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# ***Staff Paper***

**The Reform of Rice Milling and Marketing in the Office  
Du Niger: Catalyst for an Agricultural Success Story in  
Mali**

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Bingen, and Niama Nango Dembélé**

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# **THE REFORM OF RICE MILLING AND MARKETING IN THE OFFICE DU NIGER: CATALYST FOR AN AGRICULTURAL SUCCESS STORY IN MALI**

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## **1. INTRODUCTION**

One of the great successes of Malian economic policy during the 1980s and 1990s has been the transformation of the rice subsector. Domestic production shot up dramatically, growing at an annual rate of 9% between 1980 and 1997, largely due to yield increases in the irrigated area of the Office du Niger. As a result, national rice production more than tripled between 1985 and 1998, from 214,000 m.t. (paddy) to 688,000 m.t. (Egg 1999). At the same time, new macroeconomic and sectoral policies transformed the marketing system from a tight oligopoly that extracted rents from both consumers and producers to a competitive system that reduced marketing costs and effectively transmitted production incentives to farmers. The Malian experience in transforming its rice subsector in the Office du Niger (ON) illustrates the importance of combining changes in macroeconomic policy, improved technologies, and the institutional arrangements governing production in order to transform a food system. The liberalization of rice milling within the ON, particularly the introduction of small-scale rice mills, played a crucial role in this transformation, and is the main focus of this chapter.

Cereals marketing liberalization continues to be a centerpiece of development programs throughout sub-Saharan Africa. This chapter seeks to contribute to our understanding of this approach by examining the Malian experience with rice marketing reforms, and especially the role played by small, private rice mills in this process.

Following a brief historical overview of the Office du Niger, this chapter focuses on how changes in the rules regarding who could compete in rice milling in the ON combined with technological change in rice production and new macro-economic policies (particularly the CFA franc devaluation) to lead to a transformation of rice production and marketing in the ON. The chapter also pays particular attention to the synergies between technological changes in rice production, the introduction of new marketing and macroeconomic policies, and the evolution of institutions governing rice production in the ON on the transformation of agriculture in this region of Mali.

## **2. IMPORTANCE OF RICE IN THE MALIAN ECONOMY**

Rice is a major staple in Mali, particularly in urban areas, accounting for 16.7% of total per capita cereal consumption and 6.4% of the total expenses of Malian households in 1988/89. National rice consumption per capita averaged about 34 kg/year in that year, which in absolute terms is third among the cereals after millet and sorghum. Yet in urban areas, rice was the most widely consumed staple, with urban per capita consumption (58.0 kg) more than twice that of rural areas (24.3 kg). Thus, rice plays a strategic role in the Malian economy. Supply shortages or rising

prices produce inflationary pressure on wages and have a potential of creating political instability (Dimithè 1997).

Because of its strategic importance, the French colonial regime and later the Malian government were deeply involved in rice production and marketing until very recently. Rice is produced both in government-established irrigation projects, predominantly along the Niger and Bani rivers, and in lowland-inland swamps (*bas fonds*), mainly in southern Mali (see Dimithè, this volume). The oldest and largest of the government-established rice production areas is the Office du Niger (ON), which has historically produced nearly half of Mali's domestic rice production and the majority of the domestic rice entering the market. (Much of the *bas-fonds* production is for home consumption). In order to understand the importance of the ON in Mali's food strategy, a brief historical overview is needed.

## **2.1 Historical Overview of the Office du Niger**

The Office du Niger is located along the central delta of the Niger River. The Markala dam (approximately 250 km downstream from Bamako) provides the primary water retention for the Office, while canals provide access to irrigation water from an area stretching northward to Niono and eastward to Macina (see figure 1). The history of the Office dates to the French colonial era of the early 1900s.

After achieving military control of what was called the Soudan in 1890, the colonial administration began using the newly constructed Dakar-Koulikoro railway to import cloth, salt, construction material, drinks and equipment and to export products of interest to French industry. These exports were limited to gum arabic, vine rubber and ivory, and the Soudan showed no prospects for gold and high value crops such as coffee or cocoa.

In response, the French turned their attention to the agricultural potential believed to be available by irrigating the central delta of the Niger River. Realizing the dreams of French colonial military engineers, the Office du Niger was supposed to bring over 1 million hectares of near-desert land into irrigated agricultural production. With strong support from the French cotton lobby, the colonial administration promoted what it hoped would become the metropole's main source of cotton, to be shipped to Europe by the ambitious, but never constructed, Trans-Saharan railway. Only after irrigated cotton in the area proved to be a failure did the colonial government consider turning the Office du Niger into the rice bowl of French West Africa.

The Office was settled by smallholders, many of them migrants ("colons") from what is now Burkina Faso. These smallholders leased land from the ON and were obliged to grow rice, for which the Office would provide them water, seeds, fertilizer, and other inputs on credit as well as extension advice. The credit was recovered through the Office's monopsony purchase rights to the output.

Figure 1. Location of the Office du Niger



Source: University of Texas map library web site  
 ([http://www.lib.utexas.edu:80/Libs/PCL/Map\\_collection/africa/Mali\\_pol94.jpg](http://www.lib.utexas.edu:80/Libs/PCL/Map_collection/africa/Mali_pol94.jpg))

In his landmark assessment of the colonial investments in French West Africa, Samir Amin estimates that between 1928 and 1959 the French spent over \$80 million, or almost 50% of the total investment in agriculture, solely on irrigation infrastructure and land reclamation in the Office du Niger. Despite these enormous investments, by the time of Mali's political independence, fewer than 20,000 hectares were been cultivated by fewer than 10,000 farmers. (Amin 1965, Jones 1976).

Consistent with its efforts to follow a socialist path to development, the Keita regime invited both the former Soviet Union and Chinese governments to continue investments in the Office through the 1960s and into the 1970s. Nevertheless, both the former Soviets and Chinese also began to tire in face of the huge problems associated with the Office. As they began to reduce their level of investment, the Traoré regime looked both to France and the World Bank as sources for continued investment.

In 1982, the government secured financing for a series of massive rehabilitation activities financed by the Netherlands (the ARPON projects – 11,500 ha), the French Development Fund (CFD – 2,200 ha), the European Development Fund and the World Bank (the RETAIL projects –2,800 ha). In 1983, more than \$10 million was spent in these intensification and rehabilitation programs (Dembélé, 1990). By the mid- 1990s, these projects had rehabilitated almost 40% of the perimeters in the ON. In addition, each of these projects encouraged farmers to adopt improved production and harvesting practices.

## **2.2 Production Levels**

Until the great drought of 1972-74, Mali was basically self-sufficient in cereals, both for coarse grains (millet, sorghum and maize) and for rice. From the 1970s to the mid 1980s, (with the exception of 1976 and 1977), Mali became a large importer of food and a perennial recipient of food aid. Despite the large amount of resources poured into the Office in the late 1970s and early 1980s, domestic rice production stagnated, and then dipped during the poor rainfall years of the early 1980s. Between 1981 and 1987, domestic rice production covered only 55% of the total Malian rice consumption, with the remainder being supplied by imports (table 1). While poor weather certainly contributed to the poor downturn in production in the early 1980s, the stagnation of production in the ON was fundamentally due to a lack of incentives for farmers to increase their production (Kamuanga 1982). This lack of incentives resulted from the way in which rice production, processing, and marketing were organized in the ON prior to the 1986/1987 marketing year.<sup>1</sup>

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<sup>1</sup> In the ON, the main rice harvest occurs in December and is marketed over the next several months, hence the 1986/87 marketing year refers to the period December 1986-November 1987. For brevity, we denote this marketing year as "1987" in this chapter.

### 3. ORGANIZATION OF RICE PRODUCTION AND MARKETING IN THE ON

#### 3.1 Structure of Production

Small-scale farming (4.7 to 8 hectares per household) predominates in the Office. Households lease a specified number of hectares on an annual basis from the Office and agree to pay for water supply, the use of irrigation facilities and other services. Until the mid 1990s, the Office, in return, delivered fertilizer and seed, offered credit to purchase farm equipment, maintained the irrigation and guaranteed the purchase of paddy. In other words, the state controlled all input and output marketing, and paid an official price to farmers that did not fluctuate either seasonally or according to the quality of paddy produced. Until 1986/87, sales of paddy to anyone other than the Office were illegal.

**Table 1. Rice Production and Imports in Mali**

Year	Dom. Production		Imports	Total Supply	% Dom. Production
	Paddy	Milled Equivalent			
1981/82	143500	78925	26000	104925	75%
1982/83	155000	85250	71131	156381	55%
1983/84	141500	77825	64754	142579	55%
1984/85	109354	60145	100200	160345	38%
1985/86	213841	117613	114000	231613	51%
1986/87	225138	123826	129100	252926	49%
1987/88	236568	130112	50000	180112	72%
1988/89	287797	158288	70281	228569	69%
1989/90	337749	185762	50500	236262	79%
1990/91	282366	155301	20000	175301	89%
1991/92	454349	249892	128400	378292	66%
1992/93	410018	225510	40000	265510	85%
1993/94	427609	235185	31500	266685	88%
1994/95	469127	258020	3600	261620	99%
1995/96	462702	254486	45700	300186	85%
1996/97	613965	337681	30000	367681	92%
1997/98	568375	312606	30000	342606	91%
1998/99	688125	378496	N.A.	Na	

Source: Direction Nationale de la Statistique for data. FAO database for trade data.



Farmers in the Office are allocated land in one of the Office's three production areas. The RETAIL project includes full water control and regular maintenance of the irrigation network which allows double-cropping during the year. It is also the most intensive production system, with transplanting and the heavy use of chemical fertilizers. As a result, yields can exceed 5 tons per hectare. As of 1992, water charges were CFAF 42,000 per hectare and threshing services are billed at 8 percent of production.

In the ARPON project, the perimeters have not been systematically leveled and consequently flooding is irregular. In the project's semi-intensive system, farmers use fewer inputs and as a result, yields average 3.5 tons per hectare. Farmers paid less (CFAF 28,000 per hectare) for water, but still paid 8 percent of production for threshing services.

The non-restored areas still rely on gravity irrigation. The irrigation network in these areas is not maintained on a regular basis, farmers have access to fewer inputs, and as a result, yields are estimated at 2,500 kg per hectare. Nevertheless, farmers were charged CFAF 28,000 per hectare for water and 8 percent of their production for threshing services in the early 1990s (Diarra 1994).

In principle, farmers who fail to respect the lease conditions are subject to eviction from their parcels. The number of evictions varies widely from year-to-year (Samacké and Yung, 1988), and in practice, those in default more often have the size of their parcels reduced. Most often, area cut from a resident's parcel is transferred to non-residents, or those who do not live within the Office du Niger. In the late 1980s, non-residents represented 28% of the total population in the Office and were assigned 20% of the total land. While some of these may even include employees of the Office who live in nearby towns, they also include individuals with connections to Office executives, including those who live elsewhere in the country. The nonresident farmers hire seasonal laborers for cultivation, and some evidence suggests that they not only are less productive than resident farmers, but tend to misuse the water and water systems. Moreover, the yields of non-residents tend to be significantly lower (45%) than those of established residents (Samacké and Yung, 1988).

### **3.2 Organization of Rice Marketing and Processing**

The organization of rice marketing and processing within the Office needs to be viewed in relation to the evolving nature of the organization of the entire rice subsector in Mali. Reforms in coarse grain marketing begun in 1981 under the PRMC (Programme de Restructuration du Marché Céréalière), but the rice subsector within the ON remained under strong government control until 1987.<sup>2</sup> The state, through the national grain board, OPAM, and the ON, continued to monopolize rice marketing and milling in the Office.

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<sup>2</sup>See articles by Dioné and by Dembélé and Staatz in this volume for details on the PRMC. The Malian government officially allowed private traders to begin buy paddy from the main harvest in the ON starting late in the 1985/86 marketing year. Thus, private traders had very little involvement in marketing the crop in 1986, even though technically they were allowed to at the end of the season. For this reason, we denote 1987 as the first year of the "effective" liberalization. See Sanogo (1988) for details.

In part, the heavy state involvement in rice marketing in the ON was an attempt to protect the domestic rice industry from international competition, given the substantial investments the state had made in irrigation infrastructure in the ON, especially during the early 1980s. Protecting the domestic industry became both more necessary and more difficult starting in the mid 1980s due to the increasing overvaluation of the CFA franc. The overvaluation of the franc made imports, including rice from abroad, artificially cheap, undermining the competitiveness of Malian rice on the domestic market. The problem was compounded by the import policies of Mali's two non-CFA zone neighbors, Mauritania and Guinea. Both countries subsidized rice imports to keep prices low to urban consumers, and the large price differential between rice prices in these countries and in Mali encouraged large-scale smuggling into Mali, which further hurt the competitiveness of the ON rice.

The structure of the Malian wholesale market for rice further hindered competitive pricing. Rice imports were highly concentrated in the hands of the four largest rice traders in Bamako, who in 1988 were responsible for three-fourths of all rice imports (Ceolo 1990).<sup>3</sup> This same small oligopoly of rice traders also held most of the contracts to buy domestic rice from OPAM (to whom the ON sold), or later, directly from the ON. They thus could tightly control retail rice prices, as semi-wholesalers and retailers had to go to these large wholesalers to get their rice, be it imported or domestic. As we will see below, one of the major benefits of the liberalization of rice milling in the ON was to break the power of this oligopoly.

### *3.2.1 Organization of the ON Rice Subsector Prior to 1987*

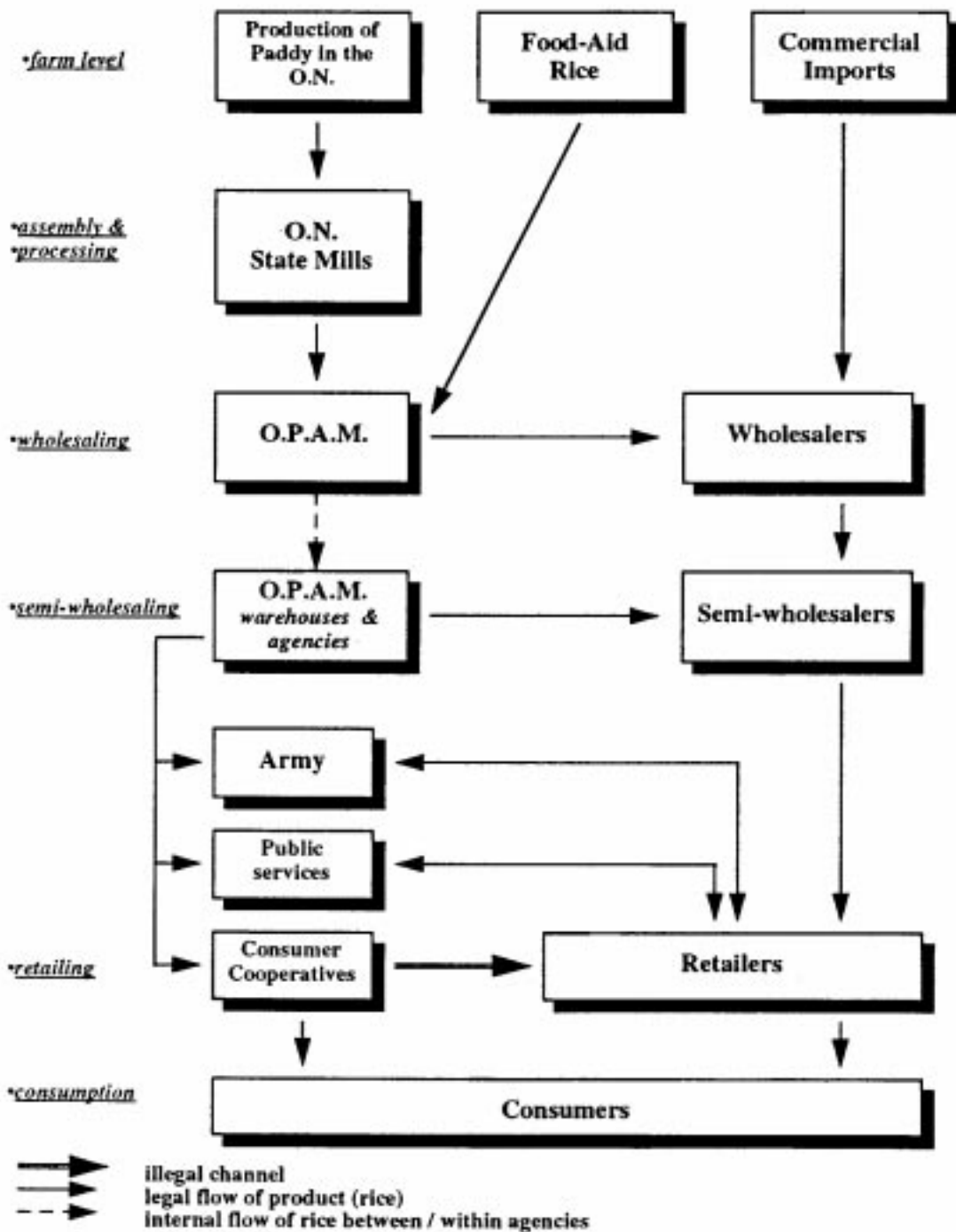
Figure 2 illustrates the structure of the rice subsector in the ON between 1981 and 1987. Prior to the effective paddy market liberalization in 1987, the Office handled all paddy assembly and processing within its boundaries. This included assembly in the fields and transport to the milling plants in the Office. Once processed, the rice was marketed exclusively through the state marketing board, OPAM, that in turn worked with the four major wholesalers to offer milled rice through consumer cooperatives, as well as to the army and other public organizations. OPAM also received all food aid rice imported into the country, while the same four wholesalers dominated the commercial imports as well. During this time, both producer prices and the prices at which the Office du Niger had to sell to OPAM, as well as the consumer prices at which OPAM sold, were fixed by a national commission, chaired by the Office de Stabilization et de Regulation des Prix (OSRP). These prices were set in relation to domestic production costs in the ON, not cheaper world prices, and as a result the four major rice importers were able to earn substantial profits on their imports.

Paddy in the ON destined for the market was processed in one of four state-owned large-scale mills, located at Molodo, N'Débougou, Kolongo, and Dogofri, which had a capacity of about 80,000 tons of paddy per year. Rice destined for home consumption was predominantly hand pounded. Private commercial milling of rice within the ON was illegal.

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<sup>3</sup> In contrast, in 1987/88, the four largest coarse grain traders handled only 42% of the coarse grains sold in Bamako (Mehta 1989).

Figure 2. Organization of the Rice Subsector in the ON between 1981 and 1987



### 3.2.2 The 1987 Reforms

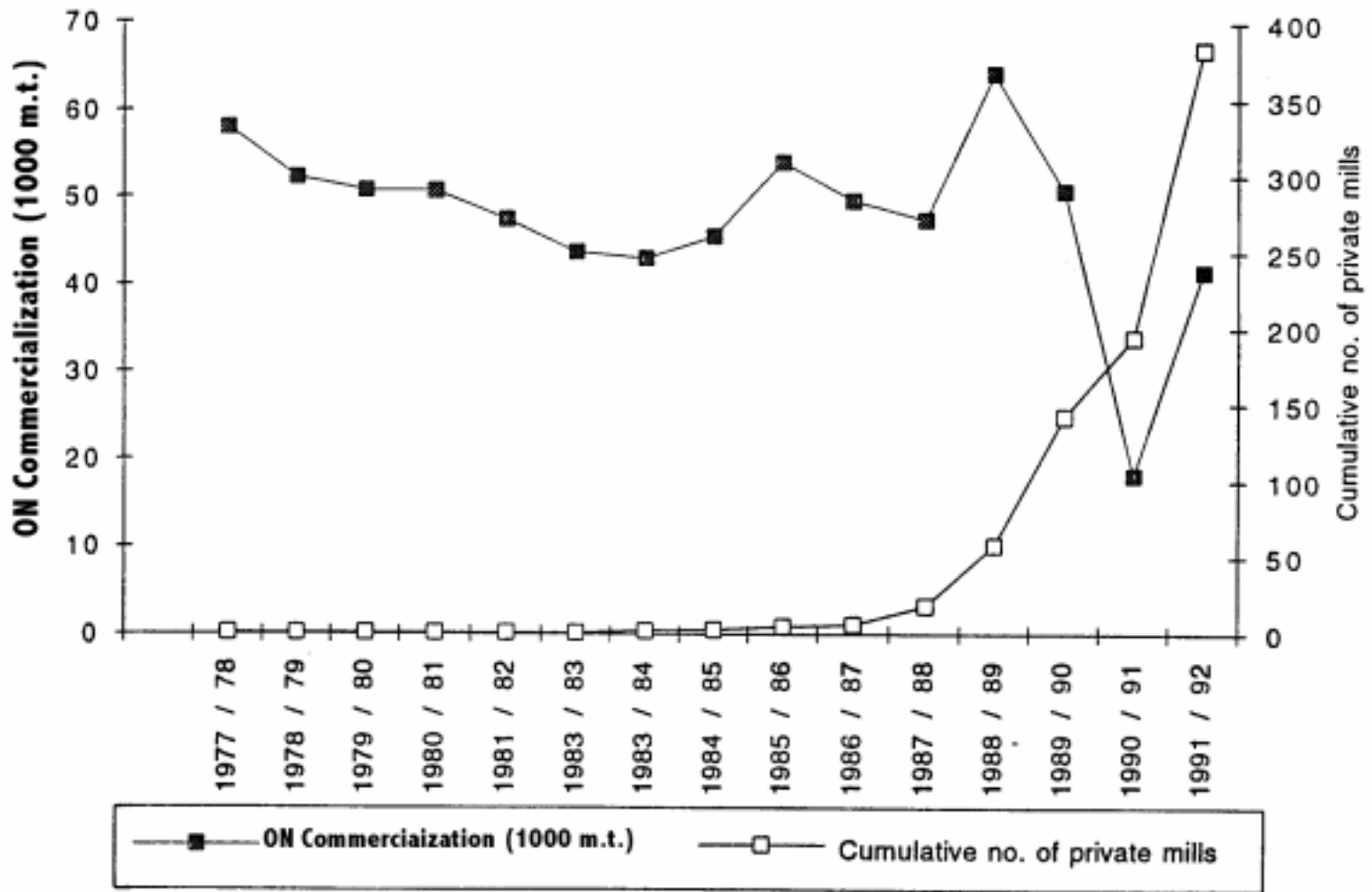
Under strong pressure from the PRMC donors and the World Bank, the Malian government agreed in 1986 to a broad set of reforms in the operation of the ON. The key changes were embodied in a contract-plan between the state and the Office, which outlined changes in the ON's roles and set benchmarks for the ON to meet if it were to continue to receive agreed-upon support from the state. Two key elements of the contract-plan were more decentralized management of the irrigation perimeters and liberalization of paddy marketing (which became widely effective in 1987). The liberalization allowed farmers in the Office to sell their paddy to whomever they pleased and abolished the Office's monopoly on rice milling within its boundaries. In addition, the Office was now required to market its rice directly to wholesalers rather than selling its grain to OPAM, which previously had handled the wholesaling operations for the ON. The marketing and milling reforms were strongly supported by the Dutch, whose foreign assistance programs began making small rice dehullers available to village associations and women's cooperatives in the Office in the late 1980s.

As a result of the marketing and milling reforms and the efforts of the Dutch and of various NGOs to promote small-scale rice mills in the ON, small dehullers began to appear in the Office in 1987. The mills were rapidly adopted by village associations (*associations villageoises*, or AVs), private entrepreneurs (typically farmers or local traders), and women's cooperatives. Between 1987 and 1992, the number of small mills operating in the ON grew from one to 383, with a total milling capacity of approximately 210,000 m.t. (figure 3). As the small mills spread, the volume passing through the state mills fell due the large mills' inability to offer prices as high as the small mills were paying for paddy. By 1992, 90% of the production in the RETAIL project zone was privately milled.

The small mills ranged in capacity from about 2 tons of paddy per day up to 30 tons/day. They had several advantages compared with the large state mills. Many of these small plate mills could be moved from village to village, which reduced the costs of hauling paddy long distances for processing. While the ON continued to pay a fixed price of 70 CFAF/kg of paddy, regardless of quality, the small mills were free to vary their prices according to market conditions. In practice, this meant that the small mills paid higher prices for paddy, particularly paddy of higher quality (e.g., paddy that had been carefully dried and therefore converted to milled rice at a higher rate, due to fewer broken kernels). The small mills also offered higher prices to farmers located closest to major markets, where transport costs were lowest.

The small mills operating costs were well below those of the large mills. A survey conducted in 1992 showed that it cost the small mills, on average, 4.3 CFAF to mill a kg of rice, compared with 17.6 CFAF/kg for the large state mills (Diarra 1994, p. 96). These cost differences were due to the lower capital and labor costs per kg of the small mills, their higher milling ratios (which reflected the poor state of repair of the state mills and the ability of the small mills, through their differential pricing, to attract better quality paddy), and their generally higher capacity utilization. As the small mills continued to attract more paddy from the state mills, the latter's unit costs continued to rise due to the large mills' falling capacity utilization.

Figure 3. Paddy Commercialization through the ON vs. Growth in Small Rice Mills



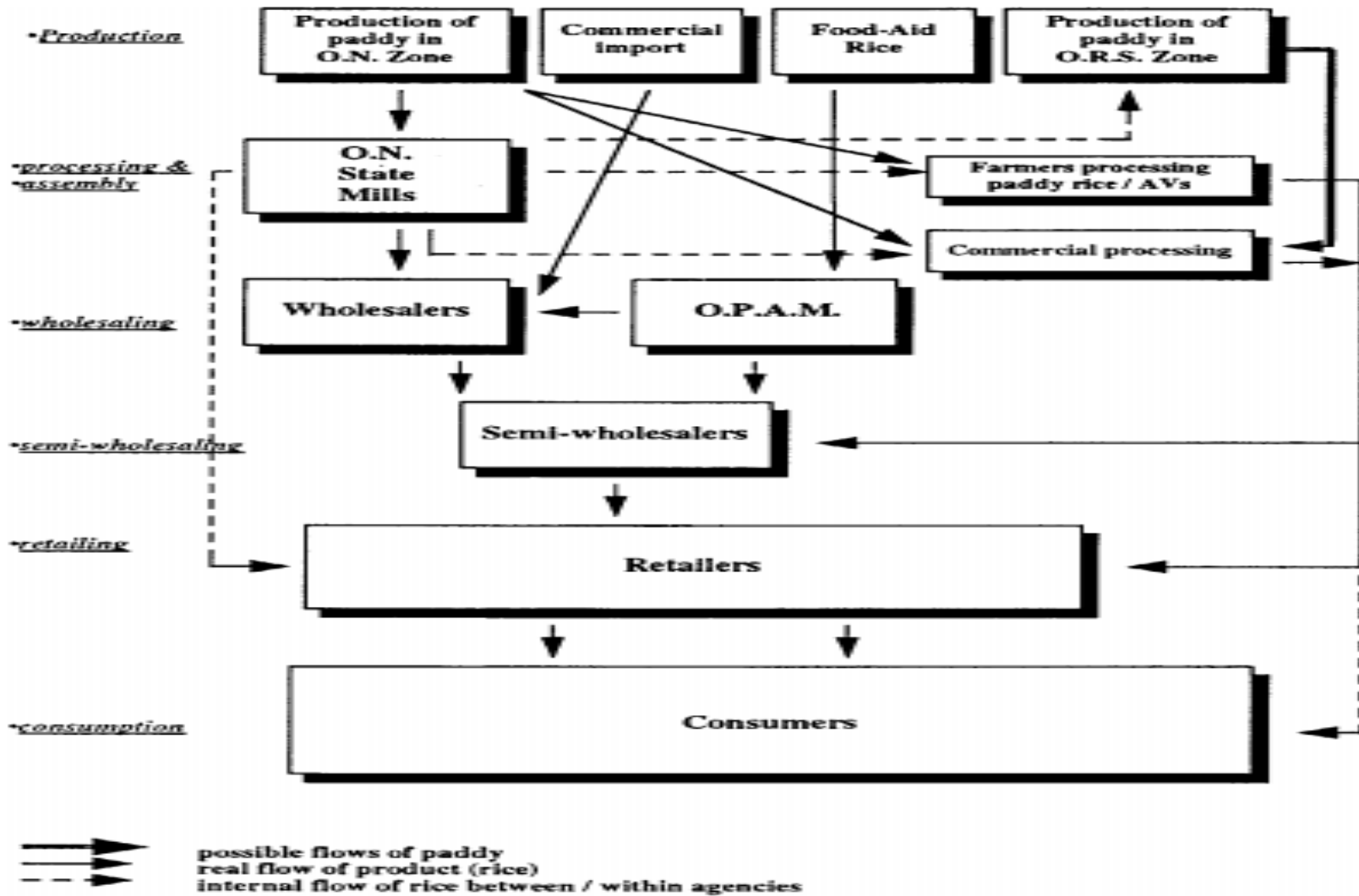
In an attempt to protect some market share for the ON, which was falling because of increased competition from both the small mills and increased imports, the government began granting import licenses for rice only to those wholesalers who would agree to purchase from the ON a quantity of rice equal to the amount being imported. Because of resistance from importers and difficulties in enforcing the rule, this “twinning” arrangement lasted only a few months, and was replaced by a 32% ad valorem tax on all imports. The latter protected all domestic rice production, whether from the ON or private mills, from foreign competition. It also allowed the state to capture the difference between the world price and the domestic price, which previously had been captured by the small oligopoly of rice importers.

The rapid spread of the small mills in the ON had profound effects on the organization of the rice subsector in the ON (figure 4). The large number of mills competed not only with the ON mills but also among themselves for paddy, which forced them to pass their cost savings back to farmers in the form of higher prices. In early 1992, for example, most of the small mills could afford to pay farmers an average price of between 72 and 82 CFA F/kg for their paddy and still earn a profit, compared to the 70 F CFA F/kg offered by the ON mills (Diarra 1994, p. 98).

Even more important, spread of the small mills broke the market power of the four major rice importers, who had previously dominated the Malian rice market, both for domestic production and imports. Even after the PRMC reforms led to liberalization of imports, scale economies in importing were so large that the four main firms continued to dominate the import market. Thus, prior to the 1987 ON marketing reforms, all other rice wholesalers, semi-wholesalers, and retailers were obliged to go to these major players for their rice supplies. The emergence of the small mills gave smaller distributors an alternative source of supply, and many wholesalers and semi-wholesalers began buying directly in the ON from village associations and other owners of small mills. The competition for supplies helped bid up the prices paid to the small mills, and because of competition among the millers, these higher prices got passed back to farmers. On the retail side, competition among sellers, now freed from having to buy exclusively from the old oligopoly, led to lower marketing margins, thus holding down prices to consumers.

Because millers and retailers were now free to pay different prices for different qualities of paddy, millers began offering higher prices for varieties that consumers preferred and for paddy that had been carefully dried and hence would mill with fewer broken kernels. The ability of the market to pay premiums for higher quality rice led to a dramatic change in rice production technology. Farmers began to search for the varieties that consumers preferred (rather than focusing solely on agronomic yield), and adopt improved post-harvest techniques to preserve paddy quality. The Office had tried in vain to extend such techniques prior to the liberalization, but now that farmers were being paid according to the quality of their paddy, Office extension agents found themselves deluged with farmers wanting to learn about these practices. This demand for new production technology complemented reforms launched in 1991 to involve farmers more in the management of the irrigation perimeters, making farmers more active participants in the basic decisions governing rice production in the Office.

Figure 4. Organization of the Rice Subsector in the ON after 1987



As part of the marketing reforms, farmers were also given the freedom to pay their water and other input charges to the ON in cash, rather than in paddy (at the official price), as had previously been the case. Farmers argued strongly for this right so that they could take advantage of the higher cash prices offered by the small mills. Once denied this secure source of paddy, the large mills market share began to fall sharply.

As a result of all these changes, the small mills quickly became farmers' preferred outlet for their grain. The small mills offered custom milling services (milling farmers' rice for a fee), and many also began buying paddy directly, milling it, and reselling it themselves to wholesalers and retailers. In 1985/86, the year before the reforms, the ON marketed 65% of the total paddy produced in the Office (most of the remainder went to home consumption). By 1989/90, the ON's share had fallen to 48%, and then plunged the following year to 13% (Figure 3). The dramatic decline in ON processing in 1990/91 was due not only to the higher prices offered by the small mills, but also to the breakdowns in several of the state mills, which prevented them from operating for several months. (Indeed, the ON was forced to subcontract with several of the small mills in 1991 to process over 40,000 tons of paddy on its behalf).

With the repair of its mills, the ON was able to increase its share back to 23% of total production in 1991/92, but the recovery was temporary. By 1994/95, the Office was no longer able to attract enough paddy to the large mills to make it economic to operate them, and the mills were closed in 1995. They remained closed until 1997, when they were sold to private entrepreneurs, including one of the former large rice importers. Yet even under private ownership and substantial refurbishing, the mills could not effectively compete with the small mills for paddy in 1998, and shut down again that year. This raises the question of the future role of large vs. small mills in the Office.

### 3.2.3 *The Economics of Small vs. Large Rice Mills*

What is likely to be the future role of small vs. large rice mills in the ON? In a classic study, Timmer (1998) identifies four factors that determine the relative profitability of small vs. large rice mills: the technical efficiency of the mills, the relative price of milled rice vs. paddy, the relative price of capital vs. labor, and the discount rate. These factors will be important in determining the future structure of rice milling in the ON.

*Technical Efficiency* refers to the rate at which the mills can convert rough rice (paddy) into milled rice. While in most instances, one would expect modern industrial mills to have a higher milling ratio than the small mills, this was not the case in Mali in the early 1990s. The ON mills, which had not been adequately maintained, achieved a milling rate of about 65-67% in 1990/91, while the small mills varied between 65 and 70% (Diarra 1994). The milling rate becomes particularly important when the price differential between paddy and milled rice is small (e.g., when retail rice prices are held down by cheap imports or by price controls). In such a scenario, mills with



higher technical efficiency gain significant advantages (Timmer 1998). While the rehabilitation of the large mills by their private owners is likely to increase their technical efficiency, the likelihood of cheap imports or effective price controls for rice in Mali seems low in the near future, meaning that the small mills, on this account at least, are likely to remain competitive.

*Relative Paddy/Milled Rice Prices:* If one type of mill can produce, for a given type of paddy, a higher quality rice that commands a premium on the market, then it will be advantaged relative to mills that produce lower quality output (more broken grains, for example). In the late 1980s and early 1990s, the large mills did poorly in this regard. Constrained to pay the same price for all paddy, regardless of quality, the large mills attracted the worst quality rough rice and hence often produced poor quality output. The ON followed the typical practice of state marketing enterprises of pooling all products together, regardless of quality, and thus did not exploit any of the profit opportunities available through developing niche markets for different qualities of grain. Some of the small millers were more successful in this regard, developing a reputation for producing high-quality products. It remains to be seen whether the new private owners of the large mills will be more successful in producing high quality output that can command a premium price on the market. In theory, the large mills, if run well, should be capable of doing this.

*Relative Price of Capital and Labor:* The large mills substitute capital for labor, and hence are more competitive when wage rates rise. Given that the devaluation has raised the price of imported capital, such as spare parts, relative to labor, one would expect the capital intensity of the large mills to work against their competitiveness in the near future.

The capital intensity of the large mills also makes capacity utilization very important for the large mills. If the large mills cannot attract enough paddy to work at close to capacity, their average fixed costs per kg of rice milled becomes very high. In the early 1990s, the large mills got into a vicious cycle: constrained by their inefficiencies, they were not able to offer farmers an attractive price for paddy. The large mills thus ran at low capacity (51% in 1991/92), driving up their unit costs and compounding their losses.

Thus, one of the challenges for the large mills in the future is to develop means to have an assured supply of rice for their mills. Some of the new owners of the large mills have explored the possibility of undertaking large-scale rice production themselves to feed into their mills. Another alternative is to offer contracts to farmers that make it attractive for them to deliver paddy to the large mills rather than the small ones. This could involve factors other than just price—e.g., assured market outlets and some guaranteed future price or guaranteed input provision. Developing such innovative contracts will be one of the main challenges for the large mill owners.

*Discount rate:* The discount rate is the rate at which future costs and benefits are discounted relative to the future. In commercial transactions, it is equivalent to the interest rate paid on borrowed or loaned capital. The large mills have relatively large initial investments and lower costs in the future, while the small mills, which have a larger labor cost per unit of output, incur a greater proportion of their costs in the future. Thus, the higher the discount rate (i.e., the more future costs are discounted relative to the present), the greater the relative profitability of the small mills compared to the large mills. Thus, the large mills would be advantaged

by programs that provided subsidized credit to investors. But barring such programs, it is likely that in a country as poor as Mali, the discount rate will remain high, working to the advantage of the small mills.

In summary, it is not apparent that simply privatizing the large mills will make them competitive with the small mills. Certainly, the experience of the first year of operation of the private mills, when they had to shut down because they could not attract enough paddy to run their mills at a profitable level of capacity, is sobering in this regard. There are many characteristics of the small mills that make them well suited to the Malian setting. It is likely that the small mills, which combine flexibility of operation with greater use of low-cost labor (a relatively abundant resource in Mali), will continue to be major players in the ON. The large mills may have a role, but it will take much more careful and innovative management than they have had in the past if these mills are to succeed.

### **3.3 Impact of the CFA Franc Devaluation**

The January 14, 1994 devaluation of the CFA franc by 50% ushered in a new era in the economics of rice production and milling in the ON. Overnight, the import price of rice, measured in CFA francs, doubled. This price increase had two effects. First, the price of rice on the Malian market quickly rose in response to the increase in import prices. The price of local rice in the Bamako (Niérala) market, for example, jumped 23% in the two weeks immediately following the devaluation (SIM, unpublished data). Second, consumers quickly began to shift away from imported rice to Malian rice, which suddenly became cheaper than similar quality imported rice.

Immediately after the devaluation, policy makers and the general public were concerned that the rapid increases in rice prices were the result of price gouging by wholesalers, eager to take advantage of the higher import prices. Research by the Malian agricultural market information system (SIM), however, quickly demonstrated that because of the competitive market structure that had resulted from the earlier reforms in the ON, almost all the increase in the consumer prices was passed back to farmers in the ON. Within two weeks of the devaluation, the ON farmers' share of the Bamako consumers' final expenditure on rice jumped from 67% to 82%, while the wholesalers' share increased only from 2% to 3%. (The increase in the wholesalers' share was due primarily to higher costs, particularly transport, resulting from the devaluation) (SIM, 1994a). This analysis quickly changed the policy debate. Instead of arguing about how to stop price gouging, debate focused on whether Malian rice could compete with imports not only in Mali but in neighboring countries as well (SIM 1994b; Barry, Diarra and Diarra).<sup>4</sup>

The higher prices resulting from the devaluation combined with the production and milling reforms initiated in the late 1980s to boost Malian rice production and yields even further (table 1). ON farmers increased rice yields substantially by switching from broadcast

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<sup>4</sup>The fact that the Malian government had the data-collection and analytic capacity to carry out these studies so soon after the devaluation is itself a tribute to the market reforms. The PRMC and USAID had funded the creation of the SIM in 1989 and strongly supported its development of local analytic capacity (see Dembélé and Staatz, this volume).

seeding to transplanting rice started in nurseries and using more organic and inorganic fertilizer. There was also increased diversification into dry-season horticultural products such as onions and tomatoes, accompanied by increases in use of organic and inorganic fertilizers. This diversification and input use increased the annual productivity of land and irrigation investments well beyond what could be produced with a single rice crop (or even a double rice crop, because dry-season rice yields are quite low). Both rice intensification and diversification into horticulture were stimulated by increased demand for the products. This demand came not only from Malian consumers but also from other countries in the region, primarily Cote d'Ivoire, but also Ghana (Yade et al. 1999; Mariko, Chohin-Kuper and Kelly 1999).

As Mali's rice production increased, it began to export small quantities of its higher quality rice to neighboring countries, particularly Côte d'Ivoire and Burkina Faso, while continuing to import lower-cost Asian broken rice, which is consumed by low-income urbanites. This trade strengthens Mali's food security, as the country is able to use the export receipts from the high-quality rice to import a greater quantity of rice calories than it exports, due to the low cost of the Asian broken rice, which is considered a milling byproduct in most rice-consuming countries (Yade et al. 1999).

The higher prices and increased productivity of Malian rice producers has allowed the government to eliminate the main import taxes on rice. Although the elimination of the import taxes removed a government a source of revenue, it has also helped hold down consumer prices and is a sign that the Malian rice subsector can now compete without special tariff protection.

### **3.4 The Problem of Production Credit**

Although the reforms have boosted production, there remains a serious challenge: developing a sustainable system of production credit. Prior to the reforms, the ON automatically recovered production credit through its monopsony marketing of the paddy. After the liberalization, banks began extending credit through village associations, but this system collapsed in part because of the inexperience of the AVs in marketing and the lack of reliable contract enforcement between the AVs and traders. Several AVs sold paddy on credit to traders who failed to repay them, leaving the AVs with no funds to repay their production credit. Other AVs held paddy late into the season, hoping to benefit from the higher prices, but in so doing, failed to repay their credit on time. The farmers complained that the banks had conspired with traders to require repayment of production credit within one month of harvest (typically in March), which forced all the AVs to sell at that time, depressing prices.

Members of AVs that defaulted on their loans no longer had access to group credit and were forced to seek individual loans to purchase their inputs. This has caused serious problems of access to inputs, particularly for smaller farmers. Thus, a major challenge in the ON, as in much of sub-Saharan Africa, is to develop effective input delivery and credit systems to replace the automatic credit recovery that was a feature of the state monopoly marketing system (Kelly et al. 1999).

#### 4. CONCLUSIONS

The marketing and milling reforms in the Office du Niger have helped bring about a remarkable transformation of rice production in Mali. The experience of market reform in the ON has also highlighted the following points concerning the nature of agricultural policy reform in Mali and possibly other areas of Africa:

- Market incentives can play a critical role in inducing farmers to invest in their agricultural enterprises. The marketing reforms in the ON were essential in assuring that the higher prices that consumers were willing to pay for better-quality rice and the higher retail prices resulting from the devaluation were effectively transmitted to farmers. The strong demand by farmers for improved production and post-harvest technologies following the reforms, in contrast to farmers' indifference to extension programs that tried to spread these technologies prior to the reforms, testifies to the importance of the market incentives in spurring farmers' interest and investment in new technologies.
- Market reforms and the devaluation were necessary but not sufficient conditions for the rapid increases in production. The data in table 1 show that production increases actually began in 1985/86, prior to the marketing reforms, in part in response to prior investments in rehabilitation of the irrigation infrastructure. But production accelerated after the marketing reforms of 1987, and particularly after the 1994 CFA franc devaluation.
- The contrast between the impact of policy reforms on rice production and its impact on coarse grain production (see Dembélé and Staatz, this volume) illustrates the synergies between changes in technologies (improved varieties, better planting techniques, and restored infrastructure), institutions governing production and marketing, and macro-economic policy in transforming agricultural production systems. The PRMC led to important marketing reforms for both coarse grains and rice, and the devaluation boosted demand for both types of cereals. Yet production of coarse grains--which are grown under rainfed conditions, with fewer improved technologies, and often in places where the basic transportation infrastructure is much weaker than in the ON-- has grown at less than 3% per year following the reforms, compared to a 9% annual growth rate for rice (Dembélé and Staatz, this volume).<sup>5</sup> The marketing reforms in the ON were effective largely because farmers in the zone had the technical capacity to respond quickly by intensifying production. In areas where structural constraints are more binding (e.g., areas of variable rainfall, poor water control, and bad roads), policy reform by itself will be a much weaker instrument to increase agricultural production.

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<sup>5</sup>The production increases for coarse grains after the devaluation were also limited because farmers in the CMDT zone apparently shifted land out of these cereals and into cotton, whose price also shot up after devaluation. But even the increases in cotton production came about entirely through increases in area planted, in contrast to rice, where higher yields (intensification) was the main source of production growth (Yade et al. 1999).

- The phasing of sectoral reforms and macroeconomic reforms was crucial in stimulating increased rice production. The marketing reforms introduced in 1987 broke the power of the small oligopoly that had previously dominated Malian rice markets, thereby creating a much more competitive marketing system within the ON. Had these reforms not taken place *before* the CFA franc devaluation of 1994, it is likely that most of the higher prices resulting from the devaluation would have been captured by the oligopolists, and not have been passed back to farmers. The competitive marketing system was thus essential in assuring that the increased production incentives reached farmers, and thereby helped stimulate the dramatic production increases that followed devaluation. This suggests that sectoral reforms often need to precede major macroeconomic reforms in order to give economies the flexibility they need to respond to the new macroeconomic incentives.
- Small, labor-intensive rice mills can effectively compete with large industrial mills in the Malian setting because they offer farmers low-cost milling services, flexibility (e.g., some are mobile, and thus can be moved from village to village), and job creation. There may be a role for the newly privatized industrial mills, but their dominance of the market is not assured. It will be important for policy makers to avoid automatically favoring the large mills (viewing them as “modern”), but instead assure a level playing field between the two types of technologies.
- While the reforms have greatly improved output marketing, access to inputs and credit remains a problem. Lack of effective enforcement mechanisms (such as bonding of traders) and inexperience of AVs in marketing output pose serious challenges in assuring farmers in the ON reliable access to production inputs.

The role of the Office du Niger has evolved dramatically since the mid-1980s. Prior to 1987, it was an agency that was involved in all aspects of production, input and credit provision, and output processing and marketing. Now it is basically a provider of irrigation and extension services. The Malian government is currently considering the potential for private irrigation schemes in Mali. A major challenge for the future will be figuring out the appropriate and evolving role of the public and private sectors in rice production in Mali. The experience of policy reform in the 1980s and 1990s shows the importance of balancing these roles carefully in order to foster agricultural growth and food security.

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