These costs of production are far below the costs two years earlier. Indeed, the World Bank recommended in 1990 that the paddy price be maintained, at least at CFAF 70 per kg, because at a paddy price as low as CFAF 60 per kg, 70% of farmers would not have been able to cover their costs of production.

#### 2.4 Overvalued CFA Franc<sup>11</sup>

The CFAF overvaluation constitutes a sensitive piece in the import policies of the West African countries sharing this currency. The amount of CFAF overvaluation varies from country to country, with estimates ranging from very low to more than 50 percent (Sijm, 1992). A recent estimate of 9.9 percent of CFAF overvaluation for Mali was used by the Netherlands Economic Institute (Anema and Diallo, 1992) when analyzing the costs and benefits of the ARPON project.

With the overvalued CFA franc, imports become cheaper in these countries, making it easier for them to reduce the gap between their growing imports and their decreasing exports, which are basically primary goods exports. Therefore, countries like Mali, which have import substitution industries, are caught between the need to protect the domestic industries (on the infant industry grounds) and to open the market to cheap rice that would give more purchasing power to the very many low income people. Indeed, an overvalued currency

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11 The CFAF was devalued by 100% on January 12, 1994.

implies that the price of tradables expressed in domestic prices declines relative to the price of non-tradables. As a consequence, an overvaluation of the exchange rate encourages the production of non-tradables (particularly those activities which intensively use tradable inputs), but it discourages the production of export and import-substitution activities, as an overvalued currency acts like a tax on exports and a subsidy on imports. On the one hand, the situation has become more complicated to handle as neighboring countries outside the CFA system have progressively devalued their currencies making it harder for domestic production of rice to compete with imports, especially illegal imports<sup>12</sup>. On the other hand, open trade would give opportunity to consumers in Mali to get cheaper rice, and therefore would help increase their real income.

Furthermore, Table 2.4 shows that commercial rice imports have been more important during years when the domestic production reached its record. Indeed, in the early 1990s' rice imports were used by the government of Mali more to fulfill its budgetary needs than to fill the gap between production and consumption needs. In mid 1991, the transition government, confronted with severe financial constraints, allowed 88,210 tons of rice to be imported for the market year 1992. The government encouraged the imports by cutting the import tariff rate if importers would pay the import tax in advance of actually importing the rice. This allowed the transition government to generate badly-needed revenues to respond to the various pressure groups following the fall of the

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12 Countries like Guinea and Mauritania buy low-priced rice on the world market and pay subsidies on these imports to give more purchasing power to their consumers. These products are then smuggled into Mali at prices that undercut domestic production.

Moussa Traore regime. Thus, imports are encouraged by both government policy and a very low world price of rice (in domestic currency), due in part to the overvalued CFA franc (Table 2.5).

**Table 2.4: Rice Imports and Rice Production in Mali 1981-1992 (in '000 tons)**

	Recorded Commercial Imports	Rice Aid	Net Prod. (Milled Equivalent)	Supply
1981-82	10.9	15.5	85.3	111.7
1982-83	-	26.6	77.8	104.4
1983-84	11.5	41.6	94.9	148.0
1984-85	130.0	48.4	58.3	236.7
1985-86	41.0	32.7	115.2	188.9
1986-87	81.5	-	122.4	203.9
1987-88	37.0	18.5	130.4	185.5
1988-89	68.0	26.0	158.4	252.0
1989-90	89.0	-	185.7	274.7
1990-91	60.4	-	155.3	215.7
1991-92	88.2	-	244.5	326.7

Source: Coelo, DNAE, and OSCE.

**Table 2.5: Average Annual CIF Prices in West African Ports for 35% Broken Rice, 1985-90 (in CFAF/kg)**

Year	1985	1986	1987	1988	1989	1990
Price	100	73	67	83	93	67

Source: Sijm [1992]

The imports of rice contribute to a declining demand for locally produced rice, the production of which is growing considerably because of the productivity gain in the Office du Niger (Table 2.3), Selingue, and Baguineda zones.

## 2.5 Rice Consumption

The average per capita annual consumption of grain in Mali is 212.4kg, of which rice accounts for 23.6%, while millet, sorghum, and maize account for 73.1%<sup>13</sup>. The consumption of rice has grown both in urban and rural areas since the 1970s drought, which turned Mali from a net cereals exporter to a net importer. However, rice consumption is more important in urban than rural areas. Rogers' and Lowdermilk's study shows that rice contributes to about half the cereal calorie consumption of all urban expenditure classes, including the urban poor (Sijm, 1992). Indeed, according to Reardon (1993), "with urbanization comes generally changes in employment patterns, increasing the opportunity cost of women's time, and increasing transport and other transaction cost constraints on households' activities". Deme (1992) points out that the increase in rice consumption in urban areas in Mali is related to the increase in opportunity costs of time for women, who favor foods that do not need much time to be cooked. A recent study from Boughton and Sanogo shows that rice consumption tends to be more related to the level of income. Indeed, rice accounts for 59% of total cereals consumed by the highest income group of the population sampled in Bamako. This percentage is higher when it comes to middle income people (61% of total cereals consumption). However, the percentage is quite low as far as low income people are concerned (44% of total cereals consumption). Conversely, the study shows that the less the income, the more sorghum consumption to the

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13 Enquete Budget Consommation 1988-1989(DNSI), a nationwide survey carried out in 1988/89 by the National Statistics and Information Service.

total cereals. Indeed, the highest income group population is found to consume 49% of sorghum to total cereals consumption. This percentage is 69% for middle income group and 72% for low income group. These results would suggest that an increase in the relative price of rice is likely to induce more consumption of sorghum and less rice consumption by low income group.

## **2.6 Price Variability of Rice**

The average producer prices of milled rice at Niono have fluctuated between CFAF 105/kg during the first five months of 1993 and CFAF 158/kg in 1988. In general, both the farm price and retail price of rice exhibit a negative trend over the period of analysis. However, the intra-annual variations of farm price have been much more important than the retail price variations. Indeed, the coefficient of variation of farm prices fluctuated between 4.6% in 1989 and 11.7% in 1990 (see Appendix II).

The consumer prices in Bamako were relatively more stable over the period 1988 to 1991, and they fell during the 1992 and 1993 period (refer to figure 2.1). This price decline was likely due to the increase in domestic production combined with the large stocks of rice imported during the period of transition government (March, 1991-March, 1992). The intra-annual coefficient of variation for Bamako consumer prices ranged from 2.2% in 1991 to 8.3% in 1990. In absolute terms, the consumer price decreases were more important, between 1988 and 1989, compared to the producer price decreases. However, from 1989 to 1990, both the producer and consumer prices increased, with producer prices increasing more than the consumer prices. On the other hand, the margins

dropped slightly. During the 1991-1992 period, both the producer and consumer prices dropped in absolute terms. More importantly, during the same period, producer prices decreased more than consumer prices, while the margins become stable again. Both producer and consumer prices dropped more during the first five months of 1993 compared to the previous period, while the margins have increased (Appendix II).

Contrasted with price variability of coarse grains, it appears that prices of rice have been more stable. Indeed, most of the domestic production of rice occurred in irrigated areas where production is less vulnerable to the erratic rainfall accounting for 50% of the variation in millet/sorghum production (Mehta, 1989). Therefore, the stabilizing effect of irrigation on domestic production contributes also to reduce relatively the variability of rice compared to that of the coarse grains. The imports also help to reduce the variability of the consumer price of rice. The coarse grains, unfortunately do not benefit from any of these stabilizing effects, and therefore, are more unstable in terms of both production and price.

The imports of 88,200 tons of rice in 1992, combined with the exceptional domestic production of 444,528 tons of paddy, have contributed to depress both the producer price and the consumer price of rice. Indeed, the average producer price decreased by 12% from 1991 to 1992, while the consumer price decreased by 7.4% over the same period. An unintended positive effect of this import policy seems to be the more aggressive behavior that both the O.N. and the AVs were

forced to develop in searching new distribution networks.<sup>14</sup> For example, in 1992 the O.N. supplied 2,000 tons of rice to a group of retailers in Bamako (Rapid Reconnaissance, July-August 1992). It was the first time in recent years that the O.N. has sold to a group other than wholesalers. Likewise, some Avs have established distribution networks through some public services in Bamako to sell more milled rice. Notwithstanding the relative good supply of rice, the cereals balance sheet exhibits, in 1991/92, a gap of 22.4% short of consumption needs. This would suggest that the method used to estimate consumption could be questioned.

## **2.7 The Rice Subsector and Its Recent Evolution**

The cereals marketing system is characterized by two different marketing channels: the coarse grains subsector, and the rice subsector. The cereals marketing system has moved through significant changes from the period of official state monopoly to various stages of liberalization. This section will describe some of the major characteristics of the coarse grain subsector and contrast this with the rice subsector. More details related to this issue will be provided later in chapter IV.

### **2.7.1 The Coarse Grain Subsector**

The coarse grain flows are born from small-scale and primarily home-consumption-oriented production systems. At the farm level, cereals are bargained and sold (on a cash basis) on weekly rural markets to a myriad of

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<sup>14</sup> The Associations Villageoises (Avs) are farmer associations at the village level. The Avs are similar to farmer marketing co-ops.

collectors. The volume handled by these markets depends on the surplus the market village and the closest neighboring villages can supply. It is also dependent upon how well the road network and/or the information network functions. For example, Fana is a relatively large assembly market which is connected to many surplus villages. In addition, Fana is connected to both surplus villages and consumption areas by a relatively good road network.

The grain assemblers are of many types: a) those who are independent and finance their own purchases, b) those who are commission agents of wholesalers, and c) consumers, i.e., either producers who are net grain buyers or consumers coming from urban areas. Some grain may also flow through barter arrangement (sales to herding communities) within the same village. Both the independent assemblers and the wholesalers' commission agents deliver their cereals to urban wholesalers or semi-wholesalers (Dione, Dembele, and Staatz, 1986). Wholesalers are defined, for PRMC credit programs, as having a turnover in excess of 1,000 tons per annum. They are the key decision-makers in the marketing chain, being the main source of finance for procurement in the field (Coulter et al., 1993 p.22). Semi-wholesalers are more concerned with distribution than with procurement. Generally they lack sufficient turnover or capital to allow them to engage in long-distance trade.

Retailers are supplied with cereals by both wholesalers and semi-wholesalers. However, wholesalers as well as semi-wholesalers also often engage in the retail trade.

In Mali, farmers produce cereals basically for their own consumption. Therefore, they are the ones who appear to be storing most of the coarse grain production. Wholesalers, the state marketing board (O.P.A.M.), and consumers also store some of the coarse grain surplus. The former store for speculative reasons, while the last two store for food security. In recent years, farmers have become more involved in storage for speculative reasons through village associations (Avs), suggesting a stronger market orientation of rice producers in the O.N. zone.

### 2.7.2 The Rice Subsector

The rice flows resemble those of the coarse grains as far as the rice production in the zones diffuses is concerned. When it comes to rice produced in the Office du Niger and O.R.S. zones, and imported and food-aid rice, the flows are different from those of the coarse grains.<sup>15</sup> In addition, marketing patterns have changed over time. The pattern that existed before paddy liberalization in 1987 (Figure 2.2) differs considerably from that which has evolved since 1987 (Figure 2.3).

The production in the Office zone is characterized by small-scale farming (4.7 to 8 hectares per household). Thirty-one percent of the farmers sampled in this zone by I.E.R.<sup>16</sup> are under-equipped (not having enough oxen to allow one pair to relax when another pair is working). There are three production systems

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<sup>15</sup> The Operation Riz Segou (O.R.S) is one of the state systems of irrigated production with partial water supply in Segou region.

<sup>16</sup> The Institut d'Economie Rurale (I.E.R.) is the government agricultural research organization of Mali.

Figure 2.2: The rice sub-sector in the O.N. between 1981 and 1987

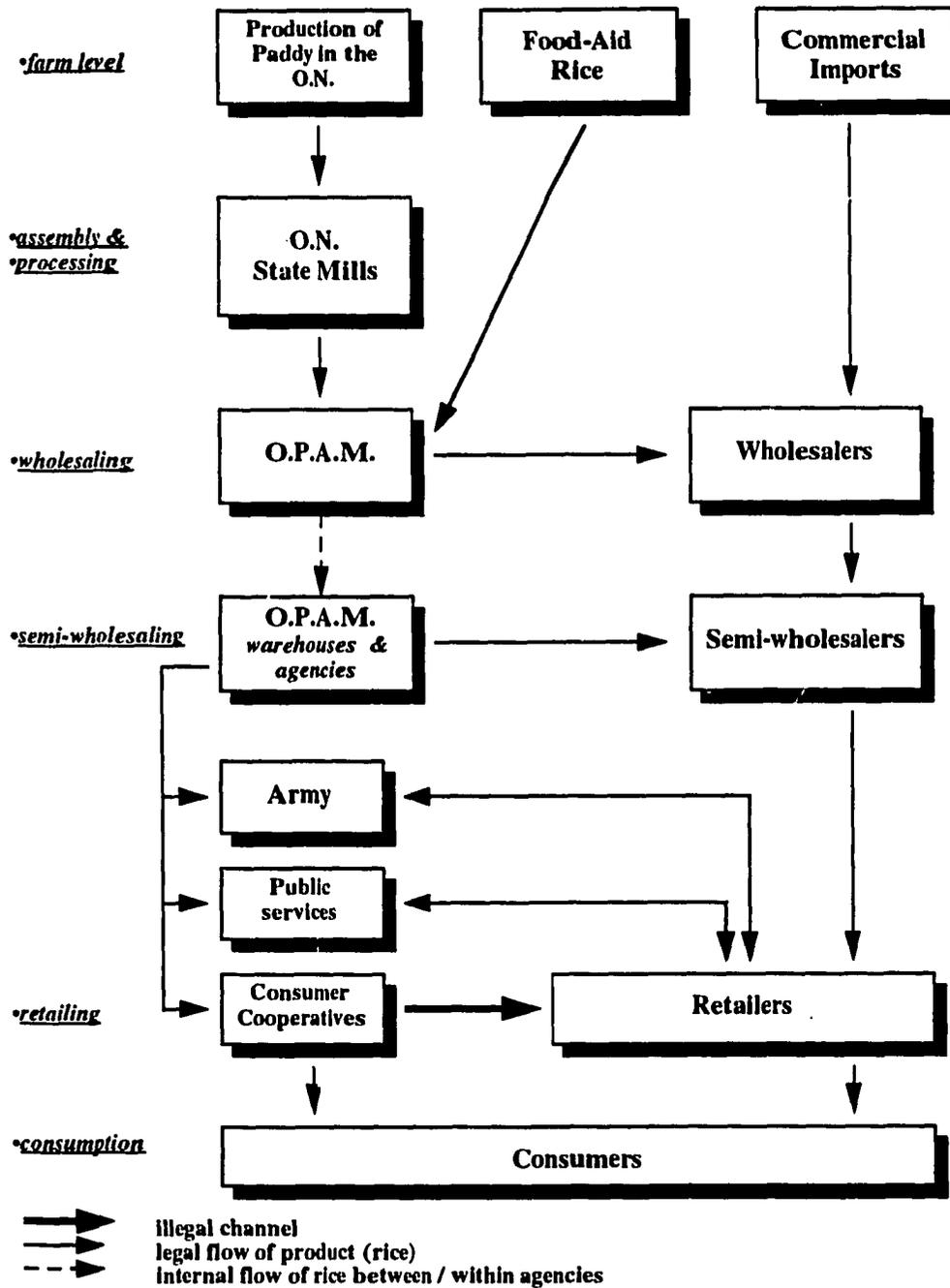
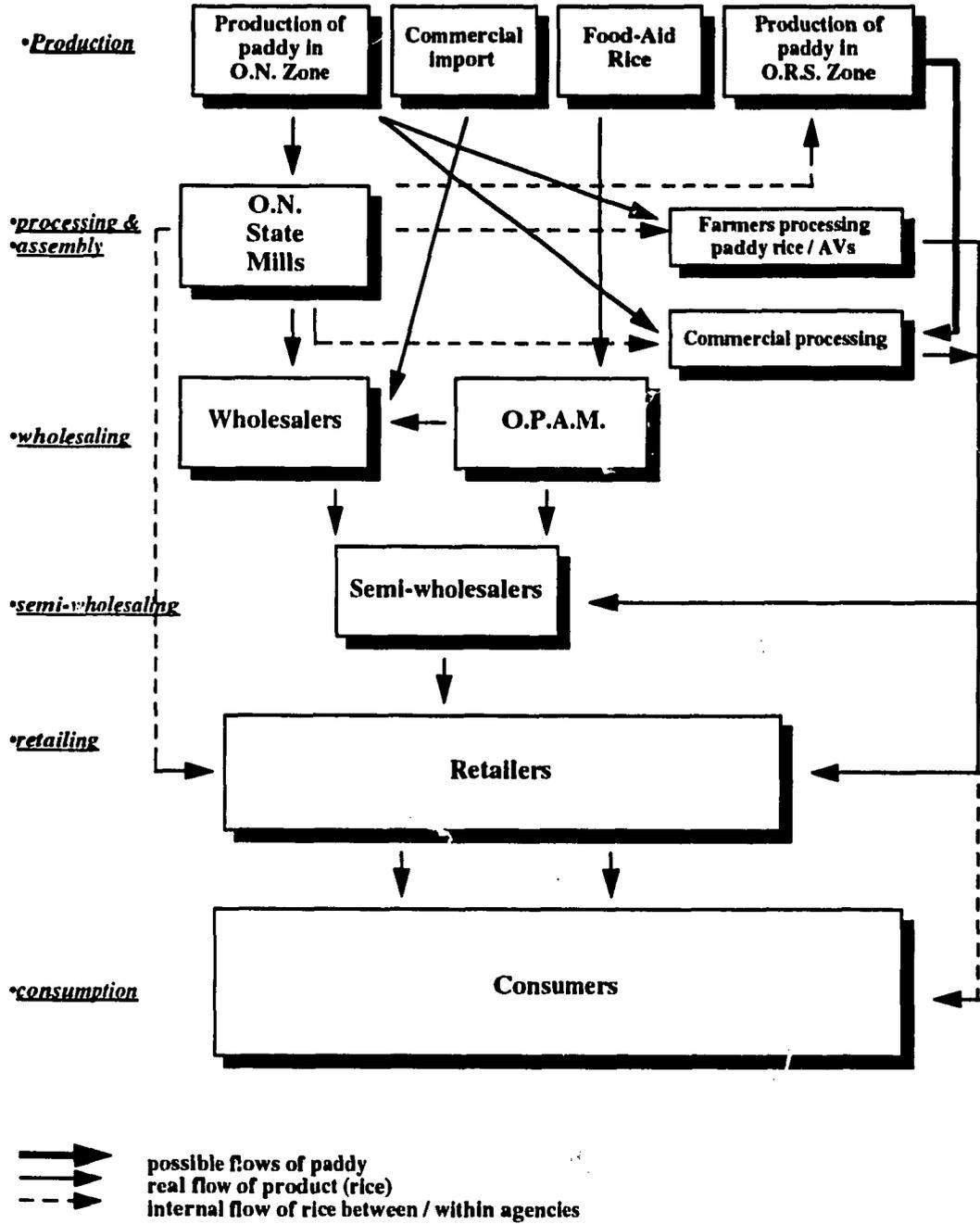


Figure 2.3: The rice sub-sector in the O.N. after 1987



in the Office du Niger zone: the Amelioration de la Riziculture Paysanne a l'Office du Niger (ARPON), the RETAIL project, and the non-restored areas. The RETAIL is a project involving intensification, transplanting and rehabilitation of infrastructure.

The most productive system in the Office du Niger is that of RETAIL, which yielded over 5 tons per hectare in 1990/91 (Barry, 1993). Yields are highest for this project because it enjoys full water control and regular maintenance of the irrigation network which allows double-cropping during the year. Moreover, it requires transplanting and the heavy use of chemical fertilizers, which make it an intensive production system. Water charges and threshing services are estimated at CFAF 42,000 per hectare and nearly 8 percent of production costs, respectively (Ibid., 1993). However, farmers are granted free extension services, estimated at nearly CFAF 13,000 per hectare.

The second most productive technique in the Office du Niger zone is the system of production of the ARPON project, which does not enjoy a systematic leveling of the fields. As a result, certain areas of the fields are poorly flooded. Partly as a result, farmers of this project use lower doses of inputs than those in the RETAIL project. The production system of the ARPON can thus be termed semi-intensive. Its yields are lower and averaged 3.5 tons per hectare in 1990/91. As a result of lower yields, farmers are charged about CFAF 28,000 per hectare for water use, while paying the same rate for threshing services.

The third production system found in the Office du Niger is that of the non-restored areas that use gravity irrigation. The irrigation network of this

production system is not maintained on a regular basis and, as a result, yields are lower than those of the other systems described above. These yields, estimated at nearly 2,500 kg per hectare, reflect also the use of a relatively lower dose of inputs. Farmers are charged CFAF 28,000 per hectare for the use of water and 8 percent of the production for threshing services (Cebon, 1992, p.8).

The land lease between farmers in the zone and the Office is based on a yearly contract giving the right to farmers to cultivate a given acreage of land. In this contract, the Office du Niger acts on behalf of the State, which owns the land, and the farmer is obligated to strictly respect certain conditions (i.e., pay the O.N. for water supply, fees for the use of other irrigation facilities, and the like). Theoretically, farmers who fail to respect these conditions are supposed to be evicted from their areas. In practice, acreage reduction has occurred more frequently than evictions, especially in the RETAIL project. However, 175 evictions occurred in 1985/86, and in 1986/87, 140 farmers (sector of Niono) were on a list proposed for eviction (Samacke and Yung, 1988).

In addition to eviction and acreage reduction, farmers can be subject to having some of the land they are cultivating transferred to new users, mostly to the non-residents, having more connections with the O.N. executives. "Non-resident farmers" refers to settlers who do not have their households living in the farming area. They include civil servants of Office du Niger living in Segou, civil servants or other parastatal workers living in Bamako, and traders as well as other businessmen living in Bamako and other cities. In theory, the first requirement one should fulfill in order to be assigned a land is to be a resident in the farming

zone. However, in practice the non-residents hire seasonal laborers who live on the land with their families. The non-residents use paddy farming as an extra activity; therefore, they are not as committed to farming as the resident farmers who earn most of their income from the farming activity.

Evictions, transfers, and acreage reduction create a constant situation of threat that may facilitate the task of the O.N. to recover its credit. However, given that these measures are seldom applied with fairness, the end results may have a negative effect on paddy production in the O.N. The tendency is that the acreage reduction and transfers benefit non-residents at the expense of resident farmers. Evidence suggests that: 1) the resident farmers are more productive than the non-residents, and 2) the non-residents misuse water and water systems. A sample of 2,600 non-resident farmers was surveyed in 1987 by the Bureau du Paysanat in the Office zone. This survey showed that 48% of the sample had a main occupation different from farming (Ibid. 1988).

Furthermore Samacke and Yung showed that in 1985/86, the yields of new farmers were 18% lower than those of the established farmers and that the yields of non-resident farmers were 23% lower than those of established farmers.<sup>17</sup> In 1986/87 this gap got even bigger, 20 and 45% less than the established farmers, respectively, for new farmers and non-resident farmers. Moreover, in 1987 the non-residents represented 28% of the total population in the O.N. and were assigned 20% of the total land (Samacke et al., 1988). The non-residents are

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<sup>17</sup> Established farmers refer to those who have lived in the farming area for at least five years.

assigned as good land as the resident farmers (Ibid., 1988). The end result of the increase in the number of non-residents is a decline in the long-term productivity in the O.N. Therefore, any future policy aiming to increase paddy production in the O.N. zone should take into account the rate at which the population of non-residents is growing.

The responsibilities of the Office under the contractual arrangements include the delivery of inputs (fertilizer and seeds) and credit to purchase farm equipment by farmers, the maintenance of the irrigation system to assure timely delivery of water to the fields, and the assurance of market outlets at fixed prices to farmers.

Prior to paddy market liberalization in 1987, all paddy assembly and processing were handled by the Office. The Office du Niger was responsible for paddy assembly from the farmers' fields. Once assembled and the farmer's home consumption subtracted, trucks were sent to carry the paddy to the different milling plants (a total of four plants). Processed rice was marketed exclusively through O.P.A.M., the parastatal marketing board (see Figure 2.2). The retailing of the locally produced rice in the Office zone as well as the food aid rice received from donor countries was channeled through consumer cooperatives and O.P.A.M.'s sales outlets throughout the country.

Both producer prices and the prices at which the Office du Niger had to sell to O.P.A.M., as well as the consumer prices at which O.P.A.M. had to sell, were fixed by a national commission, chaired by the Office de Stabilization et de

Regulation des Prix (O.S.R.P.)<sup>18</sup>. The O.S.R.P. financed these price-support activities through taxes levied on petroleum products and specific taxes on other imported goods.

The commercial imports of rice were controlled by no more than four wholesalers. This imported rice was channeled to consumers through semi-wholesalers and retailers.

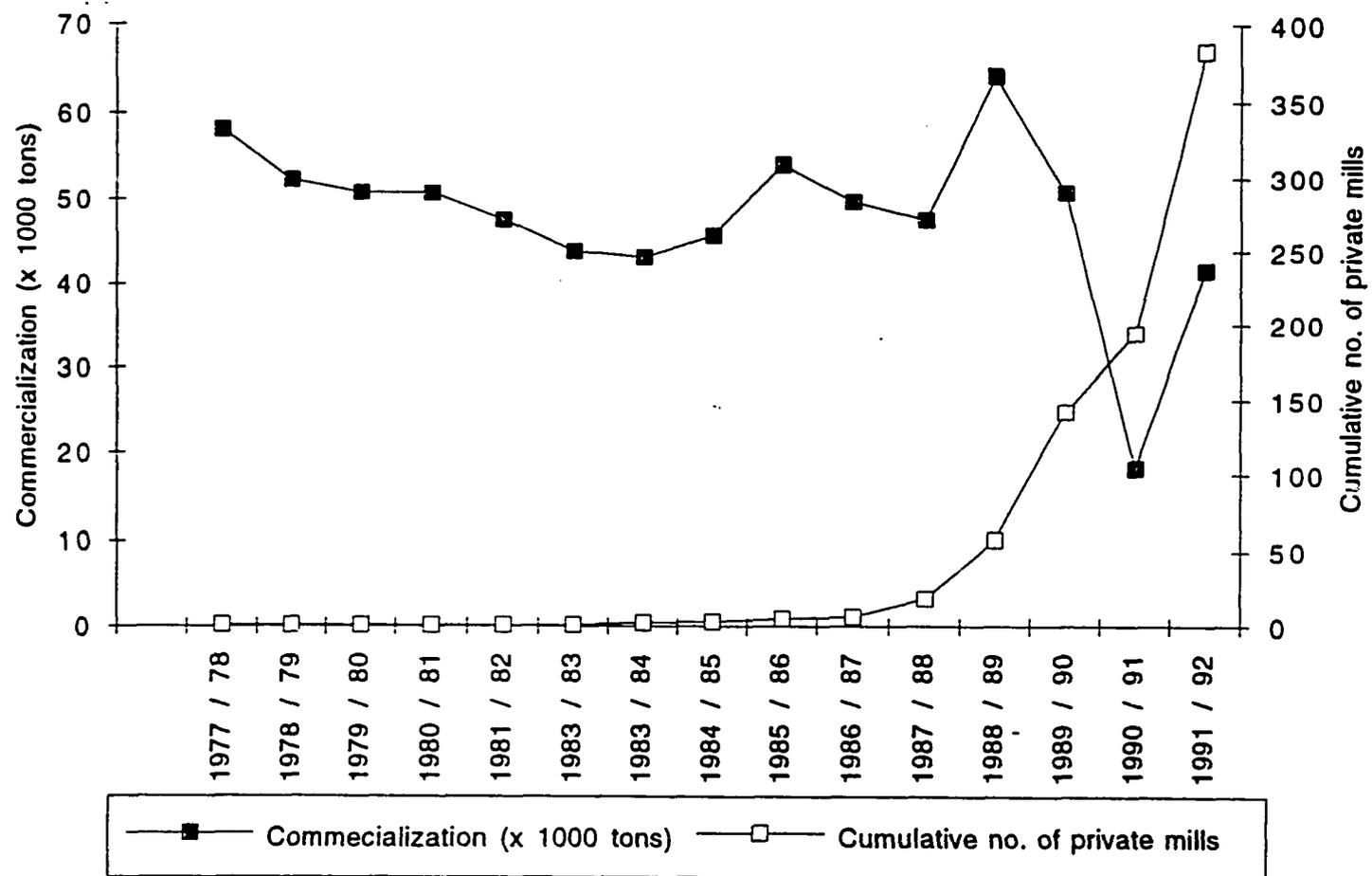
The marketing flows of locally produced rice have changed since 1987, when farmers were given the option either to sell the paddy to private traders or to mill their paddy and sell milled rice to traders (see Figure 2.3). The government has sought to protect the market for the growing Malian output through a variety of mechanisms, including a 32% import duty, "twinning arrangements," and, recently, a variable levy on imports. O.P.A.M. is completely excluded from the distribution channel of locally produced rice. The processing and the milled rice assembly activities are located both at state mills and at private mills, and most of the production in the Office zone is now processed by private mills (Figure 2.4).<sup>19</sup> These private mills are farmer-owned mills, commercial mills, and mills owned by groups of women. Most, if not all, of the rice milled by state mills is channeled through the traditional private rice

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<sup>18</sup> The Office de Stabilization et de Regulation des Prix (O.S.R.P.) was the government office whose role consisted of supporting both producer and consumer prices of agricultural products. The aim of this price support system was to stabilize and regulate the prices of major commodities throughout the country.

<sup>19</sup> In 1992, only 43,000 tons (26.5% of the total production of 161,861 tons of paddy in the O.N.) were processed through O.N. mills.

**Figure 2.4 Commercialization in the O.N. and Private Processing**



importers (wholesalers). The semi-wholesalers are supplied through AVs, commercial mills, wholesalers, and through O.P.A.M.'s open tender system.

Retailers are generally formerly unemployed professional students, workers fired from state enterprises, women, and semi-wholesalers' commission agents. They are supplied from Avs (in Niono zone), commercial rice processors, semi-wholesalers, and the O.N.<sup>20</sup>

Consumers are supplied by retailers. However, many consumers are supplied from the Niono zone either by relatives or through direct cash purchases in the weekly markets of the zone.

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<sup>20</sup> In August 1992, the Office du Niger signed a contract to sell 2000 tons of milled rice to "Sabou Nyouma," a co-op of retailers in Bamako.

## **CHAPTER III. METHODOLOGY**

### **3.1 Introduction**

This chapter presents the theoretical framework that guides this study, including the Structure-Conduct-Performance approach and the subsector approach. The chapter will also discuss some of the previous studies of the rice subsector. Finally, the chapter will briefly describe the data sources and the approach used to analyze these data.

### **3.2 Theoretical Framework**

This section will discuss the theory underlying the Structure Conduct and Performance (S-C-P) paradigm and the subsector approach, which is widely used to analyze marketing issues. The evidence drawn from application of these approaches to the rice subsector in the O.N. will be used to address the objectives of the study, which were discussed in the first chapter.

#### **3.2.1 The Structure-Conduct-Performance Approach**

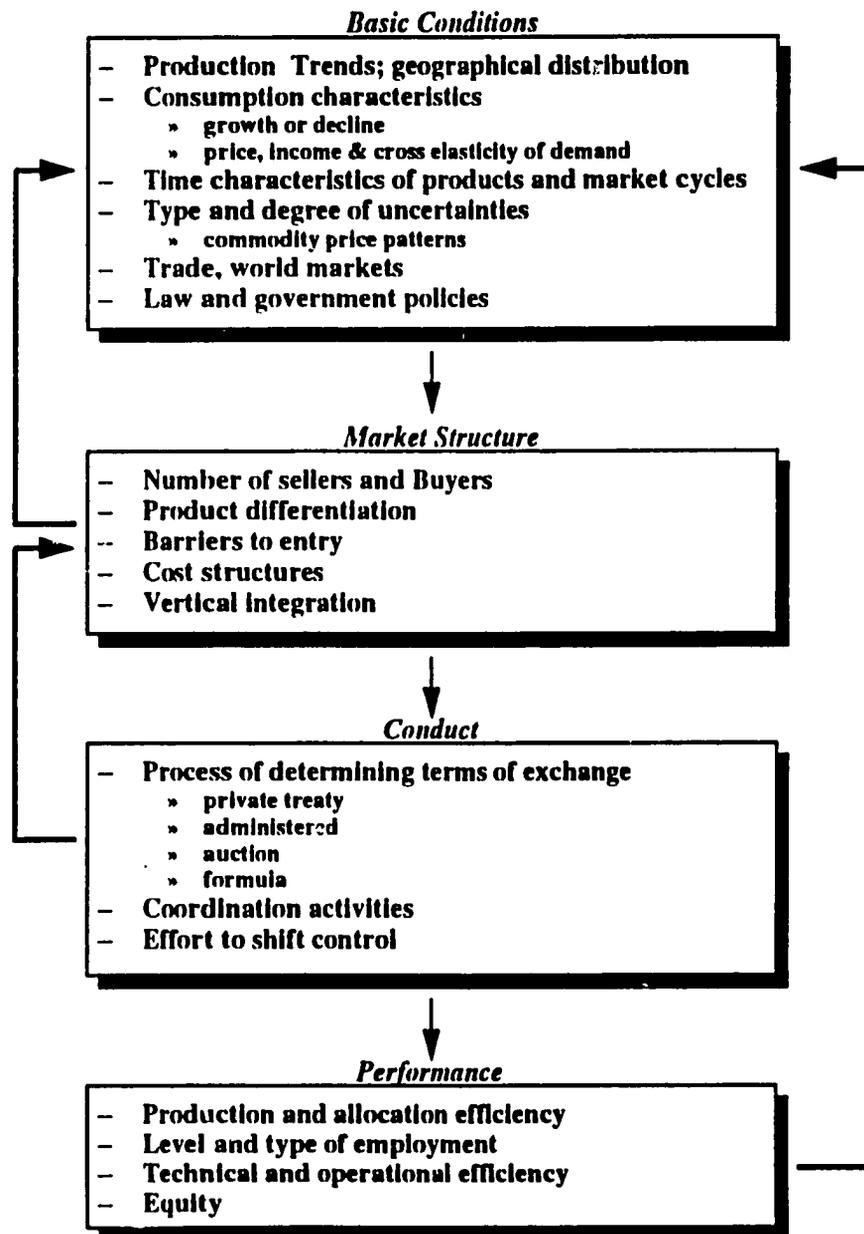
The Structure-Conduct-Performance (S-C-P) paradigm is widely used to study marketing issues. It was made popular by Joe Bain (Bain, 1958) under the broader rubric of industrial organization theory. According to F.M. Scherer, in any society there are three alternative ways to resolving questions such as what end products to produce and how much of each to produce, how scarce resources will be allocated for producing each product, and how the end products will be divided up or distributed among the various members of the society. Decisions can be made to conform with tradition, the problem can be solved through central planning, or the market-system approach can be utilized. In the field of industrial

organization, as Frank Scherer has stated it, "... we try to ascertain how market processes direct the activities of producers in meeting consumer demands, how these processes may break down, and how they can be adjusted (e.g., through government intervention) to make actual performance conform more closely to the ideal" (Scherer, 1980, p.2).

The S-C-P paradigm, which was originally popularized by industrial organization theorists, tends to focus on individual horizontal segments of economic activity (e.g., input supply, farm-level production, assembly, processing, or retailing). Performance in particular markets or industries is said to depend upon the conduct of sellers and buyers in such matters as pricing policies and the like. Conduct depends in turn upon the structure of the relevant market (e.g., the number, size and distribution of sellers and buyers, the degree of product differentiation, and entry conditions) (Scherer, 1980, p.4). The S-C-P paradigm is presented in Figure 3.1.

Although this paradigm fails to include multiple industries or levels of a subsector into the same framework of analysis, one of its central ideas is particularly pertinent to the analysis of the cereals subsector. This central concept is that the structural characteristics of an industry (e.g., the number of buyers and sellers, degree of product differentiation, conditions of entry into the market, degree of vertical integration) have a strong impact on the conduct of market participants (e.g., pricing behavior, interaction between firms or individuals, coordination of policies, opportunism) and performance (e.g., product characteristics, technical and economic efficiency, achievement of welfare goals,

**Figure 3.1: A Model of Industrial Organization Analysis**



Source: Marion et al. Organization and Performance of the U.S. Food System, adapted to the Rice Marketing System in the O.N. Zone

progressiveness, externalities, and the like) (Scherer, 1980, p.4). Therefore, this study will apply the S-C-P paradigm to the rice subsector of the O.N. to address the objectives as described in the first chapter. But first we need to discuss what we mean by the concept of a subsector.

### **3.2.2 The Subsector Approach**

Marion defines a subsector as "the array of firms, markets, rules, and arrangements involved in producing a commodity and moving it through to the point of consumption" (Marion, p.111). The subsector approach differs from traditional industrial-organization approaches in that this approach considers the grouping of economic activities related horizontally and vertically by market relationships such as input supply, farm-level production, processing, and distribution. Industry-oriented approaches, on the other hand, tend to focus on discrete horizontal slices of economic activity like input supply, farm-level production, assembly, processing, or distribution. As such, the subsector approach is more appropriate to analyzing the possible interdependencies that occur within the market of a particular commodity. In the case of the rice subsector in the Office du Niger zone, it is particularly practical to use this approach because some of the sequential activities seem to be performed poorly. For example, the manner in which the storage activities are performed does not ensure risk-sharing between different participants in the marketing system, as farmers are likely to bear most of the risks of price instability. Furthermore, the credit system that supports commercialization of rice seems to be biased towards a few traders who have good political and economic connections.

### **3.3 Previous Studies of the Rice Subsector**

Many studies have been undertaken to enable better understanding of the rice subsector in the Office zone in order to help improve its performance.

One such study was conducted by the World Bank in 1990, and involved comprehensive research on the rice subsector in the Office du Niger zone. The study was aimed at evaluating the effects of the performance contracts agreed upon between the O.N., the Malian government, and the World Bank. These performance contracts were part of a package of reforms to streamline the Office du Niger. One major recommendation made by the study was that a minimum producer price of paddy be maintained. During the first and the second years of the following performance contract, this minimum price should be CFAF 70 per kg for good quality paddy. The study recommended that the minimum price should vary in a range of CFAF 65 to 70, taking into consideration storage costs over the year. Some of the reasons underlying the recommendation that a minimum price of paddy be maintained at CFAF 70 per kg were as follows:

- more than 70% of farmers in the O.N. would be unable to cover the costs of paddy production if they were paid less than CFAF 60 per kg;
- there was a huge program of CFAF 35 billion investment to be undertaken throughout the following 4 years. This program was concerned with 30,000 ha of land reclamation, and farmers in the O.N. zone were the major actors to be counted upon for the success of such investment. Therefore, a lower paddy price would undermine farmers' incentives to undertake and maintain such investments. The Bank study foresaw that in the absence of

government support, paddy prices would fall below CFAF 70/kg. This assumption was no longer valid in 1992 because the number of small mills increased by 170% and many farmers voluntarily were choosing not to sell their paddy to the O.N. despite the minimum price of CFAF 70 per kg offered by the state mills. The World Bank study places excessive emphasis on the state mills, which were supposed to serve an important storage function, given that farmers had limited storage capacity. In addition, the study failed to examine a notable alternative: that most of the processing could be performed by farmers and, therefore, emphasis could be placed on assisting farmers in developing marketing skills.

A more recent study done by I.E.R. (July, 1992) showed that most farmers in the O.N. zone exhibit a benefit from paddy farming (about 75% of farmers). Only 25% of the households in the O.N. zone can barely cover their consumption needs through their own production. About the same percentage was found to be able to feed themselves through their own production and sell at most 300 kg of paddy per person. The other half of the households in the Office zone is found to exhibit a very large net return, about CFAF 90,000 per capita (CFAF 242,193 per ha), from paddy farming.

In terms of sensitivity to paddy price variation, the IER study showed that a CFAF 10 per kg price fall from the minimum price (CFAF 70 per kg of paddy) would result in the percentage of households that are net sellers falling by only 5%, i.e., from 75 to 70%. The study showed that at CFAF 50 per kg paddy, still 60% of the households would remain potential paddy sellers (Cebron, 1992),

meaning that these households would cover their consumption needs through their own production and still could sell profitably at most 300 kg of paddy per person.

Deme (1992) examined the cereals subsector's performance in 1992, paying particular attention to the storage issue. He suggests that one way to reduce the intra and inter-annual fluctuations of cereal prices is to develop the storage at the farm level, especially at the level of Avs. This approach of developing the storage function at the farm level, as a strategy to reduce price variability, seems to be quite straightforward. In order to better understand the issue, different strategies must be developed. However, there are several factors to be considered when devising new strategies.

In the coarse grain subsector of the CMDT zones for example, there is more incentive than in the O.N. for farmers to store cereals since cotton revenues provide liquidity to meet immediate post-harvest financial obligations. Farmers thus feel less pressure to sell cereals immediately after harvest. In the coarse grain subsector in the northern OHV zone, on the other hand, farmers do not have the income provided by cotton, and hence sell more of their grain immediately after harvest (Dione, 1989). Moreover, in the rice subsector in the Office du Niger zone, farmers are likely to be more market-oriented, having the opportunity to add more value to their paddy through processing. At the same time, they are more likely to be directly exposed to the consequences of macroeconomic policies, such as erratic rice imports and exchange rate overvaluation. Clearly, then, the storage behavior of farmers in the rice subsector in the O.N. zone should not be treated the same way as the storage behavior of

farmers in the CMDT zone, or that of farmers in the coarse grain subsector in the northern OHV zone. The storage behavior of farmers in the O.N. zone is more likely determined by both the rice imports and the access to credit. Therefore, any program which aims to help farmers perform storage activities in the O.N. zone should include these two variables in its agenda.

The structure of the rice subsector has evolved from the state monopoly (e.g., the tandem of O.N.- O.P.A.M. in supplying the population with rice), to an oligopoly of few private traders controlling the cereals marketing, and finally to a more competitive marketing system. Although there are no detailed studies to support that the rice subsector is currently less concentrated than it was in the late 1980s, it seems obvious that the introduction of private mills heightened competition in the rice milling industry in Mali. Indeed, over the 1986/87-87/88 period, the commercial imports averaged 30.4% of total rice supply in Mali, not to mention the supply from the state mills that was also controlled by the importer wholesalers. Since 1990/91, the share of the private mills in total supply has been steadily increasing (at least 500 tons a week). During the 1990/91-1991/92 period, notwithstanding the cut in import tariffs (in mid 1991), the commercial imports averaged only 27% of the total supply. Moreover, the O.N.'s marketings as a share of production in the zone fell from over 50% to around 20%. Since the four largest wholesalers are supplied largely through imports, purchases of food aid from O.P.A.M. (which also fell), and O.N. purchases, the data clearly indicate their share of the market has fallen.

### **3.4 Data Sources and Analytic Approach**

#### **3.4.1 Data Sources**

A number of data sources were used in carrying out the analysis presented in this paper. These sources included the SIM's price series, I.E.R.'s data on the number of private mills, the DNA/DNSI production data, the information collected during a rapid reconnaissance carried out by the author, and the O.N. production and commercialization data.<sup>21</sup>

The SIM price data collection covered 58 markets, of which 47 were collected by SIM agents and 11 market were covered by agents of the Systeme d'Alerte Precoce (SAP). The prices were collected at three levels: producer, wholesale, and consumer prices, for six cereals: millet, sorghum, maize, rice "RM40" (40% broken, domestic and imported), rice "BB" (100% broken, domestic and imported), and paddy rice<sup>22</sup>. The prices were collected on the weekly market places for each market sampled. The detailed methodology for the SIM price collection is presented in Appendix III.

From January to June 1992, IER carried out an exhaustive survey in the O.N. zone. The objectives were as follows:

- 1) to investigate both the paddy and milled rice marketing systems in the O.N. zone;

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<sup>21</sup> The Systeme d'Information du Marche Cerealier (SIM) is the Malian Market Information System, which was created in 1988 to collect, process, and diffuse price information of cereals throughout the country.

<sup>22</sup> The paddy rice series was not continued for the entire period of analysis. For this reason, it is not possible to test conclusively the hypothesis regarding the profitability of custom milling activity vs. buy-mill-sell activity.

- 2) to carry out an exhaustive survey that led to a census of the small mills in the region and the sampling of mills that would be monitored over the period of the research; and
- 3) to examine the possibilities of involving of the SIM in helping to process the data collected through the O.N.

The survey was conducted in 8 sectors, covering 47 villages in the O.N. zone.

A sample of 48 small mills was drawn from the total population of 383 small mills.

The O.N. data were provided by the Bureau de Coordination Industrielle et Commerciale (BCIC), which is in charge of both the paddy processing and milled rice marketing activities. These data covered the cost structure of the state mills under autonomous management conditions, and production and yield figures in the O.N. zone.

The author conducted a rapid reconnaissance survey in Mali from July 1st to August 18th, 1992. During the interviews, data and information were collected on the number of small mills and their cost structures, and on the organization of rice marketing system in general, and in the Office du Niger in particular. This work was carried out in Bamako, at the Office du Niger headquarters in Segou, in Niono, and in the many villages where small mills are located.

From the interviews of more than 20 persons (see Appendix I for a list of persons contacted), it appears that rice marketing patterns are changing very fast in the Office zone. Most of the respondents argued that this dynamic is basically

attributable to the increasing number of small mills in the Office zone and the positive way these mills have affected the paddy processing activities there. Indeed, one of the immediate effects of the proliferation of the small mills has been the debate it has created around the issue of what the role of the O.N. should be in the future.

Qualitative information related to the entry of new middlemen in the subsector as well as quantitative information related to the weekly flows of rice in consumption centers (throughout the year) were collected from key informants.

### **3.4.2 Analytic Approach**

The first analytical exercise is the examination of price variation over time. For each type of price, the coefficient of variation is computed to analyze how the prices have moved away from their mean value over the year. This relative variation of prices will be interpreted in the context of policy influences that could be part of the causes. Therefore, we would expect to learn from a negative trend in producer prices of milled rice that there might be major cost reductions due to either productivity gain in paddy farming or decreasing processing costs over time. A negative trend in prices could suggest also an increasing supply of relatively cheap imports over time.

The second type of analysis using the price series is correlation analysis. Price correlations between major supply markets (Niono zone) and major consumption markets (Bamako, Koutiala, Kayes, and Sikasso) reveal the percentage of price changes in Niono that is associated with price changes in each of these other cities. High correlation coefficients between these markets would

suggest that the two price series move together. High price correlations could indicate that the rice marketing system in the O.N. is either strongly competitive or strongly monopolistic (Harris, 1979). Cities well connected by transport and communication, such as Niono-Bamako, Niono-Koutiala, and Niono-Sikasso, are likely to be well integrated if markets are competitive and information is adequate. On the other hand, we would expect Niono and Kayes to be poorly integrated, suggesting that the markets are poorly connected by actual movements of commodities from Niono to Kayes.

The third type of analysis that will be done with the price data is the analysis of the spatial gross margins between Niono and Bamako. The spatial marketing margins refer to price margins between locations and include transport costs and transfer costs. Tomek and Robinson define marketing margins as "the difference between the price received by producers and that paid by consumers, and the price of a collection of marketing services which is the outcome of the demand and the supply of such services" (Tomek and Robinson, 1972, p.119). This part of the analysis is focused on interpreting both the inter-annual and intra-annual variations of the gross margins between Niono and Bamako. This analysis will also be related to the major policies, such as trade policy that have affected the prices and margins variation. The regression of the spatial gross margins against time will tell us whether margins have trended downward over time, possibly reflecting falling marketing and processing costs.

The fourth type of analysis will be more qualitative. Indeed, it will include analyses of the roles of the small mills in the organization of the subsector.

The fifth type of analysis will be budgeting. The cost figures collected through the rapid reconnaissance will be used to develop operating budgets for 16 small mills randomly selected in Office du Niger zone. Results of the budget analyses, especially the milling cost per kg of paddy, are used as performance measures of two alternative milling activities.

## **CHAPTER IV. BASIC ELEMENTS OF THE STRUCTURE, CONDUCT, AND PERFORMANCE OF THE RICE SUBSECTOR**

This chapter covers in more detail the descriptive material on the structure of the rice subsector in Mali. Also discussed is some of the information on conduct (pricing and price formation), as well as more in-depth price analysis than is presented in chapter II. This chapter also undertakes more in-depth analysis of price correlations and margin performance. The results and findings developed from this chapter are used in chapter V to assess the role of the small mills in affecting the performance of the subsector. Chapter VI will summarize the general conclusions and address some of the unanswered questions that are raised in the thesis.

### **4.1 Structure of the Rice Subsector and Its Recent Evolution**

Farmers were granted the right to sell paddy to private traders in November, 1987. However, the state is still heavily involved in the rice subsector. This government control is exercised any time that rice imports are seen as a threat to domestic production in the Office zone. State actions take various forms. For example, the twinning of imports with local purchases from the Office du Niger was introduced in 1987 to oblige importers to market local production. Twinning was abandoned in July, 1989.

Government interventions in the rice subsector may affect price, competition and the behavior of participants. These government actions include import limitations, a fixed floor price for paddy paid to farmers by the O.N., and the like. These measures affect entry into the subsector (the access to the right to

exercise the function of trader), access to credit (for rice marketing and imports), and the organization of rice milling activities. As Caves has stressed, all these characteristics of the subsector are interrelated; any change in one brings about changes in the others (Caves, 1982).

The market structure reflects the opportunity set that each participant is given in the marketing system. This chapter will therefore look at each segment in the rice marketing system, from the farmer in the Office du Niger zone to the consumer. The links between each segment of the marketing system will be analyzed. This chapter will investigate who the actors are and their roles, whether there are barriers to entry, to what extent the marketing structure has recently evolved, and the possible need for greater integration.

#### **4.1.1 The Actors and Their Links in the Rice Subsector**

As described in chapter II, the actors in the rice subsector include farmers, assemblers, processors, semi-wholesalers, wholesalers, retailers, and consumers. In general, the cereals market has evolved very rapidly since 1987. However, in looking at the coarse grains subsector and the rice subsector separately, one can easily notice that the coarse grain subsector has evolved more rapidly. In the coarse-grain subsector, private traders took over almost all the commercial activities that O.P.A.M. once performed. In all of the surplus zones where O.P.A.M. used to perform semi-wholesaling (through the consumer cooperatives, the public services, and individual consumers), new entrants (generally unemployed professional students), who are more business-oriented and more specialized than the old generation of traders, are taking over the cereals

business. Conversely, this takeover has not occurred in rice subsector as rapidly, especially when it comes to public-sector involvement in the paddy rice pricing as well as its assembly.

Traditionally the rice subsector was dominated by the State at all levels of the marketing system. The assembly of paddy rice and of the assembly of milled rice were done at the Office du Niger, and the distribution was channeled through O.P.A.M.. The liberalization of the cereals market contributed to break this chain.

#### **4.1.1.1 Farmers**

These individuals operate on small scales, i.e., 1 to 8 ha (DNA, June, 1993). Although a significant part of the production in many farm families goes to home-consumption, the majority of farmers in the Office zone are net sellers (IER, 1992). Before 1987 farmers were obliged to sell their production to the Office du Niger, which was the sole agent authorized to process paddy. This rule changed in 1987, when producers were given the option to sell paddy to the Office as payment for inputs, to process the paddy themselves, or to sell to traders.

#### **4.1.1.2 Assemblers**

The Office du Niger played the role of paddy and milled rice assembler in the O.N. zone until 1987. The Office du Niger was provided with funds each year to purchase and process paddy production in its zone. Milled rice was then channeled through O.P.A.M., which had the monopoly over the cereals distribution system. O.P.A.M. was funded by the government to perform this activity. The storage of rice was handled at both the O.P.A.M. and O.N. levels.

When farmers were given the alternative to manage their own production, i.e., either to sell paddy to the Office or to private traders, the number of actors performing the assembly and processing went from one (the State) to several hundred. The Office du Niger's procurement of paddy produced in its own zone dropped from an average of 65% of total production between 1983/84 and 1985/86 to 43% in 1987 (Table 2.3). This percentage dropped even more, to 40% between 1987 and 1992, was only 13% in 1990/91 and 23% in 1991/92. The drastic fall in 1990/91 could be explained by the mills being refurbished. On the other hand, the quantity of milled rice from private mills is growing every year. Fully 90% of the production in the RETAIL project zone was milled by the private sector in 1992 (Rapid reconnaissance, July-August 1992).

Instead of being channeled through the O.P.A.M. as it used to be, the domestic production of rice in O.N. zone (be it from the State mills or private mills) passes through the following channels:

- until July 1989, the milled rice from the State mills was channeled through a network of no more than four wholesalers. After the withdrawal of O.P.A.M. from the domestic marketing network, and until July, 1989, the wholesalers willing to import rice were forced undergo the "twinning" arrangements. Wholesalers were the most important component of the rice subsector due to their capability to finance rice imports as well as to fulfill the financial and other conditions necessary to bid for O.N. rice contracts. For a long period these conditions remained a major constraint

to rice marketing. The conditions of procurement from the O.N. were as follows:

- \* a minimum quantity of 500 tons had to be purchased for any trader interested in buying rice from the O.N;
  - \* the sale was on a cash basis, or on credit if the credit were endorsed (credit guarantee) by a bank. The duration of the credit was 60 days at most and the quantity purchased was to be transported by the client within approximately 10 days;
  - \* the purchase price was not negotiable and the rice was sometimes of very poor quality.
- the output from private mills is channelled through a diversity of actors including wholesalers (though less involved in this subsector), semi-wholesalers, independent middlemen, retailers, public service networks and individual consumers.<sup>23</sup> The public service representatives are generally unionists who function as distribution networks for AVs seeking markets for their milled rice. These AVs not only sell on credit, but also supply their clients at almost wholesale prices. Many of these actors, especially some of the semi-wholesalers and independent middlemen, who do not have enough capital (or the connections to get credit) to purchase from the O.N. elect to obtain supplies from private mills. Indeed, with relatively little working capital these actors can have access to rice. The wholesalers, financially

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<sup>23</sup> The public service networks are buying clubs made up of public service employees.

more powerful, enjoy the scale economies they realize on the purchase and transportation of larger quantity from AVs, and from other collectors;

- in August 1992, a group of retailers in Bamako for the first time got direct access to the milled rice from the Office du Niger's State mills, through a contract between the Office du Niger and the traders' group.

#### **4.1.1.3 Processing**

Until 1987, four State owned mills had the monopoly over the paddy processing in the Office du Niger zone. Most of the home-consumption by farm families in the zone went through hand-pounding. Currently, processing activities are performed by:

1. The State mills at Molodo, N'Debougou, Kolongo, and Dogofri, totaling 80,000 tons of capacity a year. However, in 1990 the state mills signed contracts to process 30,000 tons of paddy through the small mills. This happened when the O.N. mills broke down. The same kind of processing arrangements occurred very often between the O.N. and the O.R.S.;
2. Individual farmers, women's groups, farmer organizations, and other individuals (who are either traders or just individuals involved in custom duty milling activities).

The capacity of the mills owned by women's groups is about 50,000 tons per years, whereas the individual farmers' and the Avs' mills account for about 160,000 tons nominal capacity per year (Ibid., 1992).

In any case, what is highly notable here is the overwhelming increase in the number of private mills since 1987/88. From this date, the yearly rate of increase in the number of small mills averaged 120% (Table 2.3).

#### **4.1.1.4 Private Milling**

Eighteen percent of the private mills are owned by women's groups in the Office zone (Ibid., 1992). But these mills are basically used to help relieve women of their daily hand-pounding burden rather than adding substantial quantity to the marketable output. The average capacity of these mills is 25 sacks of 80 kg of paddy a day, i.e., 2 tons of paddy per day.

The second category of mills are more powerful and much larger than those owned by women's groups. These are owned either by Village Associations (AVs--men's farmer groups), by individual farmers, or by other businessmen. These individuals are either traders or others performing the milling activity for money. More than 70% of the second category of mills are owned by farmers (AVs and individual farmers together). Only 2 to 5% of this category is owned by other businessmen. The average capacity of these mills range from 4-6 tons to 12-30 tons per day. The number of small mills has almost doubled between 1990 and 1992 (from 194 to 383). Likewise, the paddy production is steadily increasing in the Office zone. At the same time, paddy rice is moving away from the state processing toward the small private mills. However, the authorities in the O.N. believed four years ago that the small mills were not, by any means, a threat to them. Today, they are interested in determining the number of small mills and other details about their role in the Office zone.

Most of the private mills, especially those owned by traders or businessmen, are either supplied from Niono zone or Dioro (in the O.R.S.--see Figure 2.3).

#### **4.1.1.5 Wholesaling**

The wholesalers are:

1. Rice importers, which are major clients of the O.N. as well;
2. O.P.A.M., selling food-aid rice through open tender to wholesalers as well as semi-wholesalers;
3. Village cooperatives (the AVs), which are active not only in farm-level production (through their individual members), but also in the processing activity and recently in wholesaling. Indeed, the AVs use public service networks to sell milled rice to urban workers on credit (one-month credit without interest);
4. A few large importers/wholesalers are also involved in processing paddy from Selingue and the Office du Niger as well.

#### **4.1.1.6 Semi-Wholesaling**

Semi-wholesalers were historically supplied with both imported rice and domestic milled rice by wholesalers. Until recently (1991), this channel was working this way because the milled rice coming from small mills was not enough to supply the major urban consumption centers throughout the year. During the 1992 and 1993 production years, however, Bamako was supplied with domestic rice (from private mills in the Niono zone) throughout the year, making it harder for importers to sell both the imported rice and the state-milled rice. Therefore,

the semi-wholesalers are becoming one of the major players in the rice subsector, especially for domestically milled rice from the Niono zone.

The semi-wholesalers operate in the weekly markets of Niono and Siengo through either established commission agents in Niono and Siengo, or through the AVs. These agents are given money to buy rice, while the AVs may sell on credit depending on the level of trust that exists between the two partners. The semi-wholesalers may have retailing networks as well.

#### **4.1.1.7 Independent Middlemen**

This category is recruited from among: 1) early retirees (from public services), 2) unemployed former students who graduated from professional schools, and 3) former workers fired from parastatals. Traders in this category, generally, get together to rent a 30 ton truck to transport rice from Niono to the major urban markets (Bamako, Koutiala, Sikasso, etc). The middlemen may perform the retailing as well. This segment of the marketing channel becomes a threat to both wholesalers and semi-wholesalers when its participants operate with their own capital. This group may engage in door to door trading, profiting from their social relationships to sell their products.

#### **4.1.1.8 Retailing**

The retailers obtain supplies from the semi-wholesalers, who operate on the weekly markets of Siengo and Niono. They are supplied through the wholesaler-importers as well. In general, the retailers have little working capital. Therefore, they rely on short-period credit (two weeks or at most three to four weeks; the time to sell the supply they get from the semi-wholesalers and

wholesalers to perform their activities). Moreover, most of the retailers in the central markets of Bamako belong to the traditional network (the old generation of traders). Indeed, they are relatives to the semi-wholesalers and they are more connected to their home villages where they return during the farming seasons. Besides rice, they sell millet, sorghum, maize, and other varieties of cereals.

#### **4.1.1.9 Consumers**

Consumers fall into two categories. The first category of consumers directly consumes rice purchased rather than resells it. In this category there are people who purchase at least a 50kg bag once every month while others purchase on a daily basis (very few kilos).

The second category, on the other hand, comprises small restaurant owners who cook rice and sell it to the many people who have to eat away from home (often people who, because of job constraints, cannot return home for a meal). This category of consumers gets their rice supply either from wholesalers, semi-wholesalers, middlemen, or they obtain it themselves in the Niono zone. This category is expanding since the work schedule was changed in Mali in 1993, expanding the length of the workday to 5:30 p.m. However, complementary information, such as an estimation of the market share of this category of consumers, needs to be gathered.

#### **4.2 Rice Subsector Conduct**

According to Caves, market conduct can be defined as "a firm's policies toward its product market and toward the moves made by its rivals in that market". These "strategic moves" are made by firms with respect to three major

areas: 1) price setting, 2) non-price behavior, such as product quality control, and 3) seeking strategic advantage and deterring entry (Caves, 1982, p 48).

This section will analyze pricing, price formation, and the sources of the information used in different segments of the rice subsector.

#### **4.2.1 Pricing**

Pricing systems have been classified by Marion into the following groups: auction, private treaty, administered, and formula. The key characteristic of an auction is competitive and simultaneous bidding for the good or service. There are different kinds of auctions: 1) English auction, which is a bid system going from low to high, 2) Dutch clock or descending bid, 3) double or converging bid, 4) simultaneous bid, and 5) sealed bid. The key characteristic of private treaty is the private negotiation of the terms of the deal by the two parties involved, without involving others (e.g., an auctioneer) or sharing information with others on the terms of the deal. In developing countries, where it is the most widely used pricing mechanism, private treaty is determined through bargaining. Administered pricing is the third classification, with the buyer, the seller or a third party regulator announcing the non-negotiable price prior to the sale or purchase. In developed countries, this pricing scheme is widely used in the food system. In developing countries it is exemplified by government-administered prices. Lastly, the formula pricing is a hybrid of private treaty and administered pricing. It has usually some indications of value determined by a third party.

The private treaty, administered and the sealed bid systems are the pricing methods used in the Malian rice market. At the rural market level (Niono and

Siengo), prices are based on market-day supply and demand conditions. Suppliers, at the rural market level, generally know what the consumer price in Bamako is, as the major destination of their rice. Therefore, when bargaining for the current price of rice, suppliers refer to the price information broadcast on the radio each week. Prices also depend on how long the major suppliers, the AVs, have the financial capability to perform the storage activities.

The O.N. still purchases paddy from farmers at a fixed and non-negotiable price. On the other hand, the performance contract between the O.N. and the government obliges the O.N. to sell milled rice by sealed bid, in which prices are more likely to depend only on supply and demand conditions. The buyers are supposed to be shown a sample of the product they bid for. However, in the O.N.'s bid system, this does not always give the buyers the guarantee to be protected from asymmetric information. The potential buyers do not have the option to check the product quality.

#### **4.2.2 Price Formation**

Market prices, under conditions of perfect competition, would reflect all the information needed by economic agents to plan and adjust their activities (Marion, 1986; p59). Theoretically these prices are discovered when supply is balanced against demand. Once the assumptions of perfect competition are violated, prices are necessary, but alone are insufficient as coordinating mechanisms. Should we say that the rice subsector is perfectly competitive? Or would it be more proper to say that prices are a strong means of coordination in

the rice subsector in Mali? Are there any other alternative means that would help prices to play their coordinating role?

To answer these questions, let us examine: 1) the extent to which the participants have access to the basic information they need to perform their transactions (to discover prices), 2) prices as a coordinating device, 3) the variability of both rural level and consumer prices of rice, 4) the price correlations between rural market and the consumer markets, and 5) the trends in spatial gross margins over time.

#### **4.2.3 Access to Information**

The Malian market information system, SIM, was designed to serve the needs of three groups of people: private operators (i.e., farmers, traders, and consumers), decision-makers, and researchers. As described in the third chapter, the SIM collects, in each market, three sets of prices (producer prices, assembly prices, and consumer prices). These prices, along with cost data, help researchers measure the efficiency of moving rice throughout the marketing chain. In addition to their own information system (telephone, radio, and fax for some), private operators receive information through the press, radio and TV transmissions. Researchers and decision makers are served through weekly, monthly and bi-annual bulletins from the SIM. A series of evaluations carried out in 1989, through independent consulting programs, found that farmers were using the SIM information to guide their negotiating position (Egg, 1989). It was found also that the system was having a positive impact on market efficiency as measured by a reduction in margins between the different markets of Bamako

(Dembele, 1989). Moreover, it was revealed that traders were using price information to guide their overall purchase and sales decisions.

Price information and, very recently, quantity information have played their basic coordinating role, i.e., they helped the subsector participants decide to buy/sell based, principally, on what prices and quantities happen to be prevailing.

#### **4.2.4 Prices as a Coordinating Device with Respect to Quality**

Because small mill managers pay more than CFAF 70 per kg for high quality paddy, the best quality paddy is being channeled through private mills. This leaves the Office du Niger with paddy of poor quality, and therefore, difficulties in honoring its contracts. The high quality rice coming from small mills, combined with the relatively low market price for milled (relative to the price from the State mills), have contributed to increase the demand from the small-mills channel<sup>24</sup>. One may conclude that the increase in rice supply from the private milling industry is partly a response to the higher price that farmers can get for their own production from small millers. Evidence gathered in the rapid reconnaissance showed that farmers are getting a higher value for their paddy as the farmers become increasingly involved in their own paddy processing. Indeed, when the quality of paddy is not high enough to meet the market demand

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<sup>24</sup> In a form of written request to the O.N. (May 21, 1992), one of the largest wholesalers (Bally S.A) listed several reasons that made it impossible for the firm to honor the contract it had signed with the O.N. for 5,000 tons of milled rice. Among the reasons cited were the difficulties the firm had in selling the O.N. rice, because the firm initially assumed that the supply from the small mills would no longer be available on the major consumption markets after a few months into the marketing year. At the date of their request, however (6 months into the marketing season) rice was still flowing to Bamako from small mills at a lower prices than both O.N. and imported rice.

conditions, or to yield high quality milled rice, the Office du Niger becomes the last recourse, where farmers can sell paddy of any quality at CFAF 70/kg.

### **4.3 Price Analysis**

#### **4.3.1 Price Trends**

From 1977/78 to 1987/88, an estimated 68% of the total production in the O.N. zone was processed each year through the O.N. mills, leaving about 32% for home-consumption (Table 2.3). Since 1988/89, the paddy rice milled through O.N. averaged only 30-35%, although the production in this zone increased an average of 23% each year during the same period. As noted earlier, this reflects farmers' shifting more of their processing to the small mills. As the number of private mills has grown, the supply of milled rice from private mills has been growing, averaging over 500 tons per week flowing to Bamako throughout the year (Rapid reconnaissance, July-August, 1992). However, the average spatial gross margin between Niono and Bamako has been increasing somewhat over the period 1988-1993, while the farm prices of rice in Niono have been quite unstable and decreasing over the last 5 years (Figure 4.1). The consumer prices also have been falling over the period of analysis (Figure 4.2). Indeed, both the farm price and the retail price (in Bamako) trend analysis suggest a fall over time.

Many reasons could explain the fall in the farm price of rice over 1988-1989 and 1991-1993 period. The most important appear to be:

1. The cheap rice imports competing with domestic production.

Any time there are imports flowing, the demand for domestic production decreases. Indeed, in 1991 when the government froze some of

Figure 4.1: Farm Price Trend, Mono, Jan, 1988—May, 1993

89

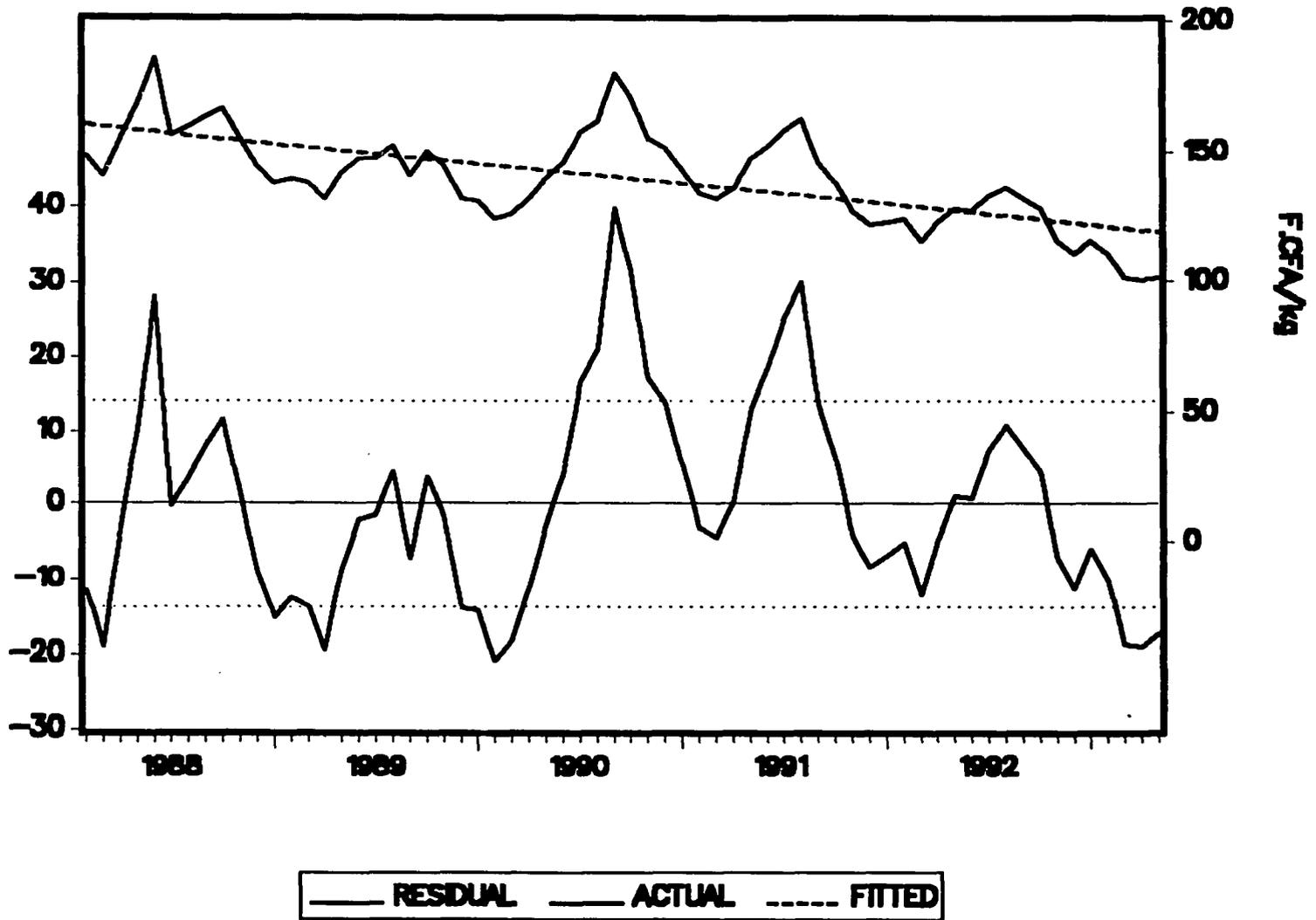
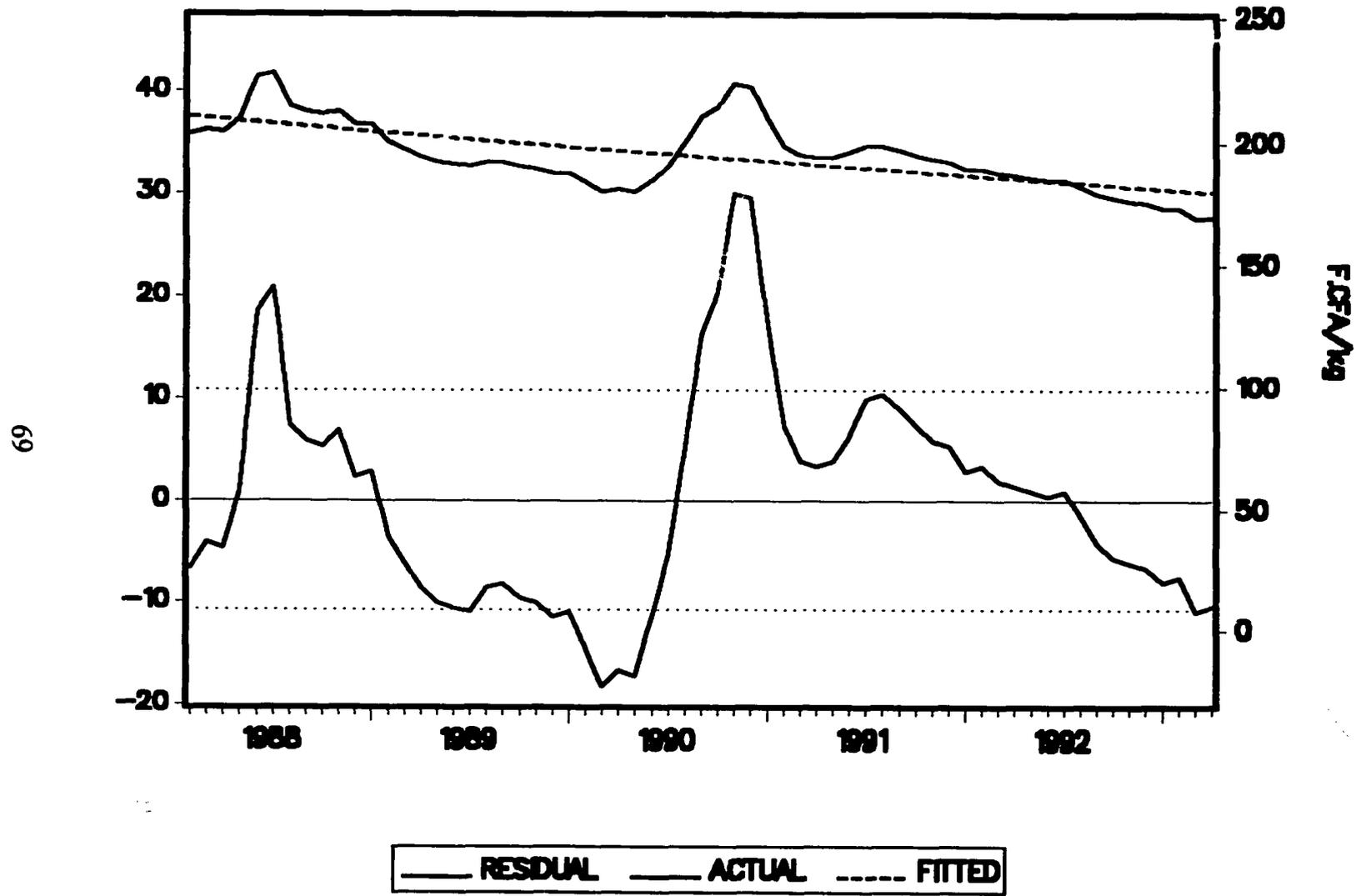


Figure 4.2: Consumer Price Trend, Bamako Jan, 1988—May, 1993



the import tariff on rice, the quantity of imported rice (official imports) reached 60,400 tons. Large quantities of illegal imports of rice are said to flow through the Guinean and Mauritanian borders as well.

Appendix II shows that the economic cost price of imported rice computed in Bamako is below the wholesale cost price of domestically produced rice. However, the wholesale financial cost price of imported rice appears to be higher than the wholesale cost price of the domestically produced rice. Therefore, it appears clear why there are difficulties in administering the import licenses, not to mention all the smuggling from Guinea and Mauritania, and considerable scope for manipulation of the system by large traders with connections in the governments of the region. Clearly then, cheap imported rice flows through the illegal channels, making it harder for domestic production to compete.

Conversely, the two big jumps in both retail and producer prices of rice shown in Figure 2.1 corresponded to periods when commercial imports were banned. Indeed, rice imports were officially banned from march, 1987 to June, 1988. Likewise, no official private rice imports have been recorded for the period July 1989 - December 1990.

2. The AVs (70% of the small mills owners) lacked marketing skills, therefore, they could not engage in long distance trade. They were left only with one alternative, namely taking the risk to sell on credit to semi-wholesalers and other small scale traders;

3. The semi-wholesalers and other small scale traders lack the capital to compete with wholesalers in performing long term storage activities. The cost of capital (35% opportunity costs of capital) is too high for traders who perform, mostly, short term activities; and
4. The expansion in domestic production of rice.

#### **4.3.2 Correlation between Prices in the Major Domestic Rice Supply Markets and the Consumption Markets**

The SIM's price data are used in this analysis. The series covers 61 months beginning in February 1988 and ending in May 1993. The price data for Niono are the market prices of the output of private mills collected on the weekly marketplace of Niono.

The extent to which one market influences another can be measured by means of correlation analysis. A correlation coefficient ( $r$ ) measures the degree of the relationship between two variables. Its values range from -1 to +1. A positive correlation coefficient indicates that the variables move in the same direction, while a negative one implies that they move in opposite directions. When the value of the coefficient is close to zero, this indicates a low degree of association between the variables. Values of  $r$  close to -1 or +1 suggest a high degree of association between studied variables.

Applying the concept of correlation to assess a marketing system, the correlation coefficient is equal to +1 when the marketing system is perfectly integrated. However, a perfectly linked system is rarely observed in the real world, especially in the Third World countries because of:

- "the lack of perfect mobility due to transport costs.

- poor dissemination of information regarding market conditions.
- the lack of standard grading of produce. As a result, prices do not refer to equivalent grades in the two markets (Barry, 1989)."

The analysis of the bivariate correlations that follows represents a test of integration between Niono (the domestic rice supply market) and the major consumer markets (Bamako, Sikasso, Koulikoro, Nara, and Kayes) that are more likely to be supplied from Niono. The producer price variable is lagged one month to account for at least one month's delay in price variation between the supply market and the demand markets. The logic behind such a lag is to account for the delay in price transmission from the supply market and the consumption markets. Likewise, the principal wholesale market variables are lagged one month for the same reason and regressed against potential destination markets.

The analysis is used to test the likelihood of integration between any of the other markets, taken two by two. Indeed, prices in all integrated markets are linked by the arbitrating decisions of merchants, and the price differential should reflect only normal transfer costs (Mehta, 1989). In this correlation analysis, at least .77 is considered as a strong correlation coefficient between markets. Indeed,  $r = 0.77$  or  $r^2 = 59.3$  means that about 60% of the variation in Sikasso prices is associated with variations in the Niono price. Bamako is supplied through both imports and domestic production, therefore, we could not expect the correlation coefficients between Niono and Bamako to be as high as 0.95, which would mean that 90% of the variation in Bamako prices is associated with variations in Niono price. Mehta (1989) and Barry (1989) have found correlation

coefficients as high as 0.95 between major coarse grain markets. This result is realistic because the demand for coarse grains is totally supplied through domestic production. Rice production, on the other hand, is not enough to meet the demand. Indeed, during the last decade, the imports and food rice-aid accounted for 23.6% to 75% of the total supply of rice. Therefore, the price relationships between the major production area and the consumption areas (like Bamako), depend on both on the domestic production and the supply from outside.

Table 4.1 shows that the correlation coefficient between Bamako and Niono is 0.87, meaning that 75% of the variation in Bamako prices is associated with variation in the Niono price, suggesting then a strong integration between these markets. Likewise, there is very strong price relationship between Bamako and Kayes (0.90). The correlation coefficients between the consumption areas, taken two by two, may not mean that the same quality of rice is being exchanged between the two areas. Indeed, there the imported rice is the most exchanged between Bamako and Kayes.

Sikasso and Niono also are well integrated, although the correlation coefficient, 0.77, is not as strong as the one between Bamako and Niono. Several factors may explain the strong price relationship between Niono and these markets. These factors include:

1. Niono is a major supply market for both Bamako and Sikasso, as far as domestic rice is concerned. Sikasso is not as integrated to Niono as Bamako because Sikasso is located in southern Mali where rainfed paddy production is developed; therefore, part of the rice

consumption needs of Sikasso is supplied through the local production.

2. Both Bamako and Sikasso are linked to Niono by good roads that make possible the exchange between these areas throughout the year.

On the other hand, Kayes and Nara are weakly integrated to Niono (the correlation coefficient: are 0.65 and 0.66 respectively).

There are major reasons explaining the weakness of the direct exchange between Niono and these areas. These reasons include:

1. The transportation network between Kayes and Niono is not straight, which means that Kayes is more supplied with rice through imports coming from Senegal than from Niono. Likewise, Nara is poorly linked to Niono, and also Nara is mostly supplied with rice through Mauritania. Moreover, the transport costs between Nara and Niono vary a lot seasonally because of the lack of paved roads to Nara (Gabre-Madhin, 1991).
2. Until recently (February-March 1993), the methodology used to collect data in Bamako was not differentiating the imported RM40 from the domestically produced RM40. As such, the price data of rice in Bamako might be more biased towards the imported RM40, which was more supplied relative to the domestic RM40. This reason may explain why there is very strong price relationship between Kayes and Bamako. In other words, there is in reality very

strong exchange of rice between Kayes and Bamako, but not necessarily exchange of milled rice from Niono.

**Table 4.1 Price Correlations Between Selected Cities - February 1988-May 1993**

	Niono	Bamako	Kayes	Sikasso	Nara
Niono	1.00				
Bamako	0.87	1.00			
Kayes	0.65	0.90	1.00		
Sikasso	0.77	0.71	0.47	1.00	
Nara	0.66	0.50	0.08	0.61	1.00

Source: Calculated from SIM/O.P.A.M. data.

#### **4.3.3 The Spatial and Temporal Marketing Margins**

Tomek and Robinson define marketing margins as "the difference between the price received by producers and that paid by consumers, and the price of the collection of marketing services which is the outcome of the demand for and the supply of such services" (Tomek and Robinson, 1972, p.119). There are three types of marketing margins. The spatial marketing margins refer to price margins between locations, and include transport costs and any commissions and other transfer costs. The more two markets are integrated, the more closely matched is the spatial margin to the sum of all the transfer costs necessary to move the product from one place to another. Temporal margins refer to price differences over time. There is also a margin with respect to changes in form--the price differential between the raw material and the processed product.

The costs of moving rice from Niono to Bamako include the price of bags that contain the product, the loading cost in Niono, the transportation costs from Niono to Bamako, and other transfer costs. The opportunity cost of capital of 35% is used to compute the storage costs<sup>25</sup>.

#### **4.3.3.1 Spatial Gross Margins**

Table 4.2 shows the steps used in the spatial marketing margins calculation. During July-August, 1992 period, the net margins were, CFAF 15.77 per kg to the wholesalers, CFAF 7.96, and CFAF 14.0 per kg to the retailer. In reality the traditional wholesalers are less involved in the subsector. Indeed, most of the supply from the small mills are collected by the independent middlemen, the commission agents of semi-wholesalers, and semi-wholesalers. What is called net margins to wholesalers in Table 4.2, represent the net margins to these collectors. These net margins represent 30% of the total spatial margins. The retailers get 27% of the total marketing margins, leaving 15% to the semi-wholesalers who get supplied.

#### **4.3.3.2 Temporal Marketing Margins**

We assume that the semi-wholesalers, who get supplied from the collectors, are involved in storage (January, 1992 through May, 1992). They paid CFAF 21.9 per kg for the storage over five months (Table 4.3). These storage costs include the rental/guard costs, possibly the treatment costs, the storage losses, and the

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<sup>25</sup> In estimating the opportunity cost of capital, we simply added five percentage points to the unofficial opportunity of capital used by Mehta (1989), reflecting the difficulties to access credit (formal or informal) by traders in the rice subsector three years later. That is, we assume that the credit was easier to get in 1989 than it was three years later, i.e., in 1992.

**Table 4.2: Costs and Returns of Moving 1 kg Milled Rice from Niono to Bamako, July - August 1992**

Costs	Items	CFAF/kg
1	Purchase price of rice (July 1992)	132.00
2	Price of sacks(4 turn over)	0.50
3	Loading in Niono (CFAF 50/sack)	0.50
4	Transport (Niono-Bamako @ 1000F/ton)	1.00
5	Unloading in Bamako(CFAF 600/ton)	0.60
6	Total costs delivered to Bamako	134.60
7	Monthly storage costs:	
	-Storage/guard rental(50F/sack)	0.50
	-Annual 2.5% loss	0.28
	-Opportunity cost of capital(35%/yr)	3.85
8	Accrued costs in Bamako(August 1992)	139.23
9	Purchase price in Bamako (Wholesale)	155.00
10	Net wholesale Margins Bamako	15.77
11	Loading Bamako(from A)	0.60
12	Unloading Bamako(to B)	0.60
13	Transport (A - B @ 50F/sack)	0.50
14	Monthly storage costs Bamako	
	-Storage/Guard rental(50F/sack)	0.50
	-Annual 2.5% loss	0.32
	-Opportunity cost of capital(35%/yr)	4.52
15	Total accrued costs	162.04
16	Purchase price (semi-wholesaling)	170.00
17	Net semi-wholesale Margins	7.96
18	Retail Price	184.00
19	Net Margins to Retailers	14.00

Source: Computed from rapid reconnaissance survey

opportunity costs of the capital tied up in keeping the inventory over the period. In our case, the opportunity costs of capital represented 83% of the storage costs. After five months of storage, the rice moved from semi-wholesaler (A) to another semi-wholesaler (B) in Bamako at CFAF 170.00 per kg. The semi-wholesaler (B) added transport costs from A to B, the loading from A and the unloading to B. No more storage was necessary at this level, because the market price was attractive to B. The purchase price at retail level was CFAF 180 per kg and the average retail price of the broken 40% rice was CFAF 185 per kg. For moving rice from Niono to Bamako, the collectors realized CFAF 15.4 per kg. The net returns to storage were CFAF 8.13/kg, while semi-wholesalers (B) made the same money. The net marketing margins to retailers are CFAF 5/kg including the losses during the retailing operations. The losses should be taken into account also in the calculation of the net margins to semi-wholesalers (B).

In general, when we consider the whole period of analysis, the spatial gross margins, between Niono and Bamako, fluctuated from the yearly mean average value between 6.9% during the first five months of 1993 and 25.4% in 1990.<sup>26</sup>

Appendix Table II.1 shows that the margins remained almost stable, in absolute terms, from 1988 to 1989. In 1990, however, they fell, slightly, compared to the previous years (6.4%). During the following years (1991 to 1993), the margins were higher compared to both the 1990 and the 1988-1989 levels. Indeed, they were 15.6% higher compared to the 1990 level. The margins

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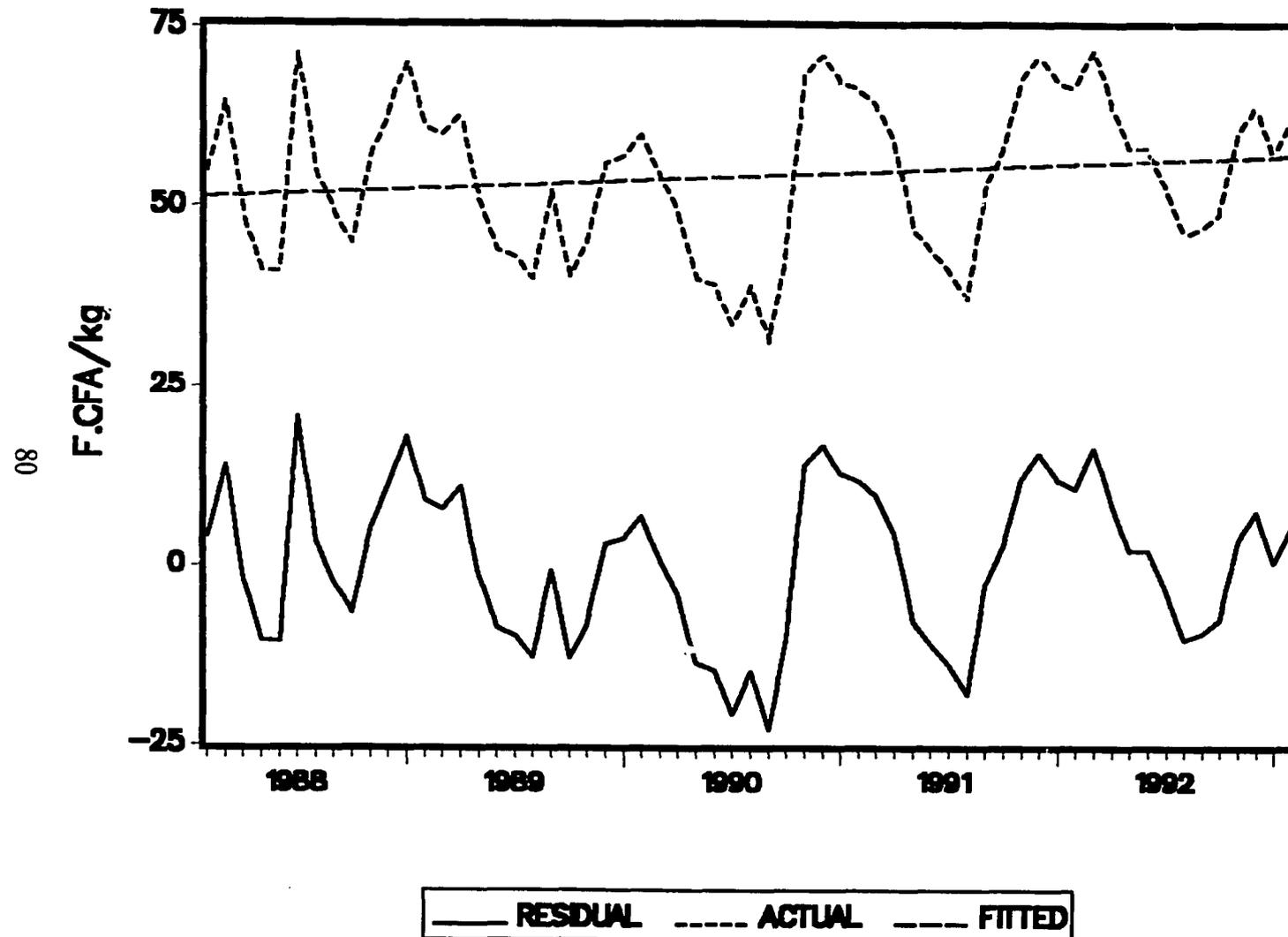
<sup>26</sup> These spatial margins are computed using the producer price of milled rice in Niono and the retail price of rice in Bamako.

**Table 4.3: Temporal Margins of Milled Rice from Niono to Bamako, January - May 1992 (5 Months Storage)**

Costs	Items	CFAF/kg
1	Purchase price of rice (January 1992)	122.00
2	Price of sacks(4 turn over)	0.50
3	Loading in Niono (CFAF 50/sack)	0.50
4	Transport (Niono-Bamako @ 1000F/ton)	1.00
5	Unloading in Bamako(CFAF 600/ton)	0.60
6	Total costs delivered to Bamako	124.60
7	Purchase price in Bamako(Semi-wh. A)	140.00
8	Margins to collectors	15.40
9	Storage Costs:	2.50
	-Storage/guard rental (50F/sack/mth)	
	-Annual 2.5% loss	1.29
	-Opportunity cost of capital(35%/yr)	18.08
10	Accrued costs in Bamako (May, 1992)	161.87
11	Purchase price in Bamako (A)	170.00
12	Net Margins to (A)	8.13
13	Loading Bamako(from A)	0.60
14	Transport (A - B @ 50F/sack)	0.50
15	Unloading Bamako(to B)	0.60
16	Total accrued costs	171.70
17	Purchase price from B	180.00
18	Net margins to B	8.30
19	Retail price	185.00
20	Net Margins to retailers	5.00

Source: Computed from rapid reconnaissance survey

Figure 4.3: Trend of Margins Niono-Bamako, Feb, 1988-Feb, 1993



remained again almost stable over the period 1991-1992 and then increased by 10% during the first five months in 1993. In general, the gross spatial margins exhibit an upward trend (Figure 4.3). In contrast, both producer and consumer prices exhibit a negative trend.

The analysis above suggests that traders gave up temporarily part of their margins during mid 1990. Indeed, during this period the producer prices have increased in absolute terms more than consumer prices.(Figure 2.1). This phenomenon occurred, for example in 1990, when rice imports were banned by the government. Therefore, the producer prices rose as a result of the new demand and supply conditions (processors facing more demand). However, one would expect a consumer price increase as well. This did not occur as much as did farm-level prices, probably because the consumer market of Bamako seems to be more competitive (traders behave more as price takers), suggesting that there are many traders competing for a market share, and therefore, are willing to sacrifice a portion of their margins to maintain their clientele.

Moreover, a regression analysis on the margins shows that these are significantly falling from May to October, suggesting a seasonality of margins. Indeed, the margins seemed to fall during the farming season and increase from harvest until beginning of the following farming season. This could be explained by the increasing number of intermediaries in the subsector after harvest, resulting in an increase in the marketing costs all the way to the consumers.

#### 4.4 Conclusion

The rice subsector in the O.N zone was traditionally dominated by the State at all level of the marketing system. This chain has been broken since the paddy market was liberalized, giving more alternatives to farmers than before. Many positive results came out of this policy implementation. These positive results include:

1. the number of actors performing the assembly and paddy processing went from one (the State) to several hundreds;
2. the quantity of milled rice from private mills has been steadily growing since and
3. currently processing and rice marketing activities are performed by the State (the O.N.), the farmers' and commercial mills, the women's groups, the AVs, and other individuals.

Evidence gathered in the rapid reconnaissance showed that farmers are getting a higher value for their paddy as the farmers become increasingly involved in their own paddy processing.

However, the erratic import policies contributed to many fluctuations in the farm-level prices. Both the farm prices and consumer prices exhibit a negative trend, while the gross margins were trending upward, suggesting higher marketing cost throughout the entire period of the study.

The strong price relationships between some of the major consumption markets and Niono suggest that these markets are well integrated. On the other hand, Niono is weakly connected to Nara, which was said to be supplied from the

small mills in the O.N. zone. Several factors explain the strong price relationship between Niono and the major consumption markets. These factors include:

1. Niono is a major supply market for those areas;
2. There are good roads that make possible the exchange between these areas throughout the year.

There are major reasons explaining the weakness of the direct exchange between Niono, Nara, and Kayes. These are:

1. The transportation network between Kayes and Niono is not straight and there are no good roads between Nara and Niono.
2. Until recently (February-March 1993), the methodology used to collect rice price data was not differentiating the imported RM40 from the domestically produced RM40. As such, the price data of rice might be more biased towards the imported RM40, which was more supplied to Kayes and Bamako relative to the domestic RM40.

## **CHAPTER V. THE ROLE OF SMALL MILLS IN THE RICE SUBSECTOR**

### **Introduction**

The move away from the O.N. mills toward the small mills has happened so fast that the ultimate destiny of the O.N. is now a source of constant debate among the donors and the government of Mali. This chapter will examine the leading forces that contributed to this rapid move away from the state mills, what made the small mills so attractive to people, and if of all types of small mills are equally attractive.

### **5.1 The Recent Evolution of the State Mills**

Prior to the cereals market reforms, the Office du Niger enjoyed rents due to its monopoly situation. However, even the post-reform era has witnessed a constant protection of the domestic production of rice through restrictions on the private import of rice ("twinning arrangements," import bans, and/or a 32% ad valorem on rice imports). These measures aimed to protect the domestic production on infant-industry grounds. The basic assumption underlying these measures was that if Mali, considered to be a relatively low-cost rice producer (in the West French African context), could temporally shield its "new industry" from import competition (using tariffs and other forms of protection), it could incur the entry costs and gain production experience (learning by doing)<sup>27</sup>. However, we

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<sup>27</sup> Although rice has been produced in the country for a long time, Mali is trying to stimulate rice production in the context of new set of parameters concerning technology (rehabilitated perimeters), management (local management of the perimeters), and policy (liberalized paddy marketing). The O.N. is being "born again" and, therefore, might need protection in its new infancy.

should be able to define the appropriate optimal length of time as well as the performance standards that we expect from the O.N. Otherwise it will not be possible to evaluate the progress and, therefore, to conclude whether the infant needs more support or not.

The results of this support, combined with other measures, including rehabilitation of irrigation perimeters, decentralized management of the perimeters, and the paddy marketing reforms, seem to be quite positive in terms of yield increase. Indeed, there has been an average 31% yield increase in the O.N. zone since 1989/90 production year (Table 2.3). Likewise, the production costs of paddy decreased by 37% between 1989/90 and 1992/93 (IER, 1990; and DNA, 1993). In any case, it's obvious that the farmers, who constitute the private component of the O.N., responded positively to the new environment. On the other hand, however, the state mills became dependent upon the protection and did not seem to be moving down enough on the learning curve to compete with the imports or, at least, with the domestic private mills. Table 5.1 illustrates the cost structure of the O.N. in 1989/90 and 1991/92. The 1991/92 structure is the one under the decentralized mill management, while the 1989/90 is the traditional cost structure.

**Table 5.1: Costs structure of State mills 1989/90 and 1991/92.**

Items	1989/1990 CFAF/ton	1991/1990 CFAF/ton
Paddy Price	70,000	70,000
Collection fees <sup>28</sup>	307	--
Rebate on Sacks	1,530	--
Capital Costs	6,424	7,495
Sacks/Strings Usage	244	--
Transport costs	1,165	863
Treatment/storage place	687	372
Checking fees of scales	30	7
Desiccation	(5%) 3,500	(4%) 2,800
Unit costs of Paddy	83,887	81,537
Rice equivalent	(0.65) 129,037	(0.67) 120,439
Processing costs	11,676	17,598
-Fixed costs	3,749	4,248
-Variable costs	7,927	13,350
Participation in general O.N. Administrative costs	--	1,250
Unit Costs of rice	140,713	139,287
Revenue from by-products	3,188	2,030
Unit cost of rice	137,525	137,257

Source: Computed from O.N. staff paper, June 1992.

<sup>28</sup> Paddy collection was done by the O.N. This activity has now been transferred to farmers.

The State's milling enterprise includes four individual mills located in different places in the Office du Niger zone. The State milling enterprise averages 80,000 tons capacity per year. The average capacity of the individual mills is shown in table 5.2.

**Table 5.2: The State Mills**

Plants	Capacity (tons/year)
Kolongo	12,000
Molodo	30,000
N'Debougou	17,000
Dogofri	21,000

**5.1.1 Analysis of the Costs Structure Before and After the Decentralized Management System of State Mills**

Notwithstanding the decrease, even the suppression of some costs items with the move to autonomous mill management in 1991/92, the unit cost of processing is still higher with the decentralized management system (CFAF 17.6/kg of rice) than it was before (CFAF 11.7/kg). The unit cost (CFAF/kg) of processing includes the following items:

**\* 1989/90**

**-Unit Variable costs<sup>29</sup>:**  
 .seasonal labor.....1.53  
 .fuel and oil.....1.80  
 .electricity.....1.36  
 .spare parts.....2.98  
 .auxiliary items.....0.05  
 .transport.....0.09  
 .repairs & misc.....0.10  
 Total.....7.91

**-Unit Fixed costs:**  
 .salary.....1.37  
 .management costs..0.23  
 .depreciation:  
   ..old invest.....1.89  
   ..new invest.....0.18  
 ..taxes.....0.06  
 .....3.73

**\*1991/92**

<sup>29</sup> The unit variable cost is calculated by dividing the total amount for each item by the quantity of milled rice in 1989/90, i.e., 42,019 tons. The result is divided by 1000 to get the per kg picture.

It has not been possible to get the same details for 1990/91 as those in 1989/90. However, the total variable cost spent per kilogram of milled rice was CFAF 13.35, that is, a 69% increase compared to the 1989/90 figure. At the same time, the volume processed decreased by 64%. Likewise, the fixed cost increased in 1990/91 by 13% compared to 1989/90. While it is clear how decreased volume could increase fixed costs, it is hard to understand why variable costs have increased. The O.N. mentioned in its 1990/91 cost figure report a "slight" increase in the processing costs associated with the decentralized management system. This would be due partly to the decrease in the volume processed, partly to the increase in the salaries at the mill level, and partly to the increase in the borrowing to finance the paddy marketing campaign, although a substantial decrease in the volume collected has occurred. Only the increase in borrowing is likely to contribute to an increase in variable costs. A major increase in the spare part costs, which accounted for 38% of the unit costs of processing, referring to the 1989/90 figures, could be a cause contributing to the 69% increase in the variable cost figures in 1990/91. But, any such major increase in the spare part costs has not been reported by the O.N. to explain the increases of the unit processing costs.

Many cost items have disappeared from the state mills' operating cost structure, since these mills went under autonomous management status in 1992. However, there is a new cost item, which was introduced to pay for joint cost to cover the O.N. administration. In the old system, no such explicit charge was made because all costs were pooled at the O.N. level.

Table 5.1 shows, however, that although the processing costs (narrowly defined per kg of milled rice) went up, the overall unit cost of rice did not, even though its volume fell drastically. Indeed, the state mills achieved major cost savings that offset their higher milling costs. These cost savings include the shift back to farmers of about CFAF 2000 per ton and a CFAF 9000 per ton gain through a higher output. So one could say that in spite of higher milling costs (narrowly defined), Table 5.1 shows the O.N. has been successful in cutting costs.

Managers of the state mills under the current management system are still constrained in strategic decision making. For example, spare parts purchases cannot be decided solely by the manager for expenses higher than CFAF 450,000. The manager also cannot decide which price to charge for his/her plants' output. This has to be decided at the headquarters. Other limitations are the pan-seasonal pricing and the uniform pricing of the output, no matter how efficient the mill.

## **5.2 The Cost of Milling Services of Small Mills**

There are several types of small mills in the O.N. zone (Table 5.3). Table 5.3 presents data from 16 mills surveyed during the author's rapid reconnaissance study. Appendix Table IV-1, and IV-2 give more details on the mills. Individual analysis of each mill would be cumbersome and would have little value for policy purposes. The mills can, however, be classified into four groups. The first group ("Type I") includes mills averaging a capacity of 4 to 6 tons of paddy per day. The "Type II" mills average 6.5 to 8 tons per day capacity. The "Type III" mills are

**Table 5.3: Cost and returns per kg rice from custom milling in a sample of private mills in the O.N. zone (CFAF/kg)**

Cost returns items Type of mills	Volume in kg paddy/day	CU %	Variable costs					Fixed costs			IC	Total Proc. Costs	Milling fees	Net returns
			fuel	oil	SPR	SAL	MF	rent	tax	dep				
Type I 1	245	5	10.40	0.52	7.60	2.06	--	0.69	--	3.49	1.22	25.98	6.25	-19.73
4-6 T per day 2	1600	35	3.93	0.12	4.02	0.31	--	0.10	--	0.62	0.22	9.32	6.25	-3.07
3	1600	37	2.02	0.06	0.50	0.45	--	0.10	--	0.43	0.15	3.92	6.25	2.54
4	2310	51	0.48	0.40	1.27	0.36	--	0.10	--	0.38	0.13	3.12	6.25	3.13
Type II 1	3030	43	2.08	0.16	0.77	0.27	--	0.04	--	0.26	0.09	3.67	6.25	2.58
2	3090	44	1.88	0.14	0.45	0.23	--	0.11	--	0.30	0.10	3.21	6.25	3.24
3	3800	54	1.11	0.39	0.73	0.44	--	0.04	--	0.26	0.09	3.06	6.25	3.09
4	6000	86	2.52	0.03	0.10	0.10	--	0.04	0.002	0.20	0.07	3.05	6.25	3.06
Type III 1	6400	53	3.13	0.88	--	0.16	--	0.08	--	0.64	0.15	4.89	6.25	1.38
12-30 T per day 2	2800		0.74	0.02	0.52	0.13	--	0.04	0.003	0.24	0.08	1.77	6.25	4.48
Type IV 1		93	1.07	0.64	1.42	0.10	--	0.05	--	1.27	--	4.55	4.37	-0.18
2 T per day														

CU: Capacity utilization in percentage to throughput capacity

SPR: Spare parts and repairs

SAL: Salary

MF: Marketing fees

dep: depreciation (mills)

IC: Interest charge on borrowed capital

Source: Rapid reconnaissance survey

few in the zone and average a capacity of 12 to 30 tons of paddy per day. The fourth category of mills ("Type IV") are the women's group-owned mills that have been financed through the Fonds de Developpement Villageois (FDV), a development project in the Segou region that helps village associations through financing storage activities, processing activities, and the like. The "Type IV" mills average 2 tons per day capacity.

The first part of this section will look at custom milling, including farmers' milling paddy from their own production. The second part will analyze the costs and returns of milling paddy assuming the mill manager buys paddy and sells the milled rice.

#### **5.2.1 Custom Milling Activities**

The supply of milling services has become more competitive than it once was during period between 1988 and 1990 when the private milling activities were not well-developed in the zone. Custom milling charges are in fact steadily decreasing. From CFAF 1000 per 80 kg of paddy in late 1980s, the rate in 1992 had dropped to no more than CFAF 500 per 80 kg of paddy for most private mills except the Type IV, which are much smaller. The milling fees for the Type IV vary between CFAF 300 and 400 per 80 kg of paddy, because the quality of the milled output from this type of mills is lower than that from the other mills<sup>30</sup>. Therefore in order to compete, the mill owners/managers should be able to

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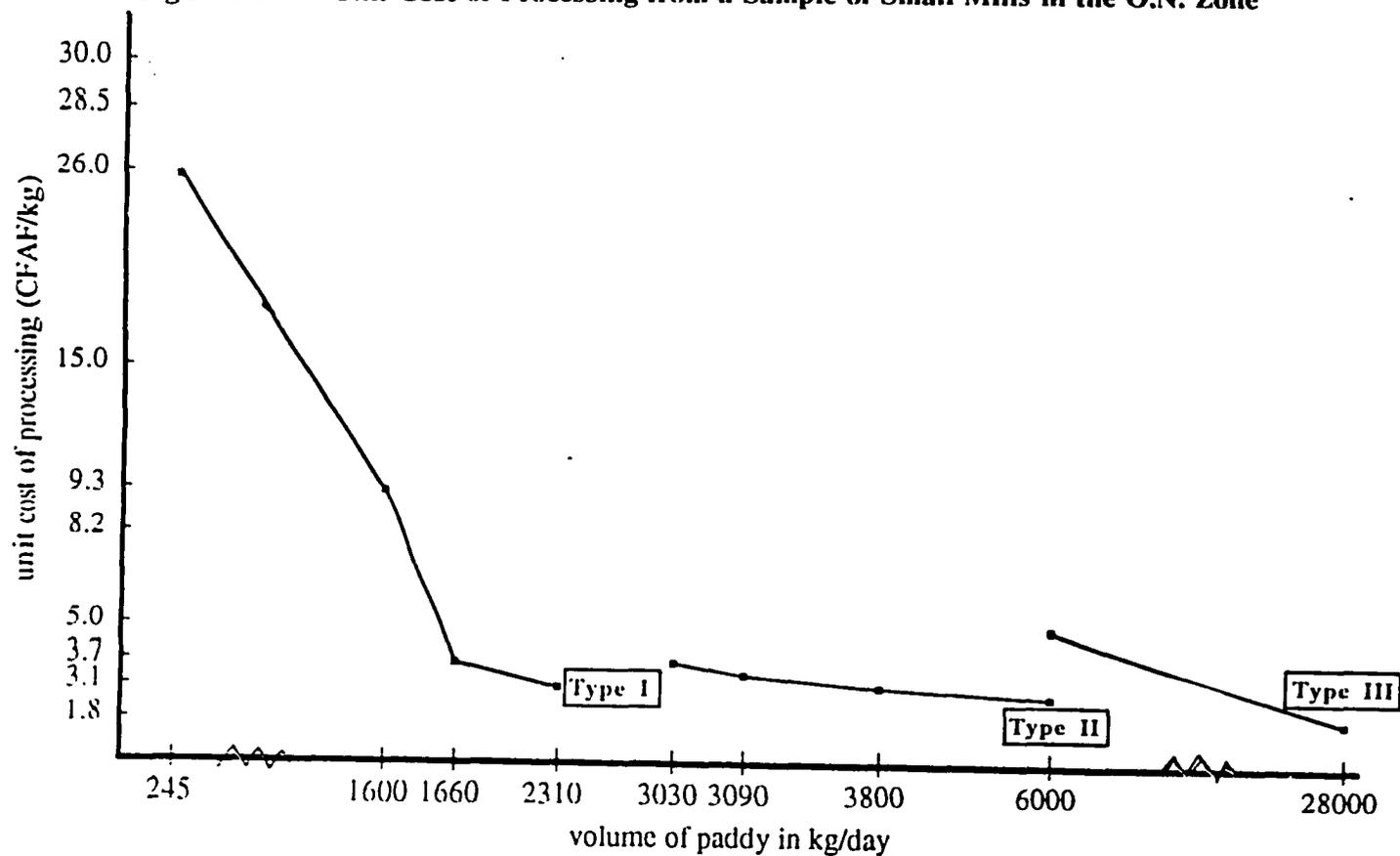
<sup>30</sup> There are many other local measurement units with different sizes used by women to set the custom milling fees. The 80 Kg paddy sack is used to make possible the comparison between the different types of mills.

process paddy for less than CFAF 6.25 per kg.(500 CFAF/80kg). At any unit cost of processing higher than that, the business would lose money.

The costs and returns for the various mills surveyed are shown in Table 5.3. Two of the Type I mills in the sample showed both a negative net revenue and the highest unit cost of processing. Furthermore, it appears that the unit cost of processing is a decreasing function of the volume of paddy processed (Figure 5.1). Indeed, the highest unit cost of processing, CFAF 26/kg, is associated with the mill showing the lowest volume of paddy processed (only 245kg/day). That mill achieved less than 5% capacity utilization (this mill also experienced major failures of the engine and major fuel purchases).

In addition to the constraints related to capacity utilization, some mills have required repairs, purchased spare parts, and/or exhibited relatively high fuel consumption. As a result, the revenue generated from milling services could not offset these costs. This is exemplified by the second Type I mill shown in Table 5.3, where 42% of the processing costs went to fuel and spare parts and 43% went to repairs. Notwithstanding a 35% capacity utilization, this mill also lost money. Three of the four Type I mills surveyed spent at least 29% of their operating expenses on spare parts and repairs, and among these three mills, two have spent at least 40% of their operating expenses on spare parts. The fourth Type I mill surveyed, on the other hand, exhibits relatively high returns due to less fuel consumption (only 15% of the processing costs) combined with relatively higher capacity utilization (51%).

Figure 5.1 Unit Cost of Processing from a Sample of Small Mills in the O.N. Zone



All of the Type II mills surveyed exhibit positive returns, although they spent at least 35% of their operating expenses on fuel purchases. The spare parts and repair expenses of these mills barely exceeded 24% of their expenses during the period under investigation. Furthermore, none of these mills operated under 43% capacity utilization.

The two Type III of mills surveyed achieved 53% and 93% capacity utilization, respectively. The first mill spent 65% of its processing costs on fuel purchases. On the other hand, spare parts purchase accounted for only 3% of the processing costs, one of the lowest in the sample. The mill in this category had the lowest processing costs and has operated at 93% capacity utilization, the highest in the sample. It also exhibited the highest net returns. However, it should not be understood from this picture that the larger mills are the most profitable. Indeed, either Type I or Type II can do as well as Type III if you can get decent capacity utilization. Indeed, at only half of their capacity utilization, most of these mills were performing as well as the larger mill, which have worked almost at full capacity (93%). The major constraints that affect the small mills were more managerial factors including the lack of technical training of most of the operators resulting in a higher percentage of spare parts failure.

The Type IV mills have been used in the O.N. zone to replace hand pounding of paddy, and have therefore contributed to save substantial amount of women's time that was once spent in performing paddy processing for domestic use. Women spent most of this saved time growing vegetables for both the market and home consumption. Besides the use of these mills to perform the

processing of paddy for domestic use, the mills were also used for custom milling at times when the supply of milling services was very small relative to the demand.

Currently the supply of better milling services has increased, leaving little breathing room for the Type IV mills to compete for market share. The relatively low milling fees combined with the poor quality of milled rice coming from the Type IV mills have contributed to undermine the financial profitability of these mills. Many millers have been either forced out of business or have chosen to process their own purchased paddy because they were not able to cut their processing costs enough to meet the market standard. However, except the extreme case where the unit cost of processing was CFAF 26/kg, the average unit cost of milling for private mills is far below the milling cost of the state mills (CFAF 4.3/kg in July-August 1992 for small mills compared to CFAF 17.6/kg for the state mills during the same period).

From the analysis above, it appears that capacity utilization is a major factor affecting the cost structure of mills. Given the same type of mill, i.e., the same technology, the volume processed determines which of the mills operate efficiently. Indeed, Figure 5.1 shows that the more paddy processed per day, the less the unit processing cost. This pattern is the same for the different type of mills taken individually. As the per-day volume of processed paddy increases, the total average costs decreases. This is even more apparent when we look at the two extreme cases, case one of the Type I and case one of the Type III mills. Indeed, at 5% of capacity the per unit cost is the highest of all cases. On the

other hand, operating almost at full capacity (93%), the Type III exhibits the lowest per unit average costs. Likewise, the smaller mills (Type I and II) could be equally profitable if they were operating at sufficient capacity. If small mills' (Type I and II) managers have enough technical and marketing expertise, it is more likely that they manage more profitably than larger mills. Indeed, the same issue was raised by Timmer (1973) when addressing the problem related to the choice of technique in rice milling in Java: "Why pay more than \$40,000 for a large rice mill when the same output can be attained by a small mill with an investment of \$7,400? Naturally the cheap unit requires far more labor, but that does not count much in a country where a mill laborer is paid \$0.24 to 0.36 per working day. The difference in output (extraction) rate (less than 1 percent) and broken percentage (around 3 percent) are also insignificant compared to the high debt service for large-scale mill."

The Malian milling industry can learn from the experience on Java briefly exemplified in the above quote.

### **5.2.2 The Own-Mill-Sell or Buy-Mill-Sell Activity**

About 70% of the millers interviewed said that it was more profitable to purchase paddy (even at more than CFAF 75/kg), process it and sell the milled rice rather than specialize in custom milling. These millers indicated that milling one's own or purchased paddy yielded a higher payoff than either selling the paddy to the O.N. or specializing in custom milling activity.

Table 5.4 and Table 5.5 show the cost and return pictures of either the own-mill-sell or the buy-mill-sell activity, assuming respectively: 1) milling the

paddy as it was harvested (assuming only one month storage), and 2) the case where the paddy has been stored until April, 1992, (i.e., 4 months storage).

#### **5.2.2.1 Milling at Harvest**

The analysis is done using the average producer price for milled rice in January, 1992, i.e., CFAF 122 per kg, the opportunity price of paddy of CFAF 70 per kg, and we assume that the interest charged for the capital used to purchase paddy is 35%.

All the mills exhibit a positive result, except the women's group-mills and the one which operated far below capacity (5%). From the Table 5.3, it appears that except these extreme cases all the mills under analysis can operate profitably when buying at prices between CFAF 72 and CFAF 82 per kg. These findings show why the quantity paddy sold to the O.N. is declining over time since 1989/90. Indeed, farmers are likely to process their own paddy and sell the milled rice at a price as low as CFAF 122 per kg and still breakeven.

#### **5.2.2.2 Milling After Four Months**

Table 5.4 shows that storage did not pay after four months in 1992, when market prices of milled rice were as low as CFAF 127 per kg. Indeed, while the price of rice rose only CFAF 5 per kg, between February and May, 1992, the cost of capital involved in storage was CFAF 8/kg. Note, furthermore, that this table only includes the capital costs of storage and not any of the other costs, like storage losses. However, even at CFAF 127

**Table 5.4: Cost and returns per kg rice from custom milling via sample of small mills in the O.N. zone**

Cost returns Type of mills		Process. Costs (1)	Opp Price Paddy (2)	Opp Cost Purchase (3)	Conv. Factor (4)	Paddy eq. of By- product (5)	Cost of 1 kg Paddy (6)	Mkt. Price Rice (7)	BE Price Paddy (8)	Paddy eq. of Rice (9)	Net Returns (10)
Type I 4-6 T per day	1	25.98	70.00	2.04	0.66	2.42	95.60	122.00	52.90	80.52	-15.08
	2	9.32	70.00	2.04	0.66	2.42	78.94		71.60	80.52	1.58
	3	3.71	70.00	2.04	0.68	2.29	73.46		79.50	82.96	9.50
	4	3.12	70.00	2.04	0.65	2.50	72.66		76.60	79.30	6.64
Type II 6.5-8 T per day	1	3.67	70.00	2.04	0.67	2.36	73.35		78.40	81.74	8.39
	2	3.21	70.00		0.66	2.42	72.83		77.70	80.52	7.69
	3	3.06	70.00		0.7	2.14	72.96		82.40	85.40	12.44
	4	3.05	70.00		0.65	2.50	72.59		76.70	79.30	6.71
Type III 12-30 T per day	1	*8.21	70.00	2.04	0.67	2.36	77.89		73.90	81.74	3.85
	2	1.77	70.00		0.68	2.29	71.52		81.40	82.96	11.44
Type IV 2 tons per day	1	4.55	70.00	2.04	0.55	3.21	73.18	118.00	63.90	60.05	-6.08

(1) Unit processing costs plus eventual marketing fees

(2) Opportunity price of paddy

(3) Opportunity cost of capital (storage cost)

(4) Conversion factor

(5) Paddy equivalent of by-product

Source: Rapid reconnaissance survey

(6) Unit cost of paddy (CFAF/kg)

(7) Market price of rice

(8) Break-even price of paddy

(9) Paddy equivalent of rice

(10) Net returns from Own-Mill-Sell

\*includes marketing fees

**Table 5.5: Cost and returns per kg rice of by-store-sell milling activity in a sample of small mills in the O.N. zone. (CFAF/kg) Storage from January - April 1992 (4 months)**

Cost returns Type of mills	Process. Costs (1)	Opp Price Paddy (2)	Opp Cost Purchase (3)	Conv. Factor (4)	Paddy eq. of By-product (5)	Cost of 1 kg Paddy (6)	Mkt. Price Rice (7)	BE Price Paddy (8)	Paddy eq. of Rice (9)	Net Returns (10)
Type I 1	25.98	70.00	8.17	0.66	2.42	101.72	127.00	52.10	83.82	-12.60
4-6 T per day 2	9.32	70.00		0.66	2.42	85.06	127.00	68.80	83.92	4.04
3	3.71	70.00		0.68	2.29	85.58	127.00	76.80	86.36	6.22
4	3.12	70.00		0.65	2.50	78.78	127.00	73.80	82.55	8.97
Type II 1	3.67	70.00	8.17	0.67	2.36	79.47	127.00	75.60	85.09	10.98
6.5-8 T per day 2	3.21	70.00		0.68	2.42	78.95	127.00	74.90	83.82	10.15
3	3.06	70.00		0.70	2.14	79.08	127.00	79.80	88.91	15.42
4	3.05	70.00		0.65	2.50	78.71	127.00	73.80	82.55	9.04
Type III 1	*8.21	70.00	8.17	0.67	2.36	84.01	127.00	71.10	85.09	6.44
12-30 T per day 2	1.77	70.00		0.68	2.29	77.64	127.00	78.70	86.36	14.16
Type IV 1	4.55	70.00	8.17	0.55	3.21	79.5	115.00	53.70	63.25	-16.25
2 tons per day										

(2) If selling paddy to the O.N., the private processor would expect CFAF 70/kg regardless of the quality of the paddy

(4) At the time of the rapid reconnaissance survey, one bag of 70 kg by-product was worth CFAF 500 per 70 kg sack

(6) = (1) + (2) + (3) - (5)

Source: Rapid reconnaissance survey

per kg milled rice, and after four months storage at an interest rate on capital as high as 35%, most of the millers could operate profitably when buying paddy between CFAF 71 and 80 per kg. Therefore, the cost of capital is one of the major determinants of profitability when performing the own-mill-sell or buy-mill-sell activity.

This analysis suggests that people are more likely to purchase paddy and process it themselves if they can purchase the paddy at around the O.N. floor price of CFAF 70/kg. Moreover, the analysis suggests that most of the millers sampled would be willing to buy paddy at a higher price than the O.N. support price of CFAF 70/kg. The quality of paddy, however, becomes a major determinant of profitability when performing the own milling or buy milling activity. Indeed, the conversion factor is a function of the quality of the paddy being processed. Paddy quality includes both the variety and the conditions under which the paddy was dried before it goes to the processing. Many private processors do not have the expertise of conditioning the paddy after harvest. Indeed, before the paddy market was liberalized, there was no incentive for farmers to clean the paddy for the O.N., because there was no premium paid for clean paddy or for well-dried paddy. As a result, there was no need for farmers to learn how to condition their paddy.

Private processors, either processing their own production of paddy for sale or buying paddy and sell milled rice after processing, are more interested than before in having more expertise on how paddy should be conditioned in order to increase the conversion factor.

Notwithstanding these positive impacts of private mills in the rice subsector of the O.N. zone, it appeared from the rapid reconnaissance survey, that some mills are still working only because the owners would do everything they could to keep their mills in good shape in order to maintain the social status of the family.

### 5.3 Conclusion

Both the state mills and the private mills seem to have a common denominator, that is, they all have spare parts procurement constraints and they have consumed a significant amount of their variable costs in fuel purchases--23% for the state mills in 1989/90 and 56%, for private mills. Therefore, any policy that would affect the supply conditions of these items (such as the recent devaluation of the CFA franc) would also significantly affect the profitability of the milling industry.

The spare parts accounted for an even more significant percentage of the variable costs, at 37%, for state mills, and accounted for an average of 28% of variable costs for small mills.

Capacity utilization also appears to be a significant determinant of the profitability of the mills. Indeed, the high fixed costs of processing has increased by 13% since the volume of paddy processed by state mills has fallen by 64%. Figure 5.1 also shows clearly how increasing volume and capacity utilization help drive down processing costs in the small mills.

In general, the own-mill-sell or the buy-mill-sell activity is far more profitable than custom milling activity if paddy can be bought at CFAF 70/kg. However, if the quality of paddy processed happens to be poor, any significant decrease in the market price of milled rice could undermine the profitability of this activity. There is also evidence that because of profitability of this operation, small mill owners have bid up the price of good-quality paddy above CFAF 70/kg, thus sharing some of the profits with farmers. Any policy implementation to train

small private processors to understand basic marketing devices, such as contract formation, accounting, and storage management, would contribute to heightened involvement of farmers and other paddy processors in the distribution channel, and would therefore contribute to a greater degree of exchange efficiency.

## **CHAPTER VI. CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH**

### **6.1 Conclusion**

Data from both secondary sources and the rapid reconnaissance survey were analyzed to test:

1. The likelihood that the itinerant traders and semi-wholesalers were the major clients of small mills. It appears from the rapid reconnaissance survey that during the 1992 commercial year, the output flowing from the small mills to Bamako was about 500 tons per week, i.e., 25,000 per year. Likewise, the small mills were supplying many other urban areas with milled rice, e.g., Sikasso and Koutiala. Although it is not clear what quantity of rice flows in these places, it is quite clear however that in 1992, the small mills supplied enough rice to disrupt the planning of major rice importer-wholesalers. The evidence suggests that the small mills were filling an important part of the demand, especially in Bamako, that was not supplied through the traditional wholesaling system. In other words, the disruption in the wholesalers' market would suggest that the output from the small mills does not fall under the wholesalers' control.

It appears also that some AVs are developing new distribution networks through the public services in Bamako. However, it is not clear what services are supplied through this channel and what is the quantity of milled rice being supplied each month.

The independent middlemen appear to be a threat for both wholesalers and semi-wholesalers because they engage in more aggressive marketing, which consists of door-to-door trading, exploiting their social relationships to sell their products.

2. The likelihood that the rapid spread of small mills in the Office zone would contribute to a higher valuation of the paddy on the open market than before the liberalization.

The own-mill-sell or the buy-mill-sell activity appears to be more profitable than custom milling activity as long as millers can buy paddy at CFAF 70/kg. The analysis shows that the quantity of paddy marketed by the O.N. is steadily decreasing over time. The major reason is that private processors are more likely to buy paddy at higher prices, process, and sell it rather than sell the paddy to the O.N. at less than their break-even prices. Indeed, at market prices of milled rice as low as CFAF 122 per kg, many private processors were still making money from own paddy processing or buy-mill-sell rice activity.

However, major constraints were found to be detrimental to the performance of the own milling activity. Indeed, if the quality of paddy processed happened to be poor, any significant decrease in the market price of milled rice could undermine the profitability of this activity.

Storage costs combined with the erratic rice import policies also appear to be very important factors affecting the farm prices of milled rice, the marketing costs of milled rice, and the profitability of own paddy milling activity. The current devaluation, however, is expected to increase the competitiveness of the

domestically produced rice if the import costs of inputs do not offset the domestic price. In other words, the future of the rice subsector in the O.N. zone depends how the relative price of rice has been evolving since the CFAF was devalued. Currently, the consumer price of rice in Bamako collected by the SIM during the period following the devaluation (until January 31) remained relatively low CFAF 150 per kg of milled rice.

Although the preceding analysis has provided some insights into the milling industry in general, there is more to be learned about the sustainability of the different types of mills. On the one hand, lots of good things have been said and written already about the private mills. On the other hand, many things much less nice are being said about the state mills. Both state mills and small mills have, however, their strengths and their weaknesses.

The major strength of the state mills lies in their capacity to differentiate the product, i.e., to provide several qualities of milled rice. Indeed, the state mills can produce four different qualities of milled rice that are priced differently on the market. These varieties include: the 40% broken rice, which is the most demanded, the 25% broken rice, the long grain rice, and the broken rice. However, except the broken 40% and, to a lesser measure, the completely broken rice, the demands for the broken 25% and the long grain are relatively very low. Therefore, what seems to be seen as a weakness for the small mills is not really as far as the domestic demand is concerned.

The major weaknesses of the state mills include:

- 1) the lack of flexibility of the local management staff to adjust to the environment of the milling industry. For example, spare parts purchases cannot be decided solely by the manager for expenses over CFAF 450,000. Moreover, the managers of the state mills do not have the power to appoint the chiefs of the technical department working under their responsibility, nor do they have the capability to fire such personnel, and the list goes on;
- 2) although there are four separate plants operating under different managers, the price of the O.N. milled rice is the same. The more efficient plants, therefore, subsidize the less efficient.

The private mills have the flexibility to adjust to their environment because most of the managers are either owners of the mills or they are given more responsibility to make key decisions. Therefore, these managers have more incentives to experiment with whatever seems to be profitable for the mill. Indeed, the managers of almost all the small mills can decide, at any time, how many laborers to hire or to fire depending on the seasonality of the processing activity. More importantly, the manager of the individual state mills does not decide how much to charge for the output, given the market conditions, at different periods in time.

The small mills cannot produce different varieties of milled rice as can the state mills; therefore, they face the demand from the 40% broken rice, which is

the only variety most of them can produce. They cannot adjust to any new demand for 25% broken or long grain rice.

From this brief concluding summary, a major recommendation would be that the state mills be separated into four different and independent management units. Each unit could then be operated under performance contracts signed between the government and either the staff of the unit, if this one wishes to do the job, or a private group wishing to sign the contracts. However, the assigned manager should give the guarantee of accountability for any negative managerial result. This guarantee is to be defined.

Although it is too soon to rely completely on the small mills, because we do not have all the details on the technical strengths and limitations of each type of mill, these mills. However, have created more incentives for farmers to be more involved in both paddy farming and processing in the O.N. zone, not to mention all the new jobs that were created from the small mills. Indeed, each new mill creates at least two new jobs in the subsector. That is, roughly 800 jobs that the small mills were able to create.

All the private millers do not operate profitably. Indeed, it appeared from the rapid reconnaissance survey that some millers purchased the mills because they have to (for social reasons). In order to keep high profile in a place where they are among the wealthiest, some farmers may decide to buy a mill, not necessarily for economic reasons.

Therefore, more studies need to be conducted in the O.N zone to answer such concerns.

## 6.2 Future Research

Chapters IV and V analyzed respectively the structure of the rice subsector in the O.N. zone and the role of the small mills in this subsector. In chapter four, the analysis shows a positive trend of the marketing margins over time. However, both the producer and consumer prices exhibit a negative trend. This would suggest that although the cost price of milled rice is being driven down with the introduction of the new technology, like the small mills, and although this has contributed to drive down the consumer price in Bamako, there are still high marketing cost associated with moving rice from Niono to Bamako. Moreover, as illustrated in Table 2.4, beginning 1990s, rice imports have been more important during years when domestic production reached record levels. All these factors have contributed to depress the farm price.

However, the rice marketing system exhibited high marketing costs in July-August, 1992. One of these high marketing costs could be found in the percentage of the margins going to the intermediaries (brokers) all the way along the marketing channel. Therefore, having a better understanding about these cost elements could help to improve the performance of the marketing system. Among other things to be learned about the rice subsector in the O.N. zone are the role of independent middlemen; the market share of the AVs, which are networking with some public service representatives; and the percentage of the margins that go to the intermediaries (brokers) throughout the marketing channel.

The goal of this second part of this chapter is to outline a plan for future research that will:

1. Investigate the economic benefits and costs of both private and state mills as opposed to financial analysis;
2. Determine the percentage sale of small mills going to:
  - traditional wholesalers in major cities (Bamako, Koutiala, Kayes, etc);
  - public service representatives in Bamako;
  - other traders (sales occurring in small quantities during the weekly market day).
3. Determine the percentage of sales of state mills going to:
  - traditional wholesalers in major cities (Bamako, Koutiala, Kayes, etc);
  - public service representatives in Bamako;
  - traders (to be specified).
4. Determine the storage conditions in the O.N.(private and public) and at the distribution level as well;
5. Investigate why spare parts and fuel account for such an important percentage of the processing costs of the mills. Maybe there is a need for the managers of the mills to get better training, or maybe some of the mills are not appropriate for the job.

The author proposes to carry out such a study when he returns to Mali as an analyst with the Cereals Market Information System. In order to fulfill the above objectives, the following research plan will be implemented. For more details, see research planning matrix in Appendix IV.3.

## BIBLIOGRAPHY

- Anema, J. W., Diallo, A., "Analyse Coûts-Avantages du Programme l'Amélioration de la Riziculture Paysane a l'Office du Niger (ARPON, Mali)", Rotterdam, August, 1992.
- AID, Cereals Market Restructuring Project, "Food for Development", Title II, Section 206, 688-0230, Program Paper Mali, DCC Approved June 14, 1984.
- Bagayoko, D., Van Der Linde, M., Thiboutot, S., Programme de Restructuration du Marche Cerealier du Mali, Rapport d'Evaluation, PRMC, Bamako, 19 Mai 1992.
- Bain, Joe. Industrial Organization. New York: John Wiley and Sons, 1958.
- Barry, A. W. A Study of Cereal Price Interrelationships Across Markets and Commodities at the Wholesale and Retail Levels in Mali, unpublished M.S. Thesis. Michigan State University, 1989.
- Barry, A. W. Comparative Advantage, Trade Flows and Prospects for Regional Agricultural Market Integration in West Africa: The Case of Cote d'Ivoire and Mali, unpublished PhD Dissertation. Michigan State University, 1994.
- Coelo, S. "An Example of Protection: Regulation of Rice Imports into Mali", Paper presented at the Lome Seminar 'Regional Cereals Markets in West-Africa' 6-11 November, 1989.
- Coelo, S. Mission d'Evaluation de la Politique de Prix et de Commercialisation du Paddy et du Riz: Contrat-Plan Etat/Office du Niger, Version provisoire, Bamako, Septembre 1990.
- Cooperation Neerlandaise-Mali. Rapport d'Evaluation du Projet Plan Conjoint de Substitution de Riz Marche Local aux Importations-6eme et 7eme Regions, Fevrier 1990.
- Coulter, J., Tyler, P. Liberalization of Cereals Marketing in Sub-Saharan Africa: Implementation Issues. Report No.4: Mali, A Case Study, February 1993.
- Deme, M. Etude sur la Gestion des Excedents et Deficits Cerealiers du Mali, Rapport Principal, Bamako, Juillet 1992.
- Dembele, N. Nango. "Note d'information relative a l'opinion des commercants sur le SIM." Projet Securite Alimentaire, Note d'Information 89-01. Ministere de l'Agriculture, Institut d'Economie Rurale, Secretariat Technique de la CESA, Mai, 1989.

- Dembele, N. Nango. Mission d'Evaluation de la Politique de Prix et de Commercialisation du Paddy et du Riz: Contrat-Plan Etat/Office du Niger, Analyse des Marges de Commercialisation (version provisoire), 1990.
- Diarra, Salifou B. Reconnaissance Rapide sur la Filiere des Decortiqueuses Privees dans la zone de l'Office du Niger, Mali, Juillet-Aout 1992.
- Dione, J., Dembele, N. N., et Staatz, J. M. Description et Analyse de la Structure du Marche des Cereales (Mil-Mais-Sorgho) au Mali, Document de Travail No. 86-04, Projet Securite Alimentaire MSU/CESA/USAID, Bamako, Septembre 1986.
- Direction Nationale de l'Agriculture (DNA). Contribution au Seminaire National sur la Politique Cerealiere, Les Filiere Riz, Bamako, Juin 1993.
- Gabre-Madhin, Eleni Z. Transfer Costs of Cereals Marketing in Mali: Implications for Mali's Regional Trade in West Africa. Unpublished M.S Thesis, Michigan State University, 1991.
- Harriss, Barbara. "There is Method to My Madness: Or is it Vice Versa? Measuring Agricultural Market Performance." Food Research Institute Studies. Vol. 17, No 2, 1979.
- IER. Determination des Coûts Moyens de Production des Principaux Produits Agricoles: Campagne 1989/90, Bamako: Institut d'Economie Rurale, Ministere de l'Agriculture, 1989.
- IER. Etude des Coûts de Production du Paddy a l'Office du Niger: Campagne 1988/89, Institut d'Economie Rurale, Ministere de l'Agriculture, Bamako, 1990.
- IER, GTZ. Economie Rizicole des Exploitations de l'Office du Niger: Campagne 1990/91, Volume 2, Cout et Rentabilite du riz-paddy, Juillet 1992.
- I.E.R. Etude Recherche Developpement a l'Office du Niger: Annexes, Bamako: 1993.
- Konare, Nafissatou, Assistant Director of the National Direction of Economic Affairs. Personal Contacts, Bamako, August, 1992.
- Levine, T. K. Trends in the Malian Agricultural Production, Washington: World Bank, August 1993.
- Marion, Bruce and the NC-117 Committee. The Organization and Performance of the U.S Food System, Lexington Books, 1986.

- Mehta, Mona. An Analysis of the Structure of the Wholesale Cereals Market in Mali, Plan B Paper for the Degree of M.S, Michigan State University (unpublished), 1989.
- Morris, Michael L. The Cereals Sub-Sector in the Senegal River Valley: A Marketing Policy Analysis, Ph.D.-thesis, Michigan State University (unpublished), 1986.
- Morris, Michael. L. "Rice Marketing in the Senegal River Valley: Research Findings and Policy Reform Options", Paper No.8, 1987.
- Office du Niger, "Procédure de Fonctionnement des Rizeries Autonomes de l'Office du Niger: Campagne 1991-1992", Decembre 1991.
- Office du Niger, Missions de Prospection du Marche Interieur: Compte Rendu, 25 Mai 1992.
- Office du Niger, "Note de Presentation de la Structure des Prix du Riz actualisee en Juin 1992", 1992.
- O.P.A.M./SIM. Bulletin d'Information sur le Marche Cerealier en Republique du Mali, Ministere des Finances et du Commerce, Division Systeme d'Information du Marche, 1988-1992.
- O.S.C.E. Statistiques de Base. Agriculture-Elevage, Office Statistique des Communautés Europeennes, Bamako, 1989.
- Reardon, T. "Cereals Demand in the Sahel and Potential Impacts of Regional Cereals Protection". World Development, January, 1993.
- Rogers, B.L., and Lowdermilk, M.L. Food Prices and Food Consumption in Urban Mali, Final Report of the Tufts/DNSI/AID Food Price Project, Tufts University School of Nutrition Medford, Massachusetts, October 1988.
- Samacke, A., Yung, J.M. Sedes, "Opinions et Objectifs des Riziculteurs de l'Office du Niger". Bamako, 1988.
- Sanogo, Ousmane. Etude Observatoire des Marches du Riz a l'Office du Niger, Rapport final, Bamako: I.E.R. Fevrier 1993.
- Scherer, Frank. Industrial Market Structure and Economic Performance. Second ed. Chicago: Rand McNally College Publishing Company, 1980.
- Sijm, J. Food Security and Policy Interventions in Mali, Tinbergen Institute, Eranus University, Rotterdam, March 1992.

- Spencer D.S.C, Parker I.I.M, Rose F.S. Employment Efficiency and Income in the Rice Processing Industry of Sierra Leone, East Lansing: MSU African Economy Paper No.15, 1976.
- Staatz, J.M., Dione, J., and Dembele, N.N., "Cereals Market Liberalization in Mali", World Development, Vol.17, 5, pp.703-718, 1989.
- Steffen, Philip, The Role and Limits of the Cereals Market in Assuring Household Food Security in Northeastern Mali, Partial Draft Ph.D. Dissertation, Michigan State University: Chapters 1-5, 1992.
- Teme B., Boughton D. "Analyse Preliminaire sur la Filiere Mais et Principales Interrogations", Bamako: I.E.R., Avril 1992.
- Thenevin, P. Mission d'Evaluation de la Politique de Prix et de Commercialisation du Paddy et du Riz: Contrat-Plan Etat/Office du Niger, Rapport de Synthese (version provisoire), Bamako Septembre 1990.
- Timmer, C. Peter. "Choice of Technique in Rice Milling on Java", In Agricultural Development in the Third World, edited by Carl K. Eicher and John M. Staatz. Second Edition, the Johns Hopkins University Press, Baltimore and London, 1973.

## APPENDIX I

### List of Persons Contacted During the Rapid Reconnaissance Survey

Abdel K. Sanankoua, chief of the "Service de Diffusion", SIM/O.P.A.M., Bamako

Abou Diarra, consultant PRMC, Bamako

Abou Diarra, AV of KM 26 member, Niono

Abdramane Traore, technical advisor SIM/O.P.A.M., Bamako

Amadou Camara, USAID Bamako

Bakry Kante, PRISAH/INSAH, Bamako

Djime Diawara, SIAEI Consul Bamako

Mohamed Sylla, Importer-wholesaler, Bamako

Ousmane Sanogo, IER, Bamako

Serge Coelo, Ministry of Finance and Commerce, Bamako

Mr. Bocoum, Director of the Processing and Marketing services in O.N.

Mr. Coulibaly Director of the milling plant in Molodo

Mamadou Safoune Traore, Director of the Fonds de Developpement Villageois in Niono

Ibrahima Diakite, cereals wholesaler in Bamako

Bourama Tangara, Semi-wholesaler and retailer in Bamako, Niarela

Gaoussou Tangara, semi-wholesaler and retailer in Bamako, Niarela

Kone and Traore wholesalers, paddy processors, and small mills suppliers in Bamako

Mr Haidara, Sahel sector in Niono

Mr Djire, in Molodo

Mr. Traore, Molodo

**James Tefft, SIM/O.P.A.M. Bamako**

**Mr. Diabate, processor and small mills supplier in Niono**

**Moustapha Diarra, Sector of Niono**

**Facourou Goita, N7**

**Issa Sissouma N9**

**Many other managers/owners of small mills in Molodo and Niono were interviewed.**

## APPENDIX II

### Import Parity Price of Domestically Produced Rice Computed at Bamako. Using the April, 1992 Figures

In order to determine the import parity price of rice, the following assumptions were made:

1. The CIF price of 35% broken rice is computed from the FOB price of Bangkok at the Dakar port, then the CIF price at the boarder of Mali was computed adding up all the charges from the port to the entry boarder of Mali. This CIF price as well as all the cost figures used in April, 1992 are assumed to be constant up to July-August, 1992. This assumption is made in order to overcome the difficulties we may have to:
  - a) Compare the import parity price computed in April, 1992 with the wholesale price of domestically produced rice computed in July-August, 1992.
  - b) Get the July-August, 1992 costs data from the port of Dakar to Bamako.
2. A 50% rate of CFA overvaluation was used to compute the shadow price of imported rice in order to get the economic price of rice.
3. The Official Exchange Rate (OER) is U.S \$1.00 = CFAF 300. Therefore, the Shadow Exchange Rate (SER) is  $= \text{OER} * (1 + 50\%) = 300 * (1.5)$ ; SER = CFA 450 for U.S \$1.
4. The CIF price of rice at Dakar port is U.S \$260.

**Appendix Table II.1: The Import Parity Price of Rice Produced Domestically in the Office du Niger Zone and Transported to the Main Consumption Market (Bamako), July and August, 1992**

Costs Items\Prices	Financial Price	Economic Price
CIF price of rice at Dakar port		
Port Charges	78,000	117,000
Loading and Storage Costs	5,270	5,270
Port taxes	3,680	3,680
Transport to Mali border(CFA/ton)	4,050	4,050
	12,198	12,198
Wholesale Cost price at Mali Border	103,198	142,198
Tariff (32% ad valorem)	33,023	-
Capital Cost related to delay in importation	3,456	-
Transportation to Bamako	8,705	8,705
Handling	2,304	2,304
Unloading in Bamako	1,250	1,250
Insurance & other taxes	1,424	-
Cost Price of rice in Bamako	153,360	154,457

Source: The costs figures are those used in the Anema et al paper (Anema et al, 1992)

## APPENDIX III

### Detailed Methodology for the SIM Price Collection

The methodology used for the weekly price collection throughout part of the period of analysis (February 1988 through December 1990) was based on random sampling techniques. As such, for the day of the week considered to be the survey day, 10 respondents were chosen at random from among the population of traders present in the market.

This methodology took into consideration two situations:

1) First, the ideal case in which the traders collaborate with enumerator. In this case, the enumerator would compose an exhaustive list of traders in the market, from which he randomly (by lottery) selected ten respondents each week for the survey; and

2) Second, the case in which the traders were unwilling to be included in a permanent list of respondents. In this event, the enumerator was obliged to count the traders in the market each week, and if the number exceeded 10, he divided the total by 10 to get the sampling frequency.

After determining the sample, the enumerator collected the different prices, either purchase or sale, depending on the actor. The enumerator asked the following questions:

- Have you purchased or sold grain on the market today?
- If so, from/to whom?

On the basis of the above, the enumerator determines whether the price is either a producer price (bought from producer), wholesaler price (bought from

trader), or consumer price (sold to consumer). Lastly, the enumerator had to compute the mean price for each type of price and for each variety of cereal he found on the market this day.

The methodology used to collect prices during the second part of the study period (January 1991 through May 1993) departs from the first in that the second was implemented to correct for a major sampling error introduced in the first methodology. Under the first methodology, for a given market, the price of a given cereal sold (purchased) in local measurement units (converted into standard kilograms) was simply aggregated with other prices of the cereal sold (purchased) in standard kilograms. The average prices computed from these different measurement units were not representative for any of the individual measurement. To deal with this problem, the new methodology currently samples every week and for each market. Five traders using the dominant local measurement units from whom the prices of cereals are collected and converted into standard kilograms.<sup>31</sup> On the other hand, the modal price in standard kilograms is simply collected weekly, for each cereal, and for each market. Therefore, as far as prices are concerned, the enumerator is asked to transmit two different types of prices as follows every week:

- 1) the mean price of the five dominant local measurement units sampled and converted in standard kilograms for each cereal. This price is called the calculated price; and

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<sup>31</sup> This should be done for each single variety of cereal under the SIM monitoring system.

2) the modal price for each cereal. This price is called the observed price.

Differentiating these two prices is very important in the weekly radio report. However, the prices used in the second part of the study period refers to the mean value of the observed and the calculated price. Indeed, for the written reports, weekly and monthly reports and the bulletins, the audience is able to understand the meaning of the mean price.

**APPENDIX IV**  
**Questionnaires for In-Depth Study**  
**Questionnaire No 1**  
**(One-shot Questionnaire)**

**The Economic of Small Mills in the Rice Subsector in Office du Niger Zone**

**Questionnaire Related to the Small Mills**

**I. Enumerator Information**

Name \_\_\_\_\_

Date \_\_\_\_\_

Time Begin \_\_\_\_ : \_\_\_\_

Time End \_\_\_\_ : \_\_\_\_

**II. Respondent Information**

Respondent number \_\_\_\_\_

Zone of location \_\_\_\_\_

The Sector \_\_\_\_\_

The Village \_\_\_\_\_

Number of Visits \_\_\_\_\_

**Subcomponent processing**

**I. Ownership of the Mill**

If the owner is around, please ask him to respond himself to the interview.

1.1 What is the profile of the owner? \_\_\_\_\_

\*Please check

Individual farmer . . . . . (1)

Individual (businessman) . . . . . (2)

A women group . . . . . (3)

A village Association . . . . . (4)

Other (specify) . . . . . (5) \_\_\_\_\_

1.2 Prior to the processing business, what was the main occupation of the owner(s)?

\*Please list the occupations from the most important to the least important, ranking from 1 to 3:

Rice Farming . . . . . (1) Unemployed Grad . . . . . (4)

Businessman . . . . . (2) Early Retiree . . . . . (5)

Housewife . . . . . (3) Civil Servant . . . . . (6)

Other (specify) . . . . . (7)

1.3 If owner is involved in paddy farming, what is the area cultivated \_\_\_\_\_ ha

1.4 Does the owner have more than one mill? Yes \_\_\_\_ No \_\_\_\_

1.4 If Yes, where are the others located? \_\_\_\_\_

## II. Specification of the Mill

### 2.1 Information related to the Dehuller:

- 2.1.1 What is the brand name? \_\_\_\_\_  
2.1.2 What is the origin? \_\_\_\_\_  
2.1.3 What is the nominal capacity? \_\_\_\_\_  
2.1.4 What is the purchase price? \_\_\_\_\_ CFAF  
2.1.5 Did this price include the engine? Yes \_\_\_\_\_ No \_\_\_\_\_

If no, also answer 2.2.3 and 2.2.4.

- 2.1.6 What were the installation fees? \_\_\_\_\_ CFAF  
2.1.6 What was the installation date? \_\_\_\_\_  
2.1.7 Was the Dehuller brand new or second-hand at time of installation?  
New \_\_\_\_\_ Second-hand \_\_\_\_\_

### 2.2 Information related to the engine:

- 2.2.1 What is the brand name? \_\_\_\_\_  
2.2.2 What is the origin? \_\_\_\_\_  
2.2.3 Was the engine purchased separately from the dehuller?  
Yes \_\_\_\_\_ No \_\_\_\_\_

If yes,

- 2.2.4 What is the purchase price? \_\_\_\_\_ CFAF  
2.2.5 What were the installation fees? \_\_\_\_\_ CFAF  
2.2.6 What was the installation date? \_\_\_\_\_  
2.2.7 Was the engine brand-new or second-hand at the time of installation?  
Brand-new \_\_\_\_\_ Second-hand \_\_\_\_\_  
2.2.8 What is the power source? \_\_\_\_\_  
(1) Electricity (3) Gasoline  
(2) Diesel (4) Other (specify) \_\_\_\_\_

## III. Financing

### 3.1 Information related to the Dehuller:

- 3.1.1 Did you finance from own money? Yes \_\_\_\_\_ No \_\_\_\_\_  
If yes, what amount \_\_\_\_\_ CFAF

If no, answer 4.1.2 and 4.1.3.

- 3.1.2 Did you finance from credit?: Source \_\_\_\_\_  
What amount? \_\_\_\_\_ CFAF

- 3.1.3 Did you finance from other source? Yes \_\_\_\_\_ No \_\_\_\_\_  
Specify if yes \_\_\_\_\_  
What amount? \_\_\_\_\_ CFAF

### 3.2 Information related to the engine:

- 3.2.1 Did you finance from your own money? Yes \_\_\_\_\_ No \_\_\_\_\_  
If Yes, what amount? \_\_\_\_\_ CFAF

If No, answer 3.2.2 and 3.2.3.

- 3.2.2 Did you finance from credit?: source \_\_\_\_\_  
What amount? \_\_\_\_\_ CFAF

- 3.2.3 Did you finance from other source? Yes \_\_\_\_\_ No \_\_\_\_\_  
Specify if yes \_\_\_\_\_

What amount? \_\_\_\_\_ CFAF

**IV. The Milling Ratio**

4.1 How much milled rice do you get from paddy? if processing the **Rice**  
Variety BG \_\_\_\_\_

- (1) A 80 kg paddy bag
- (2) A 100 kg paddy bag
- (3) Other (specify) \_\_\_\_\_

4.2 How much milled rice do you get from (70-80Kg) paddy? If processing the  
Rice Variety BH2 \_\_\_\_\_

- (1) A 80 kg paddy bag
- (2) A 100 kg paddy bag
- (3) Other (specify) \_\_\_\_\_

4.3 How much milled rice do you get from (70-80Kg) paddy? If processing the  
Rice Variety D52 \_\_\_\_\_

- (1) A 80 kg paddy bag
- (2) A 100 kg paddy bag
- (3) Other (specify) \_\_\_\_\_

4.4 How much milled rice do you get from (70-80Kg) paddy? If processing the  
Rice Variety Gambiaka \_\_\_\_\_

- (1) A 80 kg paddy bag
- (2) A 100 kg paddy bag
- (3) Other (specify) \_\_\_\_\_

4.5 How much milled rice do you get from (70-80Kg) paddy? If processing the:  
Rice Variety H15 \_\_\_\_\_

- (1) A 80 kg paddy bag
- (2) A 100 kg paddy bag
- (3) Other (specify) \_\_\_\_\_

4.6 How much milled rice do you get from (70-80Kg) paddy? If processing the:  
Other or mixed \_\_\_\_\_

- (1) A 80 kg paddy bag
- (2) A 100 kg paddy bag
- (3) Other (specify) \_\_\_\_\_

\*For own paddy milling or buying paddy, which variety do you use the  
most? \_\_\_\_\_

Why? \_\_\_\_\_

**Questionnaire No 2:**  
**(Multi-Shot Questionnaire)**  
**The Economics of Small Mills in the Rice Subsector in Office du Niger Zone**

**Questionnaire related to the milling activities**

**I. Enumerator Information**

**II. Respondent Information**

Name \_\_\_\_\_

Respondent number \_\_\_\_\_

Date \_\_\_\_\_

Zone of location \_\_\_\_\_

The sector \_\_\_\_\_

Time Begin \_\_\_\_\_:

The village \_\_\_\_\_

Time End \_\_\_\_\_:

Number of visits \_\_\_\_\_

(Two shots questionnaire)

**I. Utilization of the Mill**

1.1 When was the most intense period of activity in your area?  
 \_\_\_\_\_

1.2 Did you operate in this period?

Yes \_\_\_\_\_ No \_\_\_\_\_

If yes,

1.2.1 How many sacks did you process (average) \_\_\_\_\_ sacks/day

1.2.2 How long did you work daily (average) \_\_\_\_\_ hours/day

1.3 When was the moderate activity in your area? \_\_\_\_\_

1.4 Did you operate in this period? .

Yes \_\_\_\_\_ No \_\_\_\_\_

If yes,

1.3 When was the moderate activity in your area? \_\_\_\_\_

1.4 Did you operate in this period?

Yes \_\_\_\_\_ No \_\_\_\_\_

If yes,

1.4.1 How many sacks did you process (average) \_\_\_\_\_ sacks/day?

1.4.2 How long did you work daily (average) \_\_\_\_\_ hours/day?

1.5 When was the period of slow activity in your area? \_\_\_\_\_

1.6 Did you operate in this period?

Yes \_\_\_\_\_ No \_\_\_\_\_

1.6.1 How many sacks did you process (average) \_\_\_\_\_ sacks/day?

1.6.2 How long did you work daily (average) \_\_\_\_\_ hours/day?

\*Please specify the average weight of the full sack of paddy used as standard \_\_\_\_\_ Kg/sack.

**II. Type of Activity**

2.1 How often have you done custom milling this year? \_\_\_\_\_

- Very frequently.....(1) if "over 2/3 of activity"

- Frequently.....(2) if " between 1/3 and 2/3"

- Sometimes.....(3) if "less than 1/3 of activity"

- Not at all.....(4)
  - 2.2 How often have you been milling your own paddy this year? \_\_\_\_\_
    - Very frequently.....(1) if "over 2/3 of activity"
    - Frequently.....(2) if "between 1/3 and 2/3 of activity "
    - Sometimes.....(3) if "less than 1/3 of activity"
    - Not at all.....(4)
  - 2.3 How often have you bought other paddy for milling this year? \_\_\_\_\_
    - Very frequently.....(1) if "over 2/3 of activity"
    - Frequently.....(2) if "between 1/3 and 2/3 of activity"
    - Sometimes.....(3) if "less than 1/3 of activity"
    - Not at all.....(4)
- \*Choose one of the following adverbs that describe the best the frequency at which this activity was performed (scale from: very frequently to not at all)  
Why? \_\_\_\_\_

### III. Processing Costs

- 3.1 Is (are) the mill(s) currently working? Yes \_\_\_\_\_ No \_\_\_\_\_  
If yes;
- 3.1.1 How much do you charge to process a standard sack of paddy \_\_\_\_\_ CFAF/sack?
- 3.1.2 How long have you been charging this price since this mill has been in service? Month \_\_\_\_\_ Year \_\_\_\_\_
- 3.1.3 What were the processing fees before? \_\_\_\_\_ CFAF (in case the price has changed).
- 3.1.4 When did the change of processing fees occur? \_\_\_\_\_
- 3.1.5 How much paddy have you processed for custom milling this year during:
- Harvest period (December-February) \_\_\_\_\_ KG
  - In the middle of the commercialization(March-April) \_\_\_\_\_ KG
  - Toward the end of commercialization (May-June) \_\_\_\_\_ KG
- 3.2 Information relate to the by-products:
- 3.2.1 Are the by-products going to the own paddy miller?  
Yes \_\_\_\_\_ No \_\_\_\_\_ If so:
- 3.2.2 How much does a bag cost? \_\_\_\_\_
- 3.2.3 For what weight? \_\_\_\_\_
- 3.2.4 Are the by-products going to the custom miller?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- 3.2.5 Are the by-products going to the client? Yes \_\_\_\_\_ No \_\_\_\_\_
- 3.3 Information related to labor:
- 3.3.1 Is the operator the owner of the mill? \_\_\_\_\_
- the owner... (1)
  - a son/daughter/relative of owner... (2)
  - a member of AV/group of women... (3)
  - other...(4) (specify) \_\_\_\_\_

- 3.3.2 How many laborers work on the mill? \_\_\_\_\_
- 3.3.3 What is the salary paid to the operator \_\_\_\_\_ CFAF/month?
- 3.3.4 What is the salary paid to a laborer \_\_\_\_\_ CFAF/month?
- 3.3.5 What is the salary paid to other (specify) \_\_\_\_\_ CFAF/month?

3.4 How much did you spend in each of the following items?

Items/Period	Decem-Febr.	March.-Apr	May-June
Fuel			
Grease/oil			
Spare parts			
Repairs			

3.8 How much did you spend in tax this year? \_\_\_\_\_ CFAF

**Subcomponent Marketing (Answered by the manager of the mill)**

**4. Information Related to Paddy Purchase/Sale**

4.1 Have you bought paddy this year? Yes \_\_\_\_\_ No \_\_\_\_\_

4.1.1 What quantity (if any) did you buy this year during:

- Harvest period December-February) \_\_\_\_\_ KG

- In the middle of the commercialization (March-April) \_\_\_\_\_ KG

- Toward the end of commercialization (May-June) \_\_\_\_\_ KG

4.1.2 How much did you get paddy on the market place during:

- Harvest period (December-February) \_\_\_\_\_ KG

- In the middle of the commercialization (March-April) \_\_\_\_\_ KG

- Toward the end of commercialization (May-June) \_\_\_\_\_ KG

(Please specify the month during which the different transactions have occurred):

4.2 Have you sold paddy this year? Yes \_\_\_\_\_ No \_\_\_\_\_

If Yes,

4.2.1 To whom did you sell your paddy? \_\_\_\_\_

O.N. .... (1)

AVs .... (2)

Traders .... (3)

Other (specify)(4)

4.2.2 How much did you get paddy on the market place during:

- Harvest period (December-February) \_\_\_\_\_ KG

- In the middle of the commercialization (March-April) \_\_\_\_\_ KG

- Toward the end of commercialization (May-June) \_\_\_\_\_ KG

(Please specify the month during which the different transactions have occurred) \_\_\_\_\_.

**V. Information Related to the Gross Revenue:**

- 5.1 How much of your own milled rice (if any) did you sell during:
- Harvest period (December-February) \_\_\_\_\_ KG
  - In the middle of the commercialization (March-April) \_\_\_\_\_ KG
  - Toward the end of commercialization (May-June) \_\_\_\_\_ KG
- 5.2 How much did you get from your milled rice on the market place during:
- Harvest period (December-February) \_\_\_\_\_ KG
  - In the middle of the commercialization (March-April) \_\_\_\_\_ KG
  - Toward the end of commercialization (May-June) \_\_\_\_\_ KG

Please specify the month during which the different transactions have occurred:

5.3 How much did you sell to the following actors coming to the weekly market place in Niono? \_\_\_\_\_

Type of Buyer/Quantities	Over 2/3	1/3-2/3	Less than 1/3
Assemblers			
Public Services			
Wholesalers			
Semi-wholesaler			
Other (specify)			

5.4 Did you ever sell on credit? Yes \_\_\_ No \_\_\_

5.5 If yes, how often did you sell on credit?

- A lot...(1) if "Over 2/3 of total transactions"
- About half...(2) if "Half of the transactions"
- Less than half...(3) if "At most 1/3 of transactions"
- Not at all...(4)

5.6 When selling on credit, did you use written or oral contract?

If written, how often did you use it?

- Very frequently...(1) if "over 2/3 of activity"
- Frequently...(2) if "between 1/3 and 2/3 of activity"
- Sometimes...(3) if "less than 1/3 of activity"
- Not at all...(4)

5.7 Did you have any difficulties doing so?

Yes \_\_\_ No \_\_\_

If Yes,

5.8 What kind of difficulties? (specify) \_\_\_\_\_

5.9 What did you do to solve them? \_\_\_\_\_

- Legal procedures...(1)
- Family arrangements...(2)

Forget it...(3)

Other (specify)...(4)

5.7 How much did you get from your by-product this year during:

- Harvest period (December-February) \_\_\_\_\_ CFAF/KG
- In the middle of the commercialization (March-April) \_\_\_\_\_ CFAF/KG
- Toward the end of commercialization (May-June) \_\_\_\_\_ CFAF/KG

(Please specify the month during which the different transactions have occurred):

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### Subcomponent Storage

#### VI. Information Related to Storage

6.1 Do you have any storage facilities? Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to 6.3

6.1.1 How much storage capacity do you have? \_\_\_\_\_ KG

6.1.2 What was the maximum quantity of paddy that you stored during:

- Harvest period (December-February) \_\_\_\_\_ CFAF/KG
- In the middle of the commercialization (March-April) \_\_\_\_\_ CFAF/KG
- Toward the end of commercialization (May-June) \_\_\_\_\_ CFAF/KG

6.1.3 What was the minimum quantity of paddy that you stored during:

- Harvest period (December-February) \_\_\_\_\_ CFAF/KG
- In the middle of the commercialization (March-April) \_\_\_\_\_ CFAF/KG
- Toward the end of commercialization (May-June) \_\_\_\_\_ CFAF/KG

6.1.4 What was the maximum quantity of milled rice that you stored during:

- Harvest period (December-February) \_\_\_\_\_ CFAF/KG
- In the middle of the commercialization (March-April) \_\_\_\_\_ CFAF/KG
- Toward the end of commercialization (May-June) \_\_\_\_\_ CFAF/KG

6.1.4 What was the minimum quantity of milled rice that you stored during:

- Harvest period (December-February) \_\_\_\_\_ CFAF/KG
- In the middle of the commercialization (March-April) \_\_\_\_\_ CFAF/KG
- Toward the end of commercialization (May-June) \_\_\_\_\_ CFAF/KG

6.2 How did you finance the storage? \_\_\_\_\_

Own fund.....(1)

Credit .....(2)

Other.(specify).....(3)

6.3 Could you tell me why you don't have any storage facility? \_\_\_\_\_

Expensive.....(1)

No expertise.....(2)

Other (specify)....(3)

## **Appendix IV-2**

### **Detailed Cost Structures of a Sample of Small Mills in the O.N. Zone Task Calendar**

The implementation of the study will begin with the rapid reconnaissance work to investigate the effects of the recent CFAF devaluation. The relative price of rice will be central in this investigation. Economic analysis will follow to adjust whatever items appear distorted. A joint detail subsector work will follow. The survey on the subsector study outlined in the thesis will be launched. Before that, the training of enumerators followed by the pretest of the questionnaires. The second step would be the interview itself. The third part of the study will be the data entry and analysis. The fourth part of the study will be concerned with writing the final report. However, working papers will be written as the study evolves. The questionnaire includes the following three different components as described in the research planning matrix: the processing component, the component storage, and the marketing component. These activities are performed simultaneously and spread over the period of the study, therefore, there is not going to be a separate period for implementing the interview to address the different components. However, the task calendar will be organized to show the implementation of:

- the training and pretest of the questionnaire,
- the interview to address the three different components of the questionnaire,
- the data entry and analysis,
- production of working papers,

● and production of the final reports.

## Appendix IV-3

### Research Planning Matrix

The research planning matrix that is proposed for implementing future research includes three components:

1. As pointed out earlier, there is a need to investigate how devaluation is affecting the subsector and the relative competitiveness of the different type mills.
2. The devaluation was one move to align economic and financial costs, but there may be other adjustments that need to be done (shadow pricing).
3. A more detailed subsector study.

#### **Component No.1: How is Devaluation Affecting the Subsector and the Relative Competitiveness of the Different Mills?**

This component will be addressed through a rapid reconnaissance. The SIM may have already gathered useful information that would help address the following issues:

Are consumers substituting among grains or just cutting back on consumption?

Are their discernable shifts among the quality of grain products consumers are buying?

Is there evidence that consumers are shifting from rice to pre-processed coarse grain? How has devaluation affected the costs of the small mills and the state mills:

- Operating (variable) costs--e.g., fuel, spare parts.

- Investment costs (for mills), which may affect future expansion of the subsector.

### **Component No.2: How Does the Economic Analysis Differ from the Financial Analysis?**

The financial analysis revealed that the milling activities are profitable at the individual private processors' level. However, this analysis does not say much about how profitable the private milling is to the economy as a whole. How profitable will the private milling be years down the road? To answer these questions, information gathered during the rapid reconnaissance will be used to undertake the economic analysis. For example shadow pricing will be done to account for various price distortions and transfers. The shadow pricing includes the capital (discounted at the going interest rate or opportunity cost of capital), determination of the capital recovery factor, the exchange rate (the CFAF has been devalued by 100%, which seems exaggerated to many observers), labor also needs to be discounted. The economic analysis would be heavily drawn from a similar study done by C. Peter Timmer (1973) in Java (Indonesia).

### **Component No. 3. Subsector Study**

This component includes three sub-components: 1) processing, 2) storage, and 3) marketing.

This study could be undertaken in conjunction with the IER. The reason for doing this is that IER proposes to launch subsector work on rice in late 1994. Therefore, all the dates related to the survey work are tentative dates. However,

two questionnaires (see Appendix IV) have been designed to address some of the unanswered issues related to the rice subsector.

The first issue is related to the processing subcomponent, including both the public and private sector milling activities. The public milling activities are those performed at O.N.'s mills located in Molodo, Dogofri, N'Debougou, and Kolongo.

#### **Public Sector Processing**

No matter what mill is being investigated, three general questions could be asked to address the following issues:

- the relationship between the capacity utilization of the mills and their profitability;
- spare parts procurement as one of the major constraints to the profitability of the mill.
- the structure of the incentives facing mill managers.

Together, the above general questions would help address the processing sub-component. More specific questions would then be asked to address the general questions.

Therefore, to answer the first question, the respondent would be asked about the quantity of paddy processed at three different periods of the production year, i.e., during harvest (beginning of the marketing season), the middle of the season, and the end of season. The paddy marketing is spread over the December to April period. Therefore, the beginning corresponds to December-January period; the middle corresponds to February-March; and April

corresponds to the end of paddy commercialization. The costs related to these activities performed by each type of mill would help identify which one is the most cost efficient device and which one gives the best quality of output. There is a "one shot" questionnaire and a "multi-shot" questionnaire. The one shot questionnaire includes questions that are asked only once during the survey. On the other hand, the multi-shot questionnaire is conducted at different periods, corresponding to the changes in the intensity of the activities executed over the marketing year.

Questions related to the frequency of repairs, the types of technical failures, the deadlines in spare parts procurement, and the alternative domestic possibilities for procurement will be addressed to answer the second general question, which investigates the relationships between the spare parts procurement and the profitability of the mills.

When asking the third question, we assume that the structure of managers' incentives is likely to determine how profitably the mill performs. In this respect, most of the private mills are likely to be more flexible in cutting costs than state mills, because the private manager feels more concerned with the final results. The private manager may be either the owner, or may have a performance contract with the owner, and therefore may be given more responsibility. For example, the procurement of spare parts could follow longer administrative procedures in the state mills that may constrain the state mills from performing the processing activities more efficiently than private mills. Therefore, the lack of decision-making capability is likely to be a major impediment to the performance

of the state mills. This could happen with some operators working on the private mills as well. Therefore, specific questions that address these issues will be asked of the respondents whether they operate state or private mills.

Most of these questions could be answered through interviews conducted at the different state mill sites. The data are expected to be more easy to get at these levels, because the state mills are likely to keep written records as well as short and long term projections of their activities.

#### **Private processing**

The questions are the same as those asked in the case of state mills. However, the data needed to answer these questions would be all addressed through a complete survey, sometimes during the marketing year 1995. Most of the private mills don't keep written records of their activities. Therefore, it might be easier to keep track of their activities when they are performing them, rather than trying to make a retrospective interview covering activities that occurred months earlier. Sometime between December, 1994 and May, 1995 would be the appropriate date to investigate the private processors. Information related to the import conditions of the mills cannot be obtained from the mill users. Indeed, importers do not give their customers information related to the import price of the mills, because they might be charging high margins for the mills. Such information could be collected from the Custom Office for official import statistics, yet for informal imports (there are probably many in this sector) it may not be possible.

### **Storage Subcomponent**

The storage sub-component includes four points: the state, farmers, traders, and consumers. The storage at the state level is likely to affect storage decisions at both individual farmers' and group association levels.

On the other hand, private processors (farmers as well as other individuals performing this activity) need more space to store the paddy/milled rice that no longer moves into the O.N. marketing system. The more these actors engage in storage activities, the higher the assembly prices of milled rice they are likely to get over the commercialization period. The storage function at farm level, therefore, becomes an important policy issue when farmers become more interested in processing their own paddy. Would farmers be involved in processing if they had enough/cheap storage capacity to store the paddy? Indeed, it seems that when performing paddy processing, farmers are seeking more returns from paddy farming. Therefore, if they can add value to their paddy through other means, they may probably go for this option, and shift paddy processing, rice storage, and marketing functions to other segments of the subsector that may have better expertise in performing them.

We would expect the storage behavior of traders to be dictated by speculative reasons. Indeed, at harvest, they are likely to purchase as much as they can, taking advantage of the low price. This storage is more likely to be performed by wholesalers and, sometimes, semi-wholesalers, who have adequate storage facilities and the financial capability to do it.

Lastly, consumers (individual households and restaurants) perform a significant part of the storage activity. Indeed, for food security reasons, urban consumers have kept the reflex to store at least as much as one month supply of cereals to prevent possible crises, either monetary (late payment of salaries), or temporary supply shortages of cereals.

The general question addressed in this component would be:

- What is likely to affect your storage behavior?

Specific questions like: do you have any other alternative than storing your paddy/rice? and do you have expertise in storage techniques?

#### **Marketing Sub-component**

The general question addressed in this component of the study is how has the private processing of paddy has affected and is continuing to affect the evolving rice marketing system in the Office du Niger zone?

When analyzing the impact of liberalization on rice marketing system in the Office zone, the major issue that seems important to investigate is what the private processing has contributed to the subsector, in terms of employment gain, rice cost price reducing, and increase output (rice availability). To address this issue, specific questions that are listed below can be asked both to the public and private actors (state as well as private processors) that process paddy and sell the output. Some of the questions could be asked to private traders either through rapid reconnaissance surveys that would be conducted parallel to the survey in Bamako and probably in some major cities (Kayes, Koutiala, and Sikasso) or from the SIM data base. The specific questions addressing the issues include:

- the pricing mechanisms;
- the relationships between suppliers and clients and between different categories of traders as well;
- the rice sale/purchase conditions (credit or cash) in general and in the O.N. in particular;
- the contract mechanisms;
- the constraints that might be related to the use of contracts in rice transaction in the O.N. zone;
- the entry conditions in rice marketing;

Information including the import of rice, the world price of rice, and the cost structure of import from the major importing ports to Bamako will be collected during the rapid reconnaissance (Appendix IV; Task Calendar).

#### **Procedure**

#### **Approach**

The research will involve both a survey and a rapid reconnaissance. The survey will be conducted using two questionnaires. A one-shot questionnaire will address the issues related to the profile of the owner, the specification of the mills, the financing of the mills, and possibly the information related to the milling ratio of the mills. The second questionnaire will be used to conduct some of the interviews at three different points in the processing year. The rapid reconnaissance will be conducted parallel to the survey, especially in Bamako, Sikasso, Koulikoro, and Nara. This rapid reconnaissance will be conducted to address the first two components; 1) how is devaluation affecting the subsector

and the relative competitiveness of the different mills, 2) how does the economic analysis differ from the financial analysis. The questionnaire proposed in the study is tentative, therefore, it may change in line with the research agenda that will be developed by the IER in late 1994.

Some of the questions related to the supply of milled rice from Niono will be tested through this rapid reconnaissance. Information related to both the import of rice and the import of small mills as well as the spare parts procurement will be investigated through the rapid reconnaissance.

#### **Population and sample**

The target population is the total number of small mills in the Office zone. The results of the rapid reconnaissance conducted in July-August 1992 will be updated and used to stratify the sample by type of mill. Depending on the types of mills in the area, a two-stage stratified random sampling procedure will be used to survey the population. The sample frame will be the list of all the mills in Office zone. The list will be divided with respect to the locations. Finally, a random sample of mills will be selected from each stratum in proportion to the percent of total mills.

#### **Instrument**

Interviews will be conducted with the person in charge of managing the mill. However, for questions related to the purchase price of the mill, and the like, that the respondent cannot answer, we will ask for a knowledgeable person (e.g., the owner) who may be able answer these questions.