AGRICULTURAL AND FOOD POLICY ISSUES IN MOZAMBIQUE: A MULTI-MARKET ANALYSIS

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Mozambique is a country in transition. In recent years, macroeconomic reforms have resulted in large devaluations of the official exchange rate and liberalization of trade and foreign exchange markets. Commodity markets, including those for agricultural products, have been liberalized. Most important, rural security is being restored with the end of the long civil war. In this context, appropriate economic policies, including food and agricultural policies, are important to spur rehabilitation of the economy and enhanced welfare for the long-suffering population.

The shift away from direct government controls on prices and marketing makes policy analysis more difficult, but offers the potential for more effective policy implementation. Rather than setting prices by fiat (and providing incentives for the emergence of large parallel markets), it is possible to influence market prices through more indirect means, including trade and exchange rate policies. An appropriate analytical framework becomes necessary to understand how various commodity markets interact and the likely effects of government interventions and exogenous shocks, such as various options of reducing urban food insecurity, changes in the real exchange rate and restoration of domestic agricultural production.

Mozambique's economic development experience since independence in 1975 was profoundly influenced by its colonial and post-colonial political history, discussed in Chapter 2. Economic and social dualism under colonialism, a long war for independence, and ensuing civil war and destabilization by South Africa imposed large human and economic costs on the country. The government attempted to overcome these challenges by developing a centralized state that would mobilize resources in accordance with national priorities. With the end of the civil war in 1992, the demobilization of military forces, and political reform, the political environment in 1993 is potentially more conducive to the pursuit of economic recovery.

In the years immediately following independence, the FRELIMO government continued the colonial policy of fixing prices at all stages of the production and marketing process. Mechanized state farms were given prominence with the objective of maximizing marketed surplus in order to promote rural recovery. A recovery in agricultural production by 1980 was quickly reversed by drought and civil war, as marketed surpluses fell for most major commodities. Producer prices for most major agricultural commodities were fixed in nominal terms and on a pan-territorial basis, and combined with inflation, resulted in lower real prices for many commodities during the early 1980s.

POLICY REFORM AND AGRICULTURE

Radical economic reform initiated in 1987, involving liberalization, stabilization, and sectoral adjustment, did much to introduce greater flexibility and stability in the Mozambican economy. The agricultural sector discussed in Chapter 3, received special emphasis in the reform package, in an effort to increase agricultural production for domestic consumption, export and agro-industries. The government sought to increase incentives for family farms by adopting agricultural marketing and price liberalization, and improving the marketing of consumer goods in rural areas, since the lack of incentive goods was viewed as an additional, nonprice constraint on increased marketed surpluses. Prices for fruits and vegetables had been fully liberalized in 1985. Those for other agricultural products were decontrolled between 1986 and 1989.

There have been dramatic increases in real producer prices after 1986, reflecting the price liberalization policies of the ERP. Real maize and rice producer prices in 1992 were 52.5 and 66.0 percent higher than their 1986 levels, respectively. Cashew and cotton prices also increased dramatically following the liberalization of prices, increasing 229 and 112 percent, respectively, between 1986 and 1992.

Higher real producer prices contributed to a partial restoration of agricultural production between 1986 and 1991, especially export crops and maize. Marketed production for maize increased 165 percent between 1986 and 1991 from 33.6 thousand metric tons to 89.1 thousand metric tons, followed by a drought induced decline in 1992 to 68.7 thousand metric tons (slightly more than the 1987 level). Marketed production grew more modestly for cashew, from 45.9 to 50.2 thousand metric tons between 1986 and 1989, but fell drastically between 1989 and 1992. Marketed cottonseed production increased almost fourfold during the 1986-1992 period, from 10.8 thousand metric tons to 41.8 thousand metric tons.

Despite the far reaching agricultural liberalization policies adopted, substantial distortions in the Mozambican economy remain, resulting in prices that do not accurately reflect the incentive structure. Official producer prices continue to be substantially below border prices, a fact highlighted by recent devaluations of the exchange rate that explicitly raise the actual c.i.f. price. Using a parallel exchange rate of 2200 Mt/$, the nominal rates of protection for producers of white maize and rice in 1991 were -27.6 and -45.0 percent, respectively, representing a substantial taxation of white maize and rice production.

MACROECONOMIC CONSIDERATIONS

With the recent liberalization of agricultural markets and external trade, agricultural prices will be increasingly determined by border prices. Movements in the world prices of maize, rice, cotton and cashew, along with macroeconomic policies affecting the real exchange rate such as the level of foreign aid flows, will more directly affect farmgate prices. Chapter 4 provides a macroeconomic overview, dividing Mozambique's experience into a period of state control over

the economy between 1975 and 1986, and one of market-oriented reform and recovery in the 1987 to 1992 period. In the latter period, remarkable progress was made in reducing distortions in the macroeconomy, resulting in positive growth between 1987 and 1991.

Chapter 5 elaborates on a central aspect of the reform process - the large inflows of foreign aid, particularly food aid, in order to provide direct poverty relief during the process of transition to a market economy. Because aid inflows are so large, (equal to as much as 59.2 percent of GDP in 1989), the effects of these capital inflows on the exchange rate and agricultural incentives is an important policy issue. While necessary from the standpoint of poverty alleviation and economic recovery, these inflows have significant impacts on the real exchange rate and the competitiveness of both the export crop and the food sectors. With liberalization of imports and foreign exchange, the exchange rate is more or less market determined. But there is an important sense in which it is still not in equilibrium. Despite the massive devaluations of the metical in recent years, Mozambique's trade deficit remains large. It is likely that in the future as the economy recovers, foreign aid and net capital inflows may decrease. Should this happen, a depreciation of the real exchange rate will be required to equilibrate supply and demand for foreign exchange.

A framework for analyzing the effects of changes in foreign aid inflows on the real exchange rate is presented which focuses on the effects of a decline in the level of foreign capital inflows and changes in trade policies. The real exchange rate depreciation required to restore equilibrium with a reduction in capital inflows to only 20 percent of 1992 GDP ranges from 25 percent with relatively elastic export supply and import demand to 45 percent, using the mid-range parameter estimate.

Of course, a cutback in foreign aid inflows of this magnitude (as well as the large real exchange rate depreciation) imply massive changes in the economy which are by no means captured in a simple model based on trade elasticities. Nonetheless, these calculations give an indication of the direction and broad magnitudes of changes in real exchange rates under various scenarios.

POLICY SIMULATIONS

In Chapter 6, we present a multi-market model to analyze the various policy issues on food markets and households. Production and trade of seven commodities (including yellow maize, white maize, rice, wheat, export crops, vegetables, meat and nonagriculture) are modeled along with consumption and real incomes of three household categories (urban nonpoor, urban poor, and rural).[1] Parameters for urban household demand derive from econometric analysis of the 1991-92 Food Security Department/Cornell Food and Nutrition Policy Program Maputo household survey.

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[1] "Rural" is comprised of the non-urban population of the three southernmost provinces in Mozambique (Maputo, Inhambane, and Gaza).

Model simulations are conducted for several policy alternatives and the impact of restored agricultural production on prices, incomes and commodity supply and demand (Chapter 7). The effects of increased yellow maize food aid imports as a means to increase food consumption and incomes of the poor in Maputo are simulated. An urban income transfer is addressed as an alternative to food aid as a means of reducing urban poverty. Three final sets of simulations, more regional in scope, look at real exchange rate depreciation, rural recovery, and a combination of the two.

The preliminary simulation results presented in this paper should be interpreted cautiously, given the uncertainties surrounding the base data and parameter estimates for rural areas. Moreover, the analysis in this paper is based on data for the period April, 1991 to March, 1992, a period in which the white maize harvest of 327 thousand tons in 1991/92 was typical of those in Mozambique during the civil war. By mid-1993 conditions had changed substantially in Mozambique due to the end of the civil war, a successful harvest and ill-timed, post-harvest deliveries of food aid to rural areas. Nevertheless, several major themes of the 1991/1992 analysis apply to the current and likely future situations.

The simulations suggest that increased yellow maize imports are an effective self-targeting mechanism for increasing real incomes and food consumption of poor households in Maputo. Because poor households tend to consume more yellow maize and are more price-responsive than are nonpoor households, an increase in yellow maize supplied to Maputo above the per capita levels of 1991/92 leads to larger percentage gains in real incomes and yellow maize consumption for the poor than for the nonpoor.

The net effect of the changes in prices and agricultural production resulting from the simulated increase in yellow maize food aid supplied to Maputo is to increase real incomes of the urban poor rise by 3.6 percent, mainly because of lower food prices. Urban poor consumption of yellow maize increases by 28.7 percent. Real incomes of the urban nonpoor increase only slightly (0.2 percent) since these households consume relatively little yellow maize. Because the terms of trade shifts against rural households as the prices of vegetables, roots and pulses and grains fall, real incomes of rural households fall slightly (-0.1 percent).

The spillover effects of increased yellow maize sales in Maputo are small. The econometrically estimated substitution effects of changes in yellow maize prices on white maize demand are minimal, (given the ratio of yellow and white maize prices in 1991/92). Also potential substitutes for yellow maize, in particular white maize, are imported (often across land borders), so any reductions in net aggregate demand for these products result first in lower imports and not in lower domestic prices for producers. Moreover, the additional foreign capital inflows to fund a 15 percent increase in yellow maize imports to Maputo (as in Simulation 1) are likewise small on a macroeconomic scale, resulting in a real exchange rate appreciation of less than 1 percent, so that producers of tradable goods are not significantly affected.

Two important issues related to countervalue funds arise. First, evidence from the FSC/CFNPP household survey of Maputo (Sahn and Desai 1993), shows that most of the yellow maize consumed by poor households in Maputo is purchased in the open market (dumbanenge), rather than at low official prices through ration shops. Thus the government has sacrificed potential revenues from countervalue funds by selling at a low price, yet the subsidy has not reached the intended consumers. Selling yellow maize at a market clearing price would thus increase government revenues from countervalue funds, without a significant impact on real incomes or food consumption of poor households.

Second, paradoxically, there is a tradeoff between potential countervalue funds and the level of maize imports. As yellow maize imports increase, the open market price (the price paid by consignees) falls, reducing potential countervalue funds. The decrease in potential countervalue funds occurs despite an increase in maize sold because with a price-inelastic demand, the percentage fall in market price is greater than the percentage increase in total sales in Maputo (-18.5 percent compared with 15.0 percent). Who benefits from the decrease in potential countervalue funds in this case? The urban poor. The lower market price of yellow maize in this scenario reduces the cost of their yellow maize consumption for all of their purchases, not just for the 15 percent increase in yellow maize supplied to the market.

It is important to note that this analysis of food aid applies to commercial sales of yellow maize food aid in Maputo, not to emergency relief food aid delivered to rural areas as occurred in late 1992 through mid-1993. Unfortunately, much of the emergency food aid destined for rural areas arrived late, after the successful white maize harvest in early 1993. Thus, yellow maize food aid ended up for sale in rural markets in mid-1993, while post-harvest market prices for white maize were low. Cutbacks in yellow maize emergency food aid to rural areas are clearly appropriate, given the successful harvest in 1993. What the simulation analysis shows, however, is that reductions in yellow maize supply in the Maputo market risk substantial losses in real incomes of the urban poor.

Cutbacks in foreign aid and the resulting real devaluations have potentially larger effects. A 20 percent reduction in net foreign savings and the resulting real exchange rate depreciation affect urban households much more severely than rural households (Simulation 4). As foreign aid inflows are cut back, agricultural price incentives are likely to improve, a situation benefitting rural producers but reducing real incomes for net purchasers of food unless nonagricultural income also rises. The implication is that as foreign aid inflows are cut back and the real exchange rate depreciates, policy interventions such as continued yellow maize imports or income transfers may be necessary to prevent serious reductions in real incomes of the urban poor.

Fortunately, rural rehabilitation holds forth promise for urban households as well as the rural population. Increases in agricultural production raise rural incomes and by reducing food prices, benefit urban households. Efficient marketing linkages are the key to ensuring that rural production increases are

possible and that rural production reaches urban markets to lower food prices there.

As the civil war ends and rural security is restored, linkages between rural producers, urban consumers and world markets will become increasingly important in determining domestic supply, demand and prices for food in Mozambique. Moreover, markets for key food commodities are inter-related both because of substitution possibilities on the demand side and competition for productive resources (labor and land) on the supply side. Accounting for these linkages will be an important part of effective food policy analysis to help insure that rehabilitation and economic recovery in Mozambique leads to improved food security.

1. INTRODUCTION

Mozambique is a country in transition. In recent years, macroeconomic reforms have resulted in large devaluations of the official exchange rate and liberalization of trade and foreign exchange markets. Commodity markets, including those for agricultural products, have been liberalized. Most important, rural security is being restored as the long civil war ends. In this context, appropriate economic policies, including food and agricultural policies, are important to spur rehabilitation of the economy and enhanced welfare for the long-suffering population.

The shift away from direct government controls on prices and marketing makes policy analysis more difficult, but offers the potential for more effective policy implementation. Rather than setting prices by fiat (and providing incentives for the emergence of large parallel markets), it is possible to influence market prices through more indirect means, including trade and exchange rate policies. An appropriate analytical framework becomes necessary to understand how various commodity markets interact and the likely effects of government interventions and exogenous shocks, such as various options of reducing urban food insecurity, changes in the real exchange rate and restoration of domestic agricultural production.

Yet the knowledge base on which effective policy analysis rests is weak. The historical data base is of uncertain quality, in large part because of past shortages of government resources to collect data and the impossibility of obtaining information in many rural areas in the midst of armed conflict. Moreover, with the massive transformations of the economic and political structure of Mozambique since the late eighties, it is unclear whether most historical information truly reflects the rapidly changing situation, especially in rural areas.

After situating the political economy of Mozambique in its geographical, social and political context in Section 2, this report presents an overview of agricultural institutions, policies and performance since Independence in Section 3. The importance of macroeconomic and agricultural linkages, on the one hand, and urban-rural linkages, on the other, is stressed in this chapter. In particular, the macroeconomic environment, especially as regards the aggregate price level, the exchange rate, and nominal rates of protection, stands out as an important policy factor in determining agricultural performance.

Section 4 discusses the evolution of the macroeconomic crisis during the period of state control of the economy, and the subsequent policies and growth performance following the implementation of a comprehensive reform package in 1987. Despite the concentration on policy factors as components of any explanation of Mozambique's economic crisis, it should be noted that drought and the devastation caused by the civil war likely played a more important role than policy failure in determining the dismal economic performance during the 1980s.

Nonetheless, the point remains that state control over the economy resulted in less flexibility with which to adjust to exogenous shocks.[2]

Section 5 builds on Sections 3 and 4 to present an analysis of the linkages between foreign aid inflows and agricultural price incentives through the mechanism of the real exchange rate. In particular, the analysis estimates the devaluation of the real exchange rate required to offset the effects of reduced capital and foreign aid inflows which can be anticipated as the economy recovers.

Given the severe constraints on data, yet the importance of conducting at least preliminary analyses of food and agricultural policies with liberalized markets, this paper presents a simple multi-market model covering the major food commodities in Mozambique. The model is designed to analyze the impacts of trade and agricultural price policies on supply and demand for yellow and white maize, rice, wheat and bread, export crops and other food.

The structure of the model, the data base and parameters used are described in the Section 6. Model simulations of several policy alternatives and the impact of restored agricultural production on prices, incomes and commodity supply and demand follow in Section 7. The first set of simulations analyze an increase in the effects of an increase in yellow maize commercial food aid sales in Maputo as a means to increase food consumption and incomes of the poor in Maputo. An income transfer is also simulated as an alternative policy to increased food aid as a means of reducing urban poverty. Three final sets of simulations, more regional in scope, look at real exchange rate depreciation, rural recovery, and a combination of the two.

Although the model analysis in this paper is based on data from 1991/1992, the major lessons from the simulations are still applicable for food policy in post-war Mozambique. These points are highlighted in the Section 8, which includes preliminary observations on policy implications.

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[2] Killick (1993, p. 45), writing on the "adaptive economy," notes that an economy with a rigid structure, often as a result of extensive state controls, "is incapable of responding to changing conditions, can expect retarded development, with disjunctures between demand and supply creating bottlenecks and balance of payments strains, inflationary pressures, and other economic dislocations."

2. GEOGRAPHY, POPULATION, AND POLITICAL HISTORY[3]

Mozambique is a country of 16.2 million people (1992 estimate), occupying an area of almost 800,000 square kilometers. With a per capita income of 80 dollars in 1990, and a recent history of war and drought, Mozambique is one of the poorest countries in the world (World Bank 1993).

A country the size of England, France and Portugal combined, Mozambique has a coastline of 2,470 kilometers, and features many ideal port sites (World Bank 1985). Mozambique is situated on Southern Africa's largest coastal plain. The lowland or coastal belt reaches an altitude of only 20 meters at its highest point, and covers 42 percent of the total area of the country (World Bank 1985). Central and northern Mozambique is characterized by a plateau with altitudes ranging from 200 to 500 meters. The highlands near the Malawi-Zambia border reach 2000 meters.

While geological surveys are not complete, Mozambique appears to be well endowed with mineral resources, particularly coal. Other resources are tantalite (used for hardening steel), iron ore, bauxite, zinc, tin, copper, uranium, precious and semi-precious stones and natural gas, to name a few (World Bank 1985).

Mozambique is marked by tropical forest and savannah regions. Rainfall is generally favorable for crop production although it has been uneven and erratic since the mid-1970s. There was a severe drought in 1982-1983 in the southern provinces of Gaza and Inhambane which claimed, according to United Nations estimates, as many as 100,000 lives (Finnegan 1992).

Mozambique is characterized by an ethnically diverse population. There are ten distinct ethnic clusters with more subgroupings, and twenty-five distinct languages. The cultural axis of Mozambique is the Zambezi River. To the North are the Macua-Lomwe, the largest group, comprising one third of the entire population, the Yao, an Islamic agrarian people, and the Makonde, a conservative people known for artistry. In the South are found, among others, two main groups, the Tsonga, the largest ethnic cluster whose members constitute the bulk of migrants to Maputo and the South African mines, and the Shona-Karanga, who are pastoralists.

The population of Mozambique grew at an average annual rate of 2.5 percent between 1965 and 1980, and by 2.6 percent per year between 1980 and 1990. The expected population growth rate between 1991 and 2000 is 2.9 percent (World Bank 1993). In 1980, 45 percent of the population was under the age of 15. In 1992, that ratio was virtually unchanged at 44.5 percent (IMF 1992, World Bank 1993).

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[3] This section draws on the overview presented in World Bank (1985), Chapter 1.

Mozambique is viewed as a land abundant country based on its population density, 19.2 inhabitants per square kilometer in 1989, which is double that of Zambia, but less than one third of that of Malawi and slightly lower than those of Tanzania and Zimbabwe (Tschirley and Weber 1992).

The health and education status of the African population at independence was inadequate. Health standards were poor because of widespread poverty, a general neglect of preventive services during the colonial era, and the departure of expatriate medical personnel following independence.

Average life expectancy was only 44 years during the 1975-80 period, three years higher than during the 1970-75 period, but a full 13 years below the weighted average life expectancy for all low income countries. With an infant mortality rate of 150 per thousand during the 1975-80 period, Mozambique's rate was 70 percent higher than the 1980 group average for low income countries (IMF 1992). Consequently, the Mozambican government gave high priority to upgrading health services, becoming somewhat of a pioneer in the creation of a broad-based primary care system with an essential drugs list.

The Portuguese left behind a biased education sector and low levels of educational attainment by the Mozambican population. The colonial education system was exclusively for the urban European population. Church missions provided schooling for Mozambicans in the rural areas.

With the mass exodus of expatriates after independence, Mozambique faced a critical shortage of professionals, technicians, managers, shopkeepers and skilled and semiskilled workers. Since independence, the Mozambican government has pursued a strategy of expanding the primary and secondary education systems and increasing literacy. The literacy rate increased from 7 percent in 1975 to 28 percent in 1980, and, despite the disruption ensuing from a protracted civil war during the eighties, to 33 percent in 1990 (World Bank 1992b). Table 1 presents a summary of basic indicators.

The problems facing Mozambique since independence are intertwined with its colonial history because of the particular nature of Portuguese colonial administration and of Portugal's subordinate position in the colonial economy of East and southern Africa, as well as with the political and military conflicts that have racked the country since 1975.[4]

While the initial Portuguese presence dates from the 16th century with the establishment of prazos, or land grants, and effective occupation was only after the 1885 Berlin Conference, it took another 50 years to firmly establish Portuguese rule. The consolidation of colonial rule was largely under the impetus of the rise of fascism in Portugal under Salazar.

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[4] Finnegan (1992), Kyle (forthcoming), and Srivastava and Livingstone (1983) provide more detailed accounts of Mozambique's colonial history and subsequent political events. The following discussion in this report draws on Finnegan (1992) and Srivastava and Livingstone (1983).

Table 1 — Mozambique: Basic Indicators

	1973	1989
GDP per capita (US dollars)	358	80
Population (millions)	10.1	15.4
Life expectancy (years)	41.0	48.6
Infant mortality rate (deaths per thousand)	167.0	137.5
Daily calorie supply per capita (calories)	1,981	1,632
Illiteracy rate (percent)	93	62
Primary school enrollment rate (percent)	87	68

Source: IMF (1992).

The Portuguese colonial system rested on slavery-based plantations and the supply of African slaves to colonies elsewhere. After abolition in 1869, freed slaves were required to contract labor to former owners and there was an extensive use of corvée (forced) labor for plantations and public works. The colonial administration required that the Africans sell cotton and rice as a means of forcing them into the cash economy. Taxes were also levied on the African population to induce them to seek wage employment on plantations and in mines. Because Portugal was not a wealthy country by comparison, and because the settler population consisted, to a great extent, of lower income Portuguese and Southern Europeans escaping poor conditions at home, the colonial administration had to raise revenues by "exporting" labor to surrounding colonies such as South Africa and the Rhodesias. There were agreements which gave South African and Rhodesian employers free reign to recruit in southern Mozambique in exchange for gold.

Over time, Mozambique developed as a supplier of raw materials to Portugal, particularly cashew, cotton, copra, sugar and tea based on plantation agriculture. There was some agro-industrial development such as sugar refining, cotton, beverages and food, as well as so-called "easy" import substitution in basic consumer goods, cement and other commodities that lent themselves to profitable production. By and large, the industrial sector became dependent on South Africa for supplies and spare parts. The service sector developed primarily in the form of port and transit services for the neighboring economies.

Consistent with the underdeveloped nature of Portugal and of the desire on the part of relatively unskilled immigrant settlers to prevent competition from the African population, there was a lack of social investment, particularly in rural areas and little promotion of education among the non-European population. There was a rigid barrier between the cultural and political life of the settlers and that of the African population, with selected members of the latter, the assimilados, i.e., those who had assimilated the cultural traits of the colonizers, being allowed to gain access to European society.

As a result, the colonial political economy was dualistic in both cultural and economic senses. The privileged Europeans dominated the commercial sector (consisting of large farms, urban industry and services controlled by Europeans) while an African peasant-based sector played no part in overall growth and was not integrated into the commercial sector, apart from the payment of taxes, the consumption of a small basket of consumer goods and the provision of wage labor on plantations and in the mines (Srivastava and Livingstone 1983).

The struggle for independence began in the 1960s in response to the accession to independence of most of the other colonies of Africa. FRELIMO[5] began as one of several independence movements, but became the most important group by the late sixties. Despite the ten year independence war, independence came mainly as a result of the collapse of the government in Portugal following a military coup which brought a left-wing military regime to power.

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[5] Front for the Liberation of Mozambique.

The immediate task facing the FRELIMO government after independence was political consolidation. A new constitution was adopted at independence (and was revised in 1978). In common with many other African one-party states, but with soviet-style overtones, FRELIMO was given a monopoly position in the political arena, overlapping with a highly centralized state apparatus.[6] As with many other single party regimes in sub-Saharan Africa, FRELIMO saw itself as a pan-ethnic entity that would prevent ethnic factionalism from emerging as the driving force in politics. FRELIMO assumed responsibility for developing policies and guiding the state and society, as well as determining overall development priorities and strategies. The FRELIMO party was represented at all levels of the state in order to ensure that public administration was consistent with the goals and directives of the party. The People's Assembly, the legislature, was given central roles in the constitution, particularly in approving the state economic plan, tax policy and the national budget. By the mid 1980s, however, the Assembly had generally been relegated to playing a smaller role, with major decisions being made by the Permanent Committee of the People's Assembly, a standing body comprised of the party leadership and some high government officials.

The civil war intensified in the early eighties. The rebels organized as the Mozambican Resistance Front (RENAMO) were initially supported by Rhodesia, in response to Mozambique's adherence to United Nations sanctions following the Unilateral Declaration of Independence (UDI) and to serve as a "fifth column" to spy on guerrillas of the Zimbabwean African National Union (ZANU) which had bases in Mozambique. Rebels included former colonial administrators, collaborators and soldiers, and ex-FRELIMO members. RENAMO's mission was to attack infrastructure and "raise the cost" of FRELIMO's support for ZANU. Mozambique's adoption of sanctions cost the economy about $150 million per year between 1975 and 1980 (each year representing almost 40 percent of the value of exports in 1980 [World Bank 1985]). With Zimbabwean independence, support for rebel activity was assumed by South Africa. The intensity of RENAMO activity increased because the destabilization of Frontline states was a major foreign policy objective of the South African government. Consequently, vital economic infrastructure was destroyed, particularly the rail system, utilities, and the oil pipelines.

In 1984, the Nkomati accords were signed between Mozambique and South Africa. Under this agreement, South Africa would stop supporting RENAMO, and provide bilateral assistance. In exchange, Mozambique would not permit ANC activities to be launched from its soil. However, RENAMO activity continued, in part because South Africa did not keep up its end of the bargain due to a split in the South African government between the defense and security establishment (which supported continued sponsoring of RENAMO to keep the Frontline states off guard) and the foreign ministry (which sought rapprochement between South Africa and the rest of Africa) (Finnegan 1992).

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[6] World Bank (1985), Chapter 1 presents a detailed description of the structure of the Mozambican state and the political context for economic policy making.

The costs of the war have been enormous. By 1989, according to the United Nations, there were 900,000 dead and 3 million displaced persons (Finnegan 1992). Most railroads and highways were destroyed.[7] The conflict also destroyed or forced the closure of 979 clinics and rural health posts (46 percent of primary health care network). Schools and relief camps also sustained damage during the war. It is estimated that 3000 schools were destroyed and 400 teachers killed (Finnegan 1992). The World Bank estimates that about 50 percent of the stock of primary schools and one third of all health units were destroyed (World Bank 1990).

Due to these high costs, and the decision by Western governments to no longer provide moral and material support to RENAMO, Western assistance to the FRELIMO government increased. The need for assistance was highlighted by drought and starvation resulting from several years of bad weather. Specific action areas for donors were the establishment and maintenance of refugee camps, the provision of food aid, infrastructure rehabilitation, and reversing the adverse effects of the war on the health and education sectors.

There have been several positive developments over the last 5 years. First of all, FRELIMO moved towards a form of Mozambican *glasnost*, faced with the collapse of communist regimes in Eastern Europe and the cessation of aid from the Eastern Bloc. More concretely, FRELIMO adopted a new constitution in 1990 that entails a multiparty democracy, a market economy, the guarantee of civil liberties, and the separation of powers. Three rival parties sprang up very shortly thereafter (Finnegan 1992).

Secondly, a peace treaty was signed in Rome in October 1992 between Joachim Chissano, the president, and Afonso Dhlakama, the leader of RENAMO. The peace agreement was ratified by the Mozambican Parliament in the same month. The agreement calls for free elections, a unified army and demobilization of excess military personnel (IMF 1992). By August 1993, little progress had been made in demobilization due in part to the slow pace in political rapprochement between the FRELIMO and RENAMO leaders who are overseeing the implementation of the 1992 agreements (*The Economist* 1993).

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[7] According to World Bank (1990) calculations, revenues from rail transport fell to 25 percent of the 1980 level.

3. AGRICULTURAL POLICIES AND PERFORMANCE

The Mozambican economy is typical of low-income sub-Saharan Africa. In 1989, agriculture accounted for 54.9 percent of GDP, industry for 18.8 percent, and services for 11.8 percent of GDP (Table 2). Compared to the sectoral shares just after independence (1980), when agriculture accounted for 47.1 percent of GDP, industry for 23.9, and services for 16.5 percent of GDP, there has been a "reversal" of development, with agriculture's share growing at the expense of industry and services. This reflects a number of factors: (1) a shift back to agriculture in the context of a breakdown in commerce and investment as a result of civil war; (2) the collapse of industry due to chronic foreign exchange constraints; and, (3) the lack of attention given to the service sector, which is typical in socialist economies. The sectoral distribution of employment also reflects Mozambique's low level of development with agriculture in 1980 accounting for 84.5 percent of the labor force. Industry and services accounted for 7.4 and 8.1 percent of the labor force, respectively (World Bank 1991). The centrality of agriculture in the economy is further highlighted by the fact that the sector accounts for 80 percent of export earnings (World Bank 1989)

Mozambican agriculture has been characterized as being in a low-level equilibrium trap: Production technology is traditional and primitive, using unskilled labor, undeveloped land, and simple implements (Schuh unpublished). Consequently, there is low productivity.

PRODUCTION REGIONS, CROP PATTERNS, ORGANIZATION, AND MARKETING INSTITUTIONS

Mozambique is divided into three major production regions, the North, the Center, and the South. The North, encompassing the provinces of Cabo Delgado, Niassa and Nampula, is home to 31.3 percent of the population, and is marked by a relatively dry climate. The region supplies 76.5 percent of total cassava production (1991 national accounts data), 31.9 percent of maize production, 25.1 percent of rice production, and 31.5 percent of groundnut production (Table 3). Nampula and Cabo Delgado combined account for almost 80 percent of total cotton production (World Bank 1988). In 1986, Nampula accounted for 63 percent of total cashew production (World Bank 1988). Nampula also produces coconuts.

The Central region includes the provinces of Zambezia, Tete, Manica and Sofala and accounts for 41 percent of the population. A large share of the country's total rice supply (48.2 percent) is produced here as well as 43.8 percent of total maize production. Zambezia an also an important coconut and cashewnut producing region.

The South includes the provinces of Imhambane, Gaza and Maputo and accounts for 27.7 percent of the population. While this region accounts for only 24.3 percent of maize production and 26.7 percent of rice production, 49.6 percent of total groundnut production takes place here. Gaza and Inhambane are also

Table 2 — Mozambique: National Accounts

	1980		1989	
	1980 Meticais	Percent	1980 Meticais	Percent
		(Billion)		
Agriculture	36.8	47.1	39.7	54.9
Industry	18.7	23.9	13.6	18.8
Services	12.9	16.5	8.5	11.8
GDP at market prices	78.2	100.0	72.3	100.0

Source: World Bank (1985, 1990).

Table 3 – Mozambique: Population and Production of Major Crops by Region, 1991

	Population		Maize				Rice				Cassava				Groundnuts			
			Cultivated Area		Production		Cultivated Area		Production		Cultivated Area		Production		Cultivated Area		Production	
	Thousands	(%)	(ha)	(%)	(MT)	(%)	(ha)	(%)	(MT)	(%)	(ha)	(%)	(MT)	(%)	(ha)	(%)	(MT)	(%)
North	4,980.3	31.3	186,659	18.5	104,374	31.9	25,581	24.0	14,161	25.1	677,601	69.7	2,822,198	76.5	92,447	27.0	20,513	31.5
Central	6,516.8	41.0	437,536	43.4	143,368	43.8	64,379	60.4	27,139	48.2	188,362	19.4	637,171	17.3	53,774	15.7	12,307	18.9
South	4,409.2	27.7	385,016	38.2	79,347	24.3	16,547	15.5	15,041	26.7	106,098	10.9	231,098	6.3	195,555	57.2	32,322	49.6
Total	15,906.3	100.0	1,009,211	100.0	327,089	100.0	106,507	100.0	56,341	100.0	972,061	100.0	3,690,467	100.0	341,776	100.0	65,142	100.0

Source: FAO, unpublished.

important cashew producing regions, Gaza alone accounting for 25 percent of total cashewnut production in 1986 (World Bank 1988).

Available production figures show that cassava dominates agricultural production with 40.2 percent of the value of total production (Table 4).[8] Virtually all cassava is produced on family farms. Maize accounts for 15.9 percent of agricultural production and, as with cassava, most of it is produced on family farms. Rice accounts for 5.2 percent of production. Groundnut production accounts for 7.2 percent of agricultural value added and almost all of it takes place on family farms.

There are a number of cash crops that have important roles in the Mozambican economy as sources of export earnings or as inputs in agro-industrial processing. First, there are the tree crops — cashews and coconuts which account for 3.0 and 1.0 percent of total agricultural output, respectively. All cashew harvesting is done on family farms, while just under 53 percent of coconut production is done on "organized" state farms. Sugarcane represents only 1.4 percent of agricultural production and all of it is grown on state farms. Other crops, including fruits, vegetables, legumes, and other cash crops account for the remaining 26.1 percent of agricultural production.

Organization, Size, and Activities

The production structure of Mozambican agriculture is dominated by family farms which accounted for 92 percent of cultivated area in 1983 (World Bank 1985). The family sector primarily grows staple crops, accounting for 98 percent of total production (World Bank 1985) and supplies 51.2 percent of the marketed surplus (Kyle forthcoming). This sector also accounts for 19.4 percent of supply of agricultural exports (World Bank 1985). Family farms are the only producers of cashews, and are important suppliers of copra and cotton. The family farm sub-sector is characterized by a low level of technology, little use of modern inputs, low productivity, and worked largely by household labor.

State farms are the juridical heirs to the approximately 2000 colonial estates abandoned at independence. Many of the state farms were constructed by aggregating abandoned settler farms. Consequently, farms sizes were very large. State farms account for only 5.7 percent of cultivated area, but 43.4 percent of the supply of overall marketed surplus (Kyle 1991). Specifically, these farms provide about 70 percent of marketed rice and 65.6 percent of agricultural exports (World Bank 1985). Production conditions and factor intensities stand in marked contrast to those extant in the family farm sector. The state farms are run by workers councils, although the FRELIMO party has a large role in the decision-making process. Workers organized in "brigades" and perform farm

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[8] There are several estimates for cassava production. The figure presented here is calculated from the Ministry of Agriculture price and production estimates.

Table 4 — Mozambique: Production of Major Agricultural Commodities 1991

	Organized	Family	Total	Family/Total	Share of Total
	(Million Meticais)			(Percent)	
Beans	479	30,647	31,126	98.5	7.8
Cashews	0	11,831	11,831	100.0	3.0
Citrus	7,095	750	7,845	9.6	2.0
Copra	2,151	1,934	4,085	47.3	1.0
Cotton	7,387	6,607	13,994	47.2	3.5
Groundnuts	116	28,593	28,709	99.6	7.2
Maize	3,980	59,702	63,682	93.8	15.9
Manioc	88	160,591	160,679	99.9	40.2
Rice	8,268	12,484	20,752	60.2	5.2
Sisal	199	0	199	0.0	0.0
Sorghum	71	25,212	25,283	99.7	6.3
Sugarcane	5,713	0	5,713	0.0	1.4
Tobacco	902	0	902	0.0	0.2
Other	19,999	4,821	24,820	19.4	6.22
Total	56,448	343,172	399,620	85.9	100.0

Source: Ministry of Agriculture estimates, and authors' calculations.

operations as group activities. Theoretically, the state farms were to benefit from applications of modern technology in order to maximize output, although the main accomplishment was mechanization, resulting in a fairly capital intensive production structure. The state farms also were favored in terms of receiving what fertilizer and technical assistance was available.

The third form of agricultural organization, the cooperative, plays a small role in total agricultural production, accounting for 0.3 percent of cultivated area, 1.5 percent of marketed production, and 0.1 percent of agricultural exports (Kyle 1991).

Private commercial farms are distinct from family farms in that they pay wages on a regular basis and they pay rent to the state for land, whereas family farms pay no rent. Despite accounting for 2.0 percent of cultivated area and only 3.8 percent of marketed production of staples, they supply 14.9 percent of agricultural exports (Kyle 1991).

Distribution Network

Government intervention in agricultural marketing existed during colonialism. The colonial government set producer and consumer prices and marketing margins. A state marketing board was created to control wholesale trade. Retail trade, by contrast, was run by private traders, many of whom left the country at independence. The Mozambican government assumed control over distribution of goods to the rural sector through government stores. The government recognized that private trade would continue at the retail level in many areas that the state could not reach adequately. However, private trader margins were regulated, and a government monopoly was maintained at the wholesale level, under the direction of the Ministry of Internal Commerce.

AGRICOM, a government enterprise under the Ministry of Internal Commerce, was created in 1981 to consolidate all marketing of crops (except cashew and cotton). This body was authorized to buy all produce at government established prices. Prices were set based on barter terms of trade vis-à-vis nonagricultural goods, i.e., the quantity of consumer goods exchanged for the marketed surplus. Money and prices therefore played a passive role in distribution (Kyle 1991).

Evolution of Production and Agricultural Policies

Following independence, the FRELIMO government continued the colonial policy of fixing prices at all stages of the production and marketing process. Mechanized state farms were given prominence with the objective of maximizing marketed surplus in order to promote rural recovery. State farms received primary emphasis in the state budget, being allocated 90 percent of state investment in agriculture (World Bank 1988) and allotted the lion's share of technical assistance, scarce foreign exchange for inputs, and skilled manpower. Implicit in this strategy was a relationship between state sector and the family

farm sector in which the latter was deprived of resources in order to support the state farms.

By the end of 1980, production in many sectors had recovered to 1975 levels, although still below pre-war (1970) levels. However, there was a serious disruption of production due to the civil war and the 1982-83 drought, with adverse impacts on infrastructure and services, and the displacement of the population. The effects on production were dramatic. Marketed production fell between 1980 and 1983 for maize (14 percent), rice (60.3 percent), groundnuts (89 percent), cashew (79.3 percent), copra (17.3 percent) and sisal (59 percent) (Kyle forthcoming). However, marketed production was unchanged or higher for sorghum, cassava, and vegetables. These results were exacerbated by a lack of producer incentives, as real producer prices fell for most major commodities between 1980 and 1983.

In 1983 there was a reassessment by the government of the agricultural situation. They recognized that the agricultural sector was constrained due to the war, drought, and ineffective rural development policies. There was an admission that the government was unable to provide inputs or services for communal production, and that among the population, small family plots remained the preferred production unit, even in communal villages. Consequently, at the Fourth Party Congress, there was a call for increased emphasis on the smallholder family sub-sector, the development of private commercial farms, and less emphasis on inefficient state farms. Despite the implementation of an economic action program which embodied this spirit of reform, there was continued overall and sectoral decline. Specifically, marketed grain production fell to 10 percent of the total marketed food requirement, and there were increased food imports. There was some progress in promoting cashew and cotton production for export.

The initial reforms laid the groundwork for a later World Bank-sponsored package of reforms, supported by loans, debt relief, and commodity aid that comprised the government's 1987 Economic Rehabilitation Program. A large component of the program involved policy reform in agriculture. The primary objective relating to agriculture was increasing agricultural production for domestic consumption, export and agro-industries; In terms of the agricultural sector, the government sought to increase incentives for family farms by adopting agricultural marketing and price liberalization, and improving the marketing of consumer goods in rural areas. Prices for fruits and vegetables had been fully liberalized in 1985. Those for other agricultural products were decontrolled between 1986 and 1989. Budget reform called for an increased transfer of resources to the rural sector, especially to commercial and family farms. Finally, a program for restructuring state farms was laid out.

Real Prices and Supply Responses

Producer prices for most major agricultural commodities were fixed in nominal terms and on a pan-territorial basis, and combined with inflation, resulted in lower real prices for many commodities during the early 1980s. Table

5 shows that after relatively major changes in nominal prices in 1977, producer prices changed infrequently until the early 1980s.[9] Food prices were revised more often than were those for export crops. The main periods of price changes were 1977, 1980-82, 1985 and 1987-92 after the adoption of the ERP. The stability of nominal prices did not lead to significant declines in real prices (calculated using the official CPI as a deflator) until 1982 when inflation accelerated. The drop in real prices for all major crops in 1990 reflects the large increase in the CPI which eroded some of the gains of the previous increases in nominal producer prices. The government, however, compensated for price inflation by further raising producer prices in 1991 and 1992.

Real price patterns for staples (maize and rice) break down into three distinct sub-periods: 1976-81, 1982-86, and 1987-92 (Figure 1). Maize prices followed an erratic upward trend between 1976 and 1981. After the sharp rise in real price in 1982, there were sharp downward and upward movements through 1986. Rice prices display little overall trend between 1976 and 1981, followed by a large increase and a sharp decline during the 1982-1986 period.

The fall in real prices is more striking for the export crops, shown in Figure 2, whose price movements fall into three periods: 1976-80, 1981-1986, and 1987-92. Between 1976 and 1980, real prices fell gradually, and then jumped in 1980. Prices for cashews behaved erratically, falling gradually between 1981 and 1983, jumping 73 percent in 1984, and continuing to decline so that in 1986, real prices were 35 percent lower than the 1981 level. Real cotton producer prices followed a similar pattern in the 1976-80 period, but fell 52.8 percent between 1981 and 1986.

Figures 1 and 2 also demonstrate the dramatic increases in real producer prices after 1986, reflecting the price liberalization policies of the ERP. Real maize and rice producer prices in 1992 were 52.5 and 66.0 percent higher than their 1986 levels, respectively. Cashew and cotton prices also increased dramatically following the liberalization of prices, increasing 229 and 112 percent, respectively, between 1986 and 1992.

By and large, the overall terms of trade for agriculture declined in the early and mid- 1980s (Kyle 1991). This was due not only to a rise in consumer prices, but also to an acute scarcity of consumer goods for producers to buy. When goods were available, it was often in parallel markets, at prices much higher than those found in the official distribution system. Low real producer prices and a lack of manufactured goods supplied to rural areas were important determinants of the poor performance in terms of marketed surplus during the first half of the 1980s. Azam and Faucher (1988) provide evidence that in the case of maize, the marketed surplus is constrained by the supply of manufactured incentive goods, and is not driven by the real producer price alone. This analysis, however, neglects trade in parallel markets and may overstate the incentive goods constraint. Maize sold in the parallel market may be used to

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[9] This discussion updates that presented in Tarp (1990).

Table 5 —Mozambique: Nominal and Real Producer Prices, 1976-92

	Maize		Rice		Beans		Groundnut		Cashew		Sunflower		Cotton		Copra	
	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real
1976	2.5	2.6	5.0	5.3	6.5	6.9	8.5	9.0	3.5	3.7	7.0	7.4	6.5	6.9	3.2	3.4
1977	3.2	3.3	6.2	6.4	10.0	10.4	10.0	10.4	3.5	3.6	8.5	8.8	6.5	6.8	4.7	4.9
1978	3.2	3.3	6.2	6.4	10.0	10.3	10.0	10.3	3.5	3.6	8.5	8.7	6.5	6.7	4.8	4.9
1979	3.2	3.2	6.2	6.3	11.0	11.1	10.0	10.1	3.5	3.5	8.5	8.6	6.5	6.6	4.9	4.9
1980	4.0	4.0	6.2	6.2	15.0	15.0	10.0	10.0	5.0	5.0	8.5	8.5	11.0	11.0	5.0	5.0
1981	4.0	3.9	6.2	6.0	15.0	14.5	13.5	13.0	5.0	4.8	8.5	8.2	11.0	10.6	5.0	4.8
1982	6.0	4.9	10.0	8.2	15.0	12.3	15.0	12.3	5.0	4.1	10.5	8.6	11.0	9.0	5.0	4.1
1983	6.0	4.4	10.0	7.3	15.0	11.0	15.0	11.0	5.0	3.7	10.5	7.7	12.5	9.1	5.0	3.7
1984	6.0	3.8	10.0	6.4	15.0	9.5	15.0	9.5	10.0	6.4	10.5	6.7	12.5	8.0	5.5	3.5
1985	13.0	5.6	16.0	6.9	23.5	10.1	20.0	8.6	10.0	4.3	15.0	6.5	16.0	6.9	5.5	2.4
1986	13.0	4.0	16.0	5.0	23.5	7.3	20.0	6.2	10.0	3.1	15.0	4.7	16.0	5.0	5.5	1.7
1987	40.0	4.7	48.0	5.7	100.0	11.8	100.0	11.8	60.0	7.1	50.0	5.9	65.0	7.7	18.0	2.1
1988	65.0	5.1	75.0	5.9	150.0	11.8	150.0	11.8	105.0	8.3	75.0	5.9	104.0	8.2	30.0	2.4
1989	110.0	6.2	145.0	8.1	230.0	12.9	255.0	14.3	165.0	9.3	130.0	7.3	175.0	9.8	100.0	5.6
1990	126.0	4.8	167.0	6.4	264.0	10.1	295.0	11.3	200.0	7.6	150.0	5.7	201.0	7.7	115.0	4.4
1991	190.0	5.4	256.0	7.2	400.0	11.3	440.0	12.4	380.0	10.7	250.0	7.1	320.0	9.0	165.0	4.7
1992	275.0	6.1	375.0	8.3	680.0	15.1	640.0	14.2	460.0	10.2	348.0	7.7	478.0	10.6	210.0	4.6

Sources: 1976-87, Tarp (1990); 1988-92, IMF (1992).

Figure 1 — Mozambique: Real Maize and Rice Producer Prices

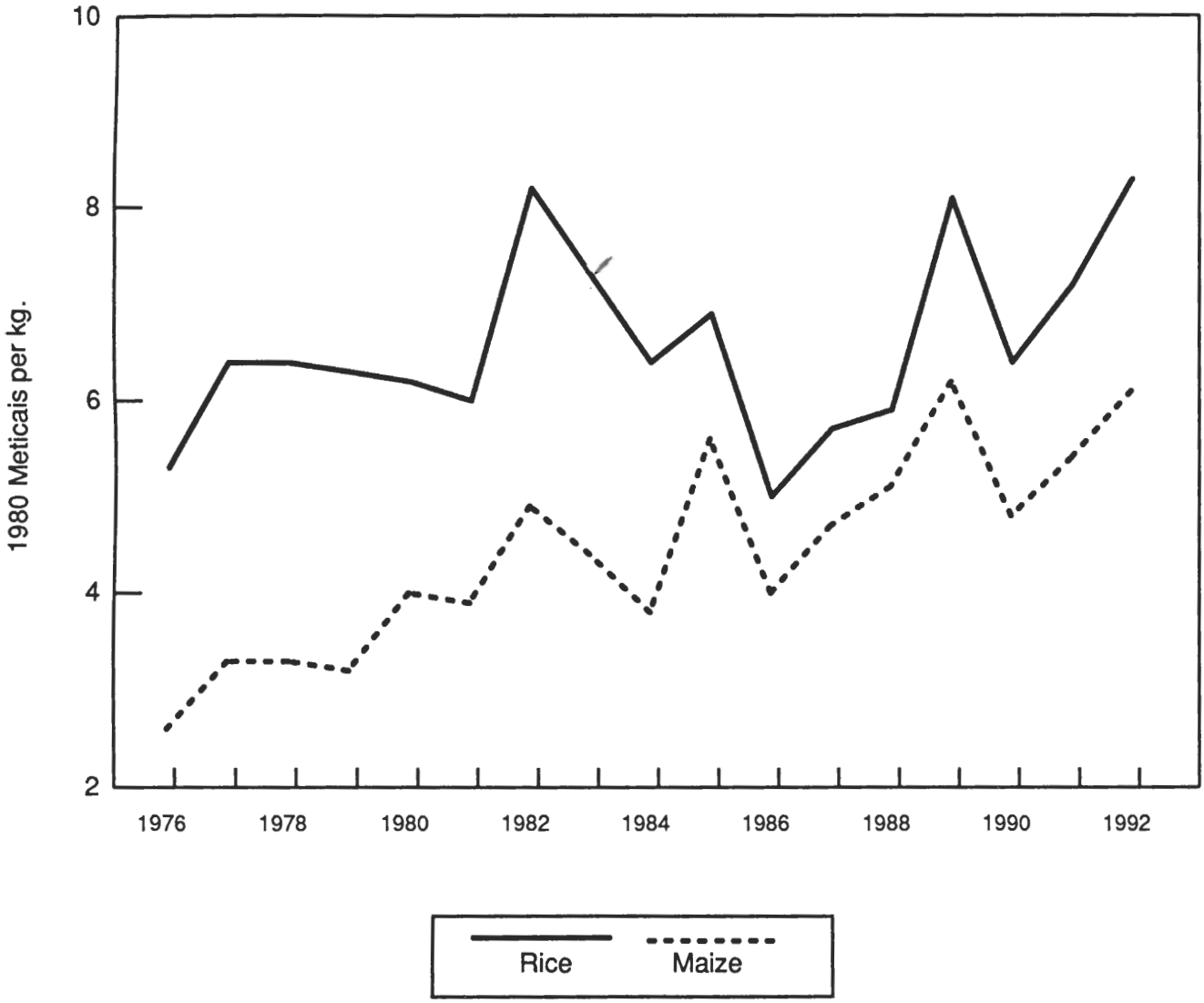
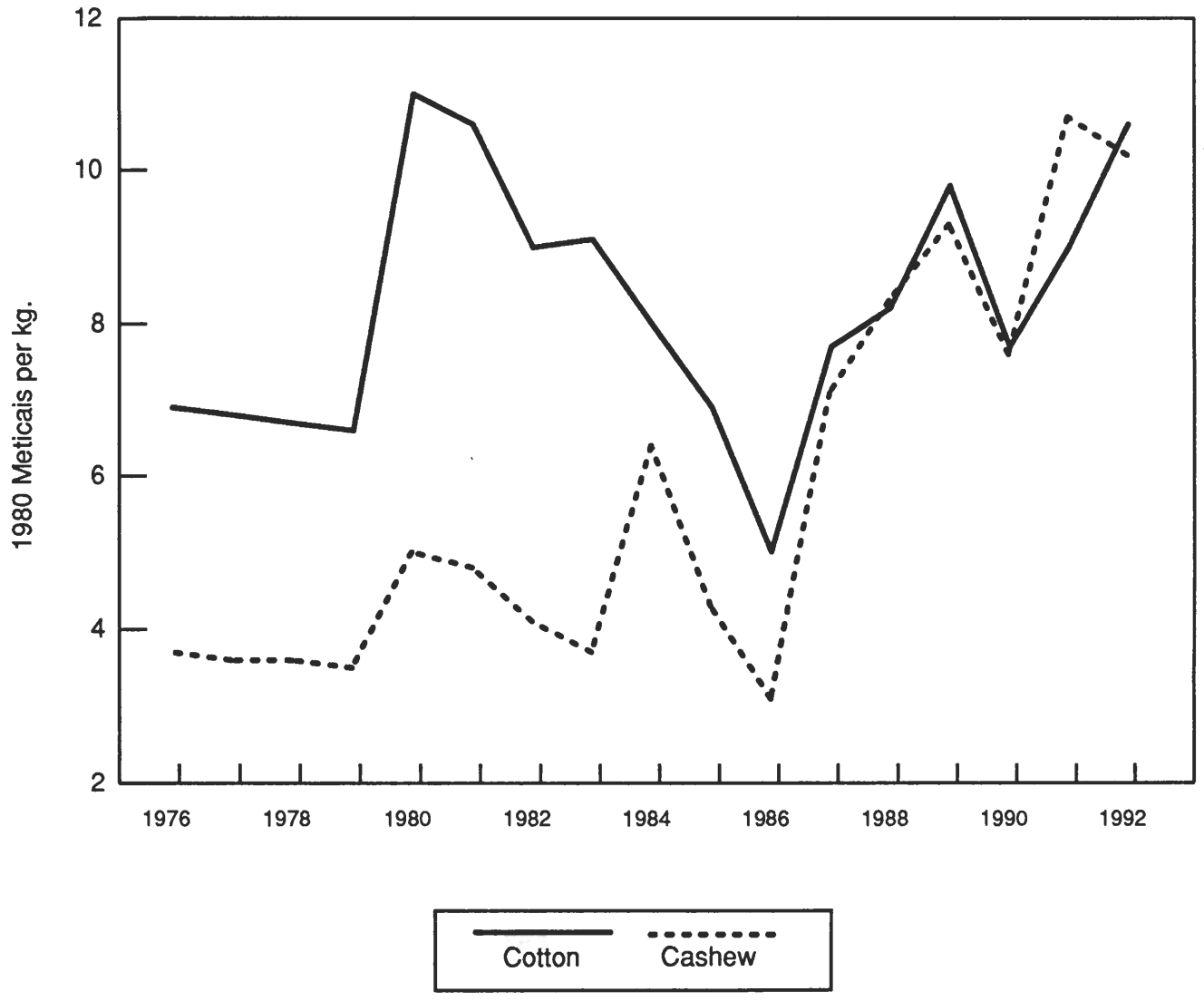


Figure 2 — Mozambique: Real Cashew and Cotton Producer Prices



purchase consumer goods that have been diverted out of official distribution channels as well.

Breaking the 1977-92 period into three sub-periods, 1977-81, 1982-86, 1986-88, Tarp (1990) finds a correlation between real prices and marketed surpluses for maize, beans, rice, groundnuts, cashew, and cotton. Accepting the view of Mackintosh (1988) that aggregate supply is price elastic to real prices, despite the lack of a straightforward causal relationship between real producer prices and total production, Tarp concludes that producer prices contributed both to economic progress (during the 1977-81 and 1986-88 periods) and to economic decline (1982-86).

Higher real producer prices contributed to the restoration of agricultural production between 1986 and 1991, especially export crops and maize. Marketed production for maize increased 165 percent between 1986 and 1991 from 33.6 thousand metric tons to 89.1 thousand metric tons (World Bank 1990, IMF 1992), followed by a drought induced decline in 1992 to 68.7 thousand metric tons (slightly more than the 1987 level). Marketed production grew more modestly for cashew, from 45.9 to 50.2 thousand metric tons between 1986 and 1989, but fell drastically between 1989 and 1992 (World Bank 1990, IMF 1992). This paradox of falling marketed surpluses during a period of rising real prices is in large part due to noneconomic factors such as drought and intensified fighting. In addition, the rise in real prices measured using the official consumer price index as a deflator may overstate actual changes in incentives, since the consumer price in the earlier (pre-1990) period did not reflect true scarcity values of goods on the official market.

Marketed cottonseed production increased almost fourfold during the 1986-1992 period, from 10.8 thousand metric tons to 41.8 thousand metric tons (World Bank 1990, IMF 1992).

Kyle (1991) calculates crude elasticities to estimate the short-run response of agricultural production to real price increases. Apart from groundnuts, all the food crop elasticities are greater than unity, while of the export crops, only cotton has a elasticity greater than unity. He concludes that the strong "pricism" of the Economic Rehabilitation Program was required because of the serious price distortions that plagued the economy. Furthermore, these measures were relatively easy to implement given the requirement for continued fiscal austerity.[10]

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[10] Kyle notes that these measures are not enough to promote long run growth: there are binding physical and institutional constraints which must be overcome. Above all, a very significant portion of the productive capacity of the economy was destroyed, and the population was dislocated by war, with adverse consequences on the human capital stock. Secondly, the dramatic nature of the required institutional reforms suggest the need for the implementation of a social safety net to minimize the adverse effects on the poor.

Border Prices of Major Agricultural Commodities

Comparisons of domestic agricultural producer prices with world prices are problematic because of uncertainty over the appropriate exchange rate for the analysis. At the official exchange rate of 1434.5 Mt/$, the nominal protection coefficient, defined as the ratio of domestic prices to border prices,[11] ranged from 1.25 to 1.95 for consumers of rice, white maize, yellow maize and wheat flour in 1991. At a parallel market rate of 2200 Mt/$, the level of implicit taxation drops to 11 and 27 percent for white maize and rice, and domestic (open market) prices for yellow maize are below world prices. Thus consumers of these commodities, instead of being heavily taxed were in fact paying prices near border levels for white maize and rice. Consumers of yellow maize were enjoying a subsidy.

The situation for producers was essentially the reverse. Official producer prices of white maize and rice were roughly at border parity in 1991 using the official exchange rate. At a parallel rate of 2200 Mt/$ producer prices were 28 and 45 percent below border prices, implying a substantial taxation of white maize production (Table 6).[12]

The case of white maize is illustrated in more detail in Figure 3. At the official exchange rate of 289.4 Mt/$ in 1987, the producer price for white maize was 35 percent above the estimated border price. But at the parallel exchange rate of 1000 Mt/$, which was closer to a market-determined exchange rate, the domestic price was 65 percent below the border price. This pattern persisted until 1992, when substantial devaluations of the official exchange rate narrowed the gap between the official and parallel exchange rates. The official producer price had not risen substantially, though, so the official price was now substantially below border prices at both the official and parallel exchange rates.

Given the substantial distortions that remain the Mozambican economy, the calculations using the parallel market rate still do not give an accurate picture of price incentives for agriculture. As is discussed in Section 5, should there be substantial reductions in foreign aid inflows in the future, a large real exchange rate depreciation will be required. The major conclusions of this chapter remain, however. Official producer prices are substantially below border prices, even at parallel exchange rates.

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[11] Calculations of border prices are based on marketing and transport costs given in World Bank (1989). Details of the calculations are shown in Appendix Table 1.

[12] This reversal of the relationship between domestic and border prices once distortions in exchange rates are considered is typical of many developing countries. See Krueger, Schiff and Valdès (1988).

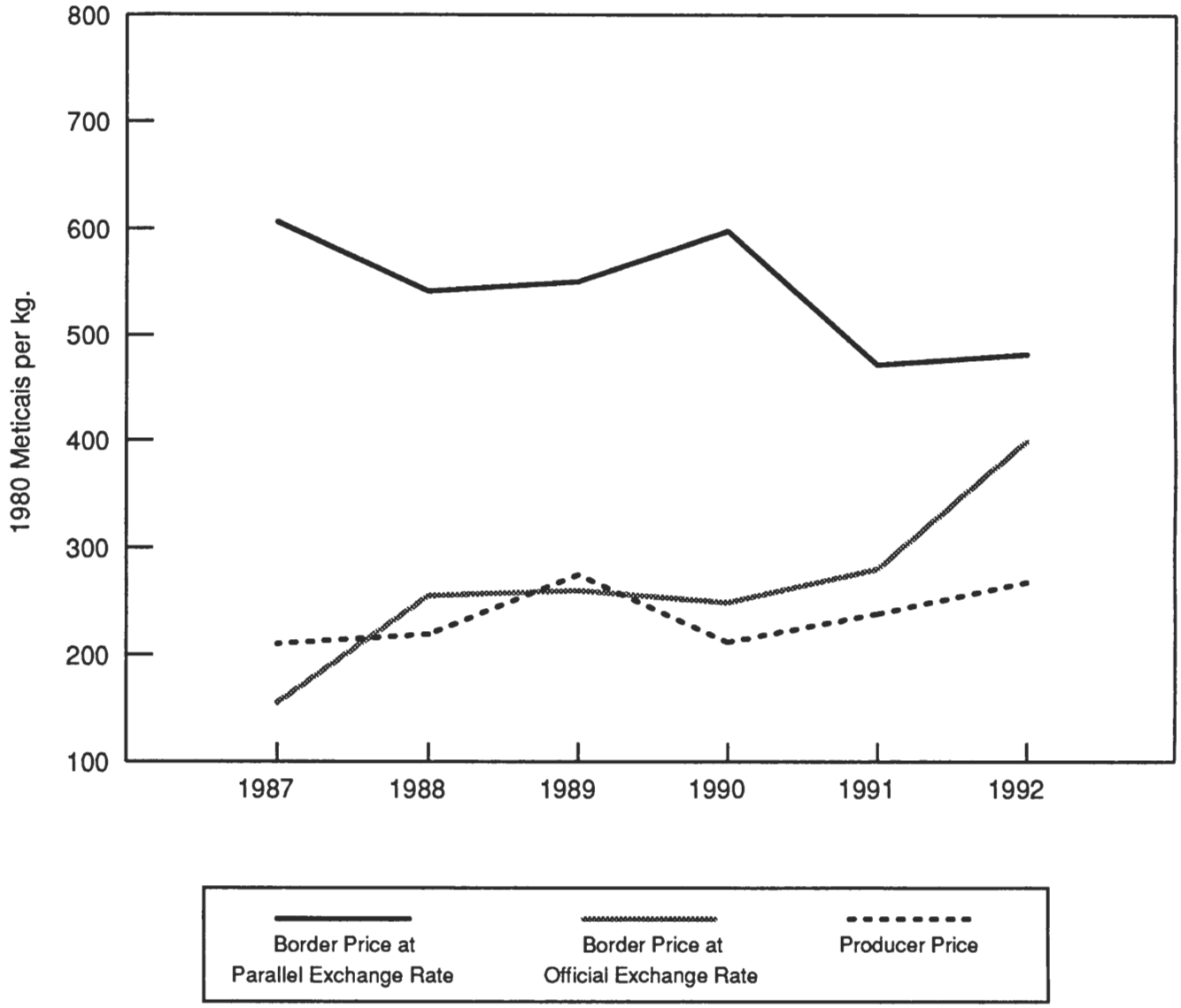
Table 6 — Mozambique: Nominal Rates of Protection, 1991

	Consumers				Producers	
	Rice	White Maize	Yellow Maize	Wheat Flour	Rice	White Maize
			(Percent)			
Exchange Rate (Mt/$)						
1434.5	94.8	70.7	25.5	-31.9	11.0	-15.7
1845.4	51.4	32.7	-2.5	-47.1	-13.7	-34.5
2200.0	27.0	11.3	-18.2	-55.6	-27.6	-45.0

Source: Calculated from Appendix Table 1.

Note: Price comparison at wholesale level for wheat flour.

Figure 3 — Mozambique: White Maize Prices



SUMMARY

The chapter has highlighted the positive agricultural supply response following price and marketing liberalization. Yet substantial distortions in the Mozambican economy result in prices that do not accurately reflect the incentive structure. Official producer prices are substantially below border prices and without increases in official producer prices accompanying devaluations of the exchange rate, the large implicit taxation of agriculture only increases. Many agricultural incentive distorting policies and conditions exist at the macroeconomic level. The next chapter surveys the macroeconomic environments under the periods of state control (1975-1986) and rehabilitation (1987-1992) and highlights the extent to which the performance of the Mozambican economy is directly linked to exogenous factors such as drought and civil war, as well as to inflows of foreign aid to finance rehabilitation. While necessary from the standpoint of poverty alleviation and economic recovery, these inflows have significant impacts on the real exchange rate and the competitiveness of both the export crop and the food sectors.

4. MACROECONOMIC POLICIES AND PERFORMANCE

Mozambique's post-independence policies prior to 1986 relied heavily on state control of markets and the development process, with little role for prices in allocating resources. Foreign exchange was allocated through rationing and control of import licenses. Noneconomic factors, drought and the devastation caused by the civil war, likely played a more important role than policy failure in determining the dismal economic performance during the 1980s.

Trends in GDP and GDP per capita demonstrate the profound and prolonged economic crisis facing Mozambique. Mozambique recorded a 1990 per capita income of 80 dollars, down from 203.3 dollars per capita in 1982 (World Bank 1990). However, there are signs that the economic reforms instituted in 1987 are producing results. In 1989, overall GDP was 17.6 percent higher than the 1985 level (World Bank 1990).

THE STATE-CONTROLLED ECONOMY: 1975-1986

The original Mozambican constitution accorded a high place to industry as a "dynamic and decisive factor" in the process of economic development, although the sector accounts for relatively little in terms of employment and value added. At independence, most industrial enterprises were abandoned by their owners and the state took them over. By 1982, the state's share of enterprise ownership had risen from 29 percent in 1977 to 73 percent (World Bank 1985).

The industrial structure at independence was concentrated in agro-industry (sugar refining, cotton, beverages and food processing), basic consumer goods (textiles, shoes), cement and other construction materials, and a few manufactured products (glass, simple machinery and metal products). The government's development strategy sought continued import substitution in branches such as textiles, matches, and tires, along with promotion of exports of processed agricultural goods (cashews, cotton, sugar and copra). Problems arose, however, as the agricultural sector failed to generate enough foreign exchange to finance the importation of needed raw material and intermediate inputs, thus constraining industrial output. After the 1983 Congress, industry was charged with the production of incentive goods which would encourage trade with the rural sector.

Little macroeconomic data is available from before 1980, but based on the scanty evidence it appears that after an initial drop in output in the years surrounding independence (1975), Mozambique's economy grew in real terms by 2.5 percent per year until 1980 (World Bank 1985). This growth was due to the recovery of the economy after having been disrupted by the civil war and the departure of the Portuguese. After 1980, however, a long-term decline in output began. Between 1980 and 1986, real GDP fell by an average 3.5 percent per year (6.0 percent on a per capita basis), as shown in Table 7. The economic crisis can be attributed to several underlying causes. First, reduced rainfall in the

Table 7 — Mozambique: Macroeconomic Summary

	1980-86	1987-91	1992
GDP Growth			
Average	-3.5	3.6	-9.4
End of period	1.8	0.8	
Per Capita GDP Growth			
Average	-6.0	0.8	-11.9
End of period	-0.9	-1.9	
Agriculture (Growth)			
Average	0.5	2.4	-0.2
End of period	0.9	11.2	
Industry			
Average	-5.5	1.4	-3.1
End of period	9.2	2.8	
Investment (Growth)			
Average	0.3	9.9	3.0
End of period	51.4	2.0	
Government Deficit/GDP			
Average	17.5	25.0	31.0
End of period	17.7	27.3	
After grants			
Average	15.1	10.2	4.7
End of period	15.3	6.1	
Current Account/GDP			
Average	-17.1	-47.9	-51.1
End of period	-10.8	-52.0	
Exchange rate (MTs/$)	38.8	784.9	2526.0
Inflation rate (CPI)			
Average	22.5	67.1	27.5
End of period	38.7	35.2	

Sources: IMF (1992), World Bank (1991), World Bank (1990), World Bank (1985).

late seventies and then a prolonged drought during the 1982-85 period sharply reduced crop yields. The civil war intensified as well, as the Republic of South Africa increased its efforts to destabilize the Frontline states that were supporting the African National Congress. Drought and the war led to 100,000 deaths from starvation in the early eighties, in addition to 900,000 war fatalities and 3 million displaced persons (Kyle 1991).

Bad policies also contributed to the poor economic performance after 1980. Centralized control over production and distribution, a defining characteristic of Mozambique's socialist development strategy, resulted in inefficient patterns of resource allocation, the emergence of growth-hindering rigidities and the erosion of market institutions. Along with an expansion of the state's role in the economy was a dramatic decline in financial and budgetary discipline. In 1984, aggregate government expenditure accounted for 42 percent of GDP (World Bank 1990). A weak tax base combined with high fiscal expenditures to create an average budget deficit to GDP ratio of 17.5 percent between 1980 and 1986 (Table 7).

Changes in Mozambique's external economic relations contributed to the downturn in economic activity, as well. With increased state control of the economy and a socialist ideology that emphasized greater self-sufficiency, the economy became increasingly isolated from the international economic environment. Not only did this have the effect of limiting the foreign exchange earning capability of the export sector, but import controls and an appreciating real exchange rate created severe price distortions as domestic and world prices diverged. The result was a worsening of the balance of payments, with the current account deficit averaging 17.1 percent of GDP between 1980 and 1986 (Table 7).

The beginnings of a turnaround were visible in 1986. This recovery was fueled by large external resource inflows beginning in 1985. Growth of GDP was 1.8 percent in 1986 due to a small rate of growth in agriculture (0.9 percent) and a strong recovery in industry (9.2 percent) prompted by a foreign-financed 51.4 percent increase in investment. On the external accounts, the ratio of the current account to GDP fell to 10.8 percent, due in part to a foreign exchange induced decline in imports from $606.8 million in 1982 to $463.6 millions in 1986 (World Bank 1990).

MACROECONOMIC REFORMS: 1987-1992

The prolonged economic crisis of the first half of the 1980s convinced Mozambican policy makers that a comprehensive reform program was needed to reverse the declines in economic activity and living standards. One of the more acute macroeconomic aspects of the crisis was a serious foreign exchange constraint and increased reliance on foreign aid to finance imports and investment. Financial assistance in support of the reform package was provided by the International Monetary Fund and the World Bank. The Bank and Fund endorsed the Economic Rehabilitation Program and provided three annual arrangements from the Structural Adjustment Facility, two annual Extended

Structural Adjustment Facility loans, and several Rehabilitation credits from the World Bank that focused on sectoral adjustment.

Apart from the agricultural policy reforms discussed above, the Mozambican government implemented other macroeconomic and sectoral policy reforms.[13] The overall objectives were: (1) to reverse the decline in production; (2) to guarantee a minimum level of consumption, particularly for the most vulnerable segments of the population; (3) to improve the balance of payments and reduce dependence on foreign borrowing; and, (4) to provide the policy and institutional basis for long-run growth. Specifically, several priorities were established within the framework of the Economic Rehabilitation Program adopted in 1987. These included: (1) increasing industrial production to provide inputs into agricultural marketing, import substitution and nontraditional export promotion; (2) rehabilitating industry and infrastructure, much of which was destroyed by the prolonged conflict; (3) rehabilitating and developing the transportation sector (which has been all but devastated by the war); and (4) mobilizing external resources such as grant aid and debt relief.

An array of policies have been proposed and implemented since 1987. To encourage exports, and to stem the inflow of imports at overvalued exchange rates, two large devaluations were carried out in 1987 of 80 and 50 percent each (Kyle 1991). To further promote financial stability and reduce inflation, attempts were made to restore fiscal balance so as to end the need for monetized deficits. This entailed a reorientation of government budgets towards the family farm sector and the rehabilitation of existing projects.

Table 7 shows that the implementation of the Economic Rehabilitation Program in 1987 resulted in a gradual turnaround in the economy. Total and per capita real GDP grew, on average, at 3.6 and 0.8 percent, respectively, between 1987 and 1991. Gross output in agriculture grew at 2.4 percent per year, led by a recovery of production in the family and private commercial farm sectors. At the microeconomic level, higher real producer prices contributed to the restoration of agricultural production, particularly of export crops and maize. Marketed production for maize increased threefold between 1986 and 1989 from 21.5 thousand metric tons to 79.8 thousand metric tons (Kyle 1991). Marketed production grew more modestly for cashew, from 40.1 to 51.3 thousand metric tons between 1986 and 1989, while cottonseed production increased threefold during the 1986-1988 period (Kyle 1991).

Fueled by large foreign aid inflows, investment growth averaged 9.9 percent during the 1987-1991 period. While the ratio of the government budget deficit to GDP continued to grow during the reform period, foreign aid grants financed a large share of the deficit. The deficit to GDP ratio averaged 25 percent before grants, yet only 10 percent after accounting for foreign aid. The government was obliged to cover after-grant deficits with foreign borrowing given a commitment to reduce domestic financing.

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[13] For further elaboration on the ERP, see World Bank (1990), Chapter 2.

Mozambique's external accounts improved slightly throughout the 1987-1991 period, reflecting a recovery in exports. Exports grew, on average, 15.9 percent per year (in dollar terms), while imports (mostly aid-financed) grew 10.7 percent per year. Because imports were on average 6.8 times the value of exports, the slower growth of imports was insufficient to stop an increasing current account deficit which averaged 47.9 percent of GDP over the period (52 percent in 1991 alone). Figure 4 demonstrates the recovery in exports and the aid-financed surge in imports, both of which directly and indirectly contributed to GDP growth. The recovery of exports was marked by a significant increase in nontraditional exports. However, prawns and cashews remained the principal export products. As the bulk of Mozambique's current account deficit is financed by aid, import capacity is highly sensitive to the realization of donor commitments. In 1988, external aid accounted for 79.3 percent of aggregate foreign exchange inflows — compared to ratios of 13 percent for Zimbabwe, 25.9 percent for Kenya, and 51.9 percent for Tanzania (World Bank 1990).

Addressing the experience of the past decade from a sectoral standpoint, there were across the board declines from the late 1970s until 1986 when positive growth rates were recorded for construction and transportation. There have been positive growth rates for agriculture, industry and services since 1987 (despite temporary declines for construction and transportation in 1987, with a subsequent recovery in 1988 and 1989).

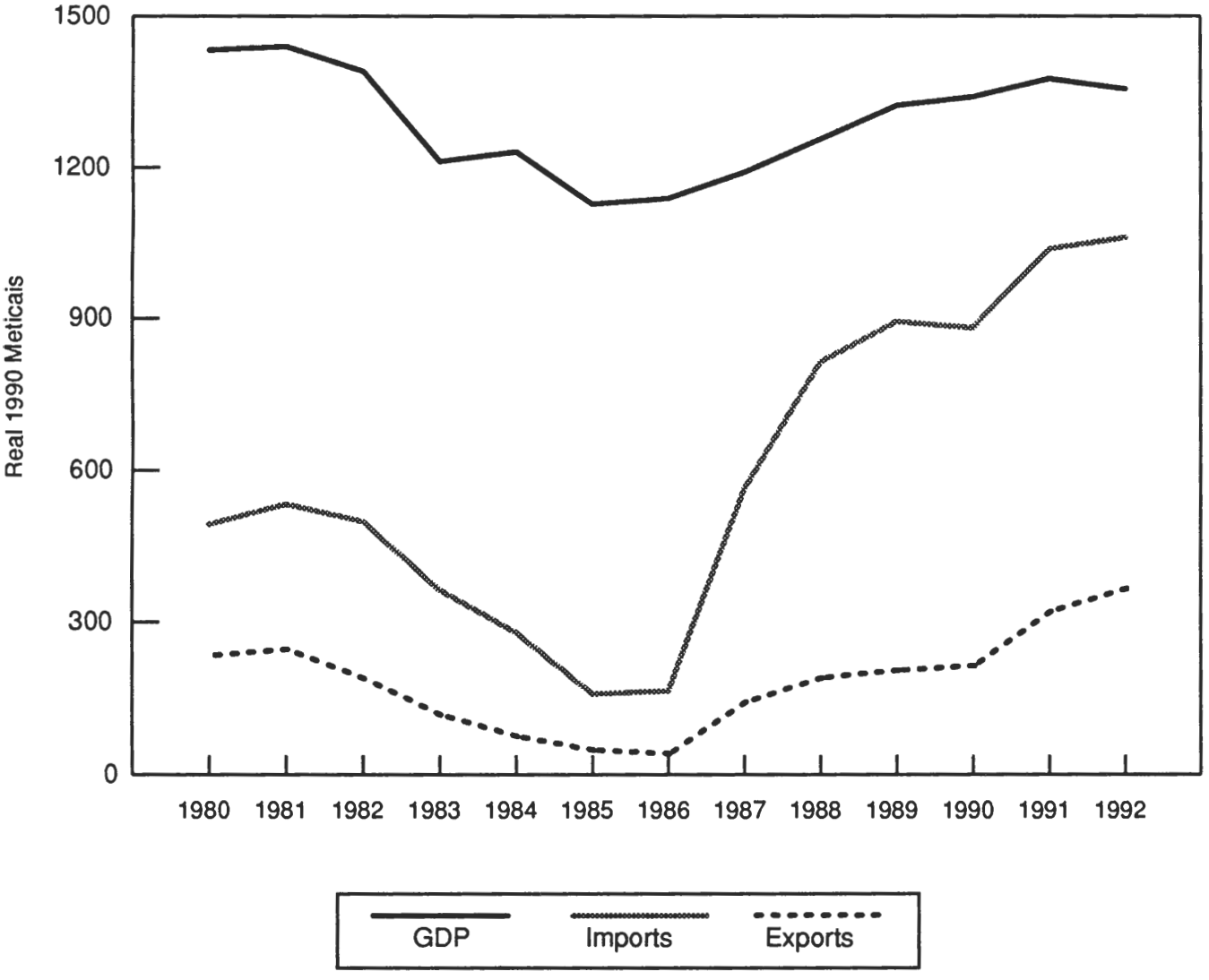
In other sectors of the economy, the declines in production have been slowed or even reversed. Gross output in industry grew 1.4 percent per year. However, industry remained dependent on imported inputs which are contingent on sufficient access to foreign exchange.

The data for 1992 show the effects of that year's drought. The government believed that increased food imports would be financed by aid inflows with no net balance of payments effect. However, shortfalls in foreign aid inflows due to delay resulted in reduced foreign exchange availability for nonfood imports and contributed to a contraction of the economy (IMF 1992). In addition food shortages caused increased inflation. Real GDP declined by 9.4 percent in 1992 (11.9 percent per capita).

SUMMARY

This chapter provided an overview of the major macroeconomic issues that confronted policy makers during the 1980s, and outlined the major policy responses undertaken to promote recovery and long-run growth. A central conclusion is that remarkable progress was made in reducing distortions in the macroeconomy through liberalization, devaluation, and sectoral adjustment, which resulted in a positive growth performance in the between 1987 and 1991. The downturn in 1992 resulting from drought only underlines the extent to which Mozambique's fragile economy is dependent on exogenous factors. The fact that such extensive policy reform did take place raises important questions about the effects of liberalization, devaluation, and food aid and other capital inflows,

Figure 4 — Mozambique: Trade and GDP, 1980-1992



on both economic recovery and poverty alleviation. The remainder of this report addresses these questions from a more analytical perspective, beginning in Section 5 with an analysis of the linkage between foreign aid inflows, the real exchange rate and agricultural price incentives. The multi-market model presented in Sections 6 and 7 provides a more comprehensive approach to analyzing policy and external shocks on agricultural commodities considering supply, demand, trade and incomes.

5. FOREIGN AID INFLOWS, THE REAL EXCHANGE RATE, AND AGRICULTURAL PRICE INCENTIVES

Prior to the agricultural marketing liberalization of 1986, agricultural prices in Mozambique were set without reference to border prices and foreign trade was monopolized by state marketing agencies. With the recent liberalization of agricultural markets and external trade, agricultural prices will be increasingly determined by border prices. Movements in the world prices of maize, rice, cotton and cashew, along with macroeconomic policies affecting the real exchange rate such as the level of foreign aid flows, will more directly affect farmgate prices.

In this chapter, a framework for analyzing the effects of changes in foreign aid inflows on the real exchange rate is presented. Equilibrium real exchange rates under alternative scenarios then are estimated. The real exchange rate analysis will form one component of the model simulations in Section 7.

REAL EXCHANGE RATES

The real exchange rate, the relative price of tradable and nontradable goods, is a key determinant of economic incentives throughout an economy. Unlike the nominal exchange rate, however, the real exchange rate is not an exogenous policy variable, but is itself determined by a combination of other policies and external factors, including fiscal and trade policies, the external terms of trade, and the level of foreign capital inflows. As government policies and external conditions change, there are likely to be substantial changes in Mozambique's real exchange rate and, unless countervailing measures are put into place, changes in the incentive structure of the economy. In particular, this chapter focuses on the effects of a decline in the level of foreign capital inflows and changes in trade policies.

The Real Exchange Rate: Basic Definitions

The real exchange rate (*RER*) can be expressed as:

$$RER = PT / Ph = E * PT^{w} / Ph, \qquad (5.1)$$

where PT is the price of tradable goods, Ph the price of nontradable (home) goods, PT^{w} is the world price of tradable measured in foreign currency and E is the nominal exchange rate expressed in units of domestic currency per foreign currency.

When there are trade taxes or changes in the terms of trade, it becomes useful to distinguish between real exchange rates for imports (RER_m) and exports (RER_x) where

$$RER_m = PM/Ph = E * PM^w * (1 + t_m) / Ph \quad (5.2)$$

and

$$RER_x = PX / Ph = E * PX^w * (1 - t_x) / Ph, \quad (5.3)$$

where *PM* and *PX* are the domestic prices of imports and exports, respectively, the superscript *w* denotes world prices expressed in foreign currency, and t_m is the import tariff and t_x is the export tax as a percentage of fob (free on board) value.

Empirically, the nominal exchange rate deflated by an index of domestic prices of nontraded goods (usually the consumer price index [CPI]) is a simple measure of the real exchange rate that does not reflect the roles of trade policy or changes in world prices (*RER = E/CPI*). This measure reflects changes in the real exchange rates for imports and exports if changes in world prices and trade taxes are negligible in comparison with movements in the nominal exchange rate and the domestic price level.

Table 8 shows the real exchange rate for Mozambique from 1976 to 1992 calculated using the official nominal exchange rate and the consumer price index. Mozambique maintained a nearly constant nominal exchange rate vis à vis the U.S. dollar between 1976 and 1980, and with relatively low inflation, the real exchange rate hardly changed, appreciating slightly. Between 1980 and 1986, there was a 24.7 percent nominal depreciation, and with the price level increasing 221.9 percent, the real exchange rate appreciated by 61.2 percent. The government began a series of large nominal devaluations in 1987, with an initial devaluation in 1987 of over 600 percent. By 1992, the nominal exchange rate, in meticais per dollar had risen to a level 8.7 times the 1987 rate. Despite an equally large increase in the price level (the CPI having risen 433 percent between 1987 and 1992), the real exchange rate depreciated by 63.8 percent between 1987 and 1992.

The above measure of the real exchange rate does not accurately reflect relative prices for many transactions because of widespread parallel markets in foreign exchange coupled with quotas on imports.[14] With demand for foreign exchange at the official price far exceeding supply of foreign exchange available for imports (or capital flight), parallel market exchange rates were 186 percent higher than the official exchange rate in the early eighties (1980-1983 average), testifying to the huge rents associated with the import licensing system.

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[14] Until the trade liberalization of 1992, foreign exchange for imports was allocated through the system of import licensing.

Table 8 — Mozambique: Official and Parallel Exchange Rates

	Official Exchange Rate		Parallel Exchange Rate	
	Nominal	Real	Nominal	Real
1976	31.4	102.7	300.0	397.3
1977	32.2	103.3	300.0	389.6
1978	32.9	104.4	100.0	128.6
1979	32.7	101.9	90.0	113.6
1980	32.4	100.0	80.0	100.0
1981	35.4	105.1	75.0	90.3
1982	37.8	95.2	—	—
1983	40.2	90.7	160.0	146.2
1984	42.4	83.4	1450.0	1153.7
1985	43.2	57.4	1750.0	942.5
1986	40.4	38.8	1950.0	757.2
1987	289.4	105.4	975.0	143.8
1988	528.6	128.2	1000.0	98.2
1989	745.0	129.1	1275.0	89.5
1990	929.1	109.4	2177.0	103.8
1991	1434.5	125.0	2199.5	77.6
1992	2526.0	172.6	2962.5	82.0

Sources: World Bank (1985), IMF (1992), Cowitt (1989), and Tarp (1990).

Note: "—" Not available.

Since liberalization of imports and foreign exchange, the exchange rate is more or less market determined. But there is an important sense in which it is still not in equilibrium. Despite the massive devaluations of the metical in recent years, Mozambique's trade deficit remains large, financed by capital inflows. It is likely that in the future as the economy recovers, foreign aid and net capital inflows may decrease. Should this happen, a depreciation of the real exchange rate will be required to equilibrate supply and demand for foreign exchange. Two methods by which this anticipated real exchange rate depreciation can be measured are described below.

ELASTICITIES APPROACH

The elasticities approach uses price elasticities of demand for imports and elasticities of supply of exports to estimate interactions between exchange rates, trade policy, and the trade balance. Supply of exports and demand for imports are assumed to depend only on nominal prices, and cross-price effects do not exist. The approach is straightforward: a change in the (nominal) exchange rate raises the price of exports and imports, inducing a decline in import demand and an increase in export supply according to the relevant elasticities.

Defining the trade balance (in foreign currency terms), B as

$$B = PX^{w} * X - PM^{w} * M \tag{5.4}$$

and assuming that world prices of importables and exportables are fixed, the change in the trade balance dB due to a devaluation is:

$$dB/dE = (1/E) * PX^{w} * X * \epsilon_{x} - PM^{w} * M * \epsilon_{m}, \tag{5.5}$$

where ϵ_{x} is the elasticity of supply of exports and ϵ_{m} is the (compensated) price elasticity of demand for imports.[15]

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[15] From the definition of the trade balance, B:

$$dB/dE = PX^{w} * (dX/dPX) * (dPX/dE) - PM^{w} * (dM/dPM) * (dPM/dE)$$

Multiplying the first term by (X * E)/(X * E) and the second term by (M * E)/(M * E)

gives:

$$dB/dE = PX^{w} * (dX/dPX)\ PX^{w}\ (E * X)/(E * X) - PM^{w} * (dM/dPM)\ PM^{w}\ (E * M)/(E * M)$$
$$= PX^{w} * X * (dX/dPX)\ (PX^{w} * E/X)\ (1/E) - PM^{w} * M * (dM/dPM)\ (PM^{w} * E/M)\ (1/E)$$

(continued...)

THE ROLE OF NONTRADED GOODS

Nontraded goods are left in the background in the elasticities approach. Implicitly, some nominal variable is held fixed, so that changes in the nominal exchange rate and nominal prices of importables and exportables translate into changes in relative prices. (If all nominal prices and incomes in an economy increase by the same percentage, there would be no change in relative prices and in theory, no change in any real variables.)

Dornbusch (1975) presents an explicit formulation for nontraded goods and the real exchange rate for the elasticities approach.[16] Assuming that the price of nontraded goods is held constant (or is used as the numeraire) and that exportables are not consumed domestically, the effect on the trade balance, given fixed world prices as above is:

$$dB/dE = (1/E) * (PX^w * X * \epsilon_x - PM^w * M * [\epsilon_m^* + \eta_m]) / (1 - a\eta_m), \qquad (5.6)$$

where ϵ_m^* is the compensated price elasticity of demand for imports, η_m is the income elasticity of demand for imports and a is the budget share of imports in total demand, $a = M/Y$. The term $a\eta_m$ is thus equal to the marginal propensity to consume imports, $\partial M/\partial Y$ or m:

$$a * \eta m = M/Y\ (\partial M/\partial Y)\ (Y/M) = \partial M/\partial Y = m \qquad (5.7)$$

Thus, the total effect of the exchange rate change is determined by the total price elasticity of demand for imports, $\epsilon_m = \epsilon_m^* + \partial_m$, and the marginal propensity to consume importables out of total income. Equation 5.6 reduces to equation 5.5 when m equals zero and the total price elasticity of demand is used in the denominator.

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[15](...continued)

Since by definition, $\varepsilon_x = (dX/dPX)\ (PX/X)$ and $\varepsilon_x = (dX/dPX)\ (PX/X)$ we have:

$$dB/dE = (1/E) * (PX^w * X * \epsilon_x - PM^w * M * \epsilon_m)$$

Note that the change in the trade balance expressed in local currency is:

$$\begin{aligned} d(B * E)/dE &= B + E * dB/dE \\ &= (PX^w * X - PM^w * M) + (PX^w * X * \epsilon_x - PM^w * M * \epsilon_m) \\ &= PX^w * X * (1 + \epsilon_x) - PM^w * M * (1 + \epsilon_m) \end{aligned}$$

[16] See Appendix 2 for a formal presentation of the effects of a change in foreign capital inflows on the real exchange rate.

The above adjustment for income effects is especially important for the case of Mozambique since foreign aid funds a large share of national expenditures and because the marginal propensity to consume imports out of foreign aid is high.[17] In other words, foreign aid-financed imports do not simply substitute for imports that would otherwise be imported commercially.

Aid financed imports can potentially have another effect: they may supply intermediate and capital goods which can increase current and future domestic production and real incomes. The level of foreign capital inflows may be especially critical for firms accustomed to preferential access to foreign exchange in the transition from a controlled economy to a liberalized market economy. To fully model these effects, however, would require a more complete specification of domestic production, including intermediate input use.

EMPIRICAL ESTIMATES

Table 9 presents estimates of the effects of a reduction in foreign capital inflows on the equilibrium real exchange rate using the simple elasticities approach. The base levels for the calculations are the 1991 levels of imports and exports; the real exchange rate depreciations shown correspond to a reduction in foreign capital inflows by 61 percent, from 51 percent to 20 percent of 1992 GDP. Ideally, the import demand and export supply elasticities would be estimated econometrically, but detailed data on trade flows, tariffs and domestic prices (with which to estimate implicit tariffs) are not available. As an alternative, sensitivity analysis is performed using a range of parameter values reported for econometric estimates for developing countries (Khan and Reinhart 1990). Price elasticities of import demand are varied from 0.1 to 0.5 and a conservative range of export supply elasticities (0 to 1.0) is chosen.[18]

The table illustrates two major points. First, the effects of changes in the export supply elasticity are smaller than the effects of changes in the price elasticity of import demand. This is because the level of imports, equal to 78.1 percent of GDP in 1991, is much larger than the level of exports (27 percent of GDP in 1992) (See Figure 4). Second, with income effects of a reduction in capital inflow not fully accounted for, the required depreciation of the real exchange rate is very large. Using the mid-range value for the price elasticity of import demand of 0.3 and a conservative estimate of the export supply elasticity of 0.7, reductions in foreign capital inflows from 51 to 20 percent of GDP would result in a real depreciation of 74 percent, holding trade policy and other factors constant.

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[17] The degree of substitutability of foreign aid financed imports for commercial imports is also a key parameter in analysis of the effects of counterpart funds on the money supply and inflation. See Roemer (1989).

[18] Khan and Reinhart (1990) report a range of 0.7 to 1.3 for econometrically estimated export supply elasticities.

Table 9 — Mozambique: Real Exchange Rate Depreciation Resulting from Reduced Capital Inflows

	Import Demand Elasticity		
	0.1	0.3	0.5
	(Percent depreciation)		
Export supply elasticity			
0.0	398	133	80
0.3	196	99	66
0.7	117	74	54
1.0	89	62	47
Memorandum items:			
Target trade deficit/GDP:	0.2		
1992 Exports:	721	billion Mt	
1992 Imports:	2086	billion Mt	
1992 GDP:	2670	billion Mt	
Trade Deficit/GDP:	0.511		

Source: IMF (1992) and authors' calculations.

Table 10 shows the changes in the real exchange rate when income effects of a decline in capital inflows are more fully taken into account. Compensated price elasticities of import demand vary from 0.1 to 0.3 and export supply elasticities range from 0.7 to 1.3. Marginal propensities to import (out of additional income) also vary, from 0.4 to 0.6.[19] Again, no change in trade policy (implicit tariff rates or export taxes), is modeled. The implied import demand elasticities for the various combinations of compensated price and income elasticities are shown in Table 11.

The values in the first row of Table 10 (with the marginal propensity to import equal to zero), replicate results using the simple elasticities approach. As before, the depreciation resulting from the reduction in capital inflows with price elasticities of export supply and import demand equal to 1.0 and 0.3, respectively (the elasticity case), is 62 percent.[20] At the other extreme, if the marginal propensity to import out of foreign capital inflows is unity, then a cutback of foreign aid inflows will require no real exchange rate depreciation, since imports will drop the same amount as capital inflows with no price adjustment necessary. This is the case where the imports financed by foreign aid are totally nonsubstitutable for other commercial imports. Marginal propensities to import are typically 0.2 to 0.3, but given the large share of imports in total expenditures in Mozambique (52 percent in 1992), the marginal import propensity is likely to be larger, on the order of 0.4 to 0.6.[21]

Given the above range for marginal import propensities, the real exchange rate depreciation required to restore equilibrium with a reduction in capital inflows to only 20 percent of 1992 GDP ranges from 25 percent with relatively elastic export supply and import demand to 117 percent under assumptions of highly inelastic price responsiveness. Using the mid-range μestimates for price elasticities and a marginal propensity to import of 0.5, the required depreciation is 45 percent.[22]

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[19] Khan and Reinhart (1990), report ranges of compensated price elasticities of import demand of 0.1-0.5, and 0.7-1.3 for export elasticities of demand. Reported income elasticities of import demand range from 0.7 to 1.3.

[20] Note that the compensated and uncompensated elasticities price elasticities of import demand are equal in this case, since the marginal propensity to import (and therefore the income elasticity of demand) are zero.

[21] The marginal propensity to import $\partial M/\partial Y = (\partial M/\partial Y)(Y/M)(M/Y) = \eta * a$, M is imports, Y is income or expenditures, η is the income (expenditure) elasticity of import demand $(\partial M/\partial Y) * (Y/M)$, and a is the average budget share (M/Y). Given $a = M/Y = 0.5$, and η between 0.9 and 1.3, m is 0.45 to 0.65.

[22] Note that the implied price elasticity of import demand is high (0.7, on the upper end of the reported range of 0.4-0.7), despite a conservative estimate of 0.2 for the compensated price elasticity of import demand because of the large marginal propensity to import (0.5).

Table 10 — Mozambique: Real Exchange Rate Depreciation Resulting from Reduced Capital Inflows (including income effects)

	Elasticities		
	Low	**Medium**	**High**
	(Percent depreciation)		
Marginal propensity to import ($\partial M / \partial Y$)			
0.0	196	90	62
0.4	117	54	37
0.5	98	45	31
0.6	78	36	25
Memorandum items:			
Target trade deficit/GDP 0.2			
Low elasticities: Export supply elasticity (ϵ_s) = 0.3,			
Import price elasticity (compensated) η_m^* = 0.1			
Medium elasticities: (ϵ_s) = 0.7, η_m^* = 0.2			
High elasticities: (ϵ_s) = 0.1, η_m^* = 0.3			

Source: IMF (1992) and authors' calculations.

Table 11 — Mozambique: Total Price Elasticities of Import Demand

Marginal Propensity to Import ($\partial M / \partial Y$)	Compensated Price Elasticity		
	0.1	0.2	0.3
0.0	0.1	0.2	0.3
0.4	0.5	0.6	0.7
0.5	0.6	0.7	0.8
0.6	0.7	0.8	0.9

Source: Authors' calculations.

Of course, a cutback in foreign aid inflows of this magnitude (as well as the large real exchange rate depreciation) imply massive changes in the economy which are by no means captured in a simple model based on trade elasticities. The parameter estimates chosen are borrowed from other developing countries and in general are estimated from considerably smaller changes in prices, imports and exports than those assumed here. A recovery in domestic production after peace is established would itself bring about significant changes in the economy. Nonetheless, the point of this exercise is to understand the direction and broad magnitudes of changes in real exchange rates under various scenarios. Despite the uncertainties regarding parameters and supply effects, it is clear that a cutback in foreign aid inflows without other changes in policy or external conditions would lead to substantial real exchange rate depreciation, perhaps on the order of thirty percent or more.

6. THE MULTI-MARKET MODEL

The analysis of the impact of policy and external shocks on agricultural commodities involves consideration of supply, demand, trade, and incomes. While this analysis is sometimes done separately for individual commodities, there are often important interactions between commodities on both the supply and demand side that make it important to conduct the analysis in a multi-commodity framework.[23] The multi-market model summarized here (and shown in detail in Appendix 3) is designed to capture the major interactions across commodity markets and thus provide an appropriate analytical framework for Mozambican agricultural and food policy.

MODEL STRUCTURE

Eight commodities are included in the model: yellow maize, white maize, rice, wheat, export crops and vegetables (including fruits, roots and tubers, and pulses), meat (including fish and other food not listed above), and nonagriculture. All are produced domestically except yellow maize and wheat, and all are traded internationally, although trade in vegetables and meat is very small and is fixed exogenously in the model. Households are divided into three groups: Maputo nonpoor, Maputo poor, and "rural" (the rest of the population of the three southern provinces of Maputo, Inhambane and Gaza).

The model determines the level of domestic production of agricultural commodities given rural prices; nonagricultural production is fixed exogenously. Rural prices are linked to urban consumer prices by a fixed marketing margin.[24]

Consumption of both urban and rural households is a function of household income and consumer prices. (For rural households, the consumer price is equal to the producer price). Nonagricultural output is fixed and nonagricultural income varies with the price of nonagricultural goods in the model.[25] Agricultural incomes are determined by quantities produced and producer prices.

The method by which prices are obtained varies according to whether the commodity is traded or nontraded. For traded goods, the domestic price level is

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[23] See Braverman and Hammer (1986) for a formal presentation of a multi-market model in another African context.

[24] The marketing margin is fixed as a constant percentage markup between rural and Maputo prices.

[25] An alternate assumption would be to fix non-agricultural income in real terms, with the overall price level used as the deflator.

determined by world prices and the exchange rate. Net imports adjust so that total supply equals demand.[26] For nontraded goods (vegetables and meat), net imports are set to the base level of imports (equivalent to 20.8 percent of consumption) and the model solves for the consumer price that clears the market, equating supply and demand.

For traded goods, consumer prices are linked to border prices by the exchange rate, tariffs, marketing costs and, in cases where the official consumer price is fixed, rents. For commodities where the level of net imports is not fixed, rents are zero and the consumer price is determined by the border price. The level of net imports adjusts to equate supply and demand. For yellow maize, which is imported in fixed amounts under foreign aid agreements, the quantity of net imports is fixed, the consumer price adjusts to equate supply and demand, and rents are earned by those able to buy at the official border price and sell at the market clearing price.

The numeraire of the model is the price index of nontraded goods, PNT, which is computed from the price of nontraded agriculture (vegetables and meat) and nontraded nonagricultural goods. The exchange rate adjusts so that exogenous foreign capital inflows equal the excess of import demand over export supply. Given the fixed price index of nontraded goods, PNT, the nominal exchange rate is equivalent to the real exchange rate.

BASE DATA

The base data for the model consist of levels of consumption expenditures by households, production, trade and prices for the eight commodities included.

Base data for expenditures of urban households derive directly from the 1991-1992 FSC/CFNPP household survey of Maputo as the product of per capita

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[26] World prices are themselves endogenous, depending on the choice of elasticity of export supply parameter. An export supply function from the rest of world is included, with Mozambique's import price (PW_i) positively related to the level of its imports (M_i), reflecting higher marketing costs associated with smuggling larger quantities of goods across borders:

$$M_i = MO_i * (1 + \epsilon_{mi} * [PW_i / PWO_i - 1])$$

For goods which are traded freely on international markets, such as export goods and rice, the elasticity of export supply ϵ_{mi} is made very large, so that the world price is essentially fixed. For goods such as white maize which is traded across land borders, this elasticity may be less than infinity, but still greater than zero. In all the simulations presented in Chapter 7, ϵ_{mi} is made very large and world prices are exogenous.

values and quantities[27] and an assumed population of 1.5 million. A poverty line of 31,904 meticais per capita (del Ninno and Sahn 1993), is used to distinguish between nonpoor and poor households. In constructing the base data for the multi-market model, average prices for all Maputo are used rather than household specific prices for nonpoor and poor households.

Quantities consumed by rural households are considerably less certain. Consumption of white maize and rice are based on estimates for rural production less marketings (assumed to be zero for white maize). Per capita rural consumption of wheat products and yellow maize is assumed to equal that for the urban poor. Nonfood expenditures are estimated as 25 percent of total expenditures. Other food, both vegetables (including pulses and roots) and meat, are the residual item, with the share of meat in other food equal to its share for the urban poor (25 percent). In general, rural consumption is valued at the producer price.[28] Rural incomes are estimated as the value of own-production food, production of export crops (mainly cashews, but small amounts of cotton and copra), and nonagricultural incomes (assumed to equal 30 percent of total incomes). Rural savings are assumed to be zero.

The resulting household expenditure shares are given in Table 12. Incomes of rural households are estimated at 51,400 meticais per person, less than 20 percent of per capita incomes of the urban poor in the Maputo survey. The very low figure for the rural poor is in part explained by the lower food prices in rural areas (which determine the value of food consumed from own-production, a major source of imputed incomes). As shown in Table 13, the estimated per capita consumption of major grain staples and cassava in rural areas is over half that of the urban poor. Consumption of groundnuts and beans, major crops (along with white maize) in the farming systems of the region, likely accounts for a significant share of calories for rural households to compensate for the low grain consumption. Nonetheless, even though the estimates of the value of expenditures may overstate the gap in incomes between rural and urban households, there is near universal agreement that in fact rural households are considerably poorer than their urban counterparts, a fact reflected in the expenditure estimates.

Commodity Flows

Production, trade and total consumption of each commodity are given in Table 14. Production data are Ministry of Agriculture estimates; producer prices are

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[27] Quantities consumed of flour, bread, and pasta are converted to grain equivalents.

[28] Rural consumption of imported goods is valued at the urban (c.i.f.) price plus a 100 percent marketing margin.

Table 12 —Mozambique: Household Expenditure Shares

	Maputo Nonpoor	Maputo Poor	Maputo Total	South Rural	Mozambique Rural	Mozambique Total
Yellow maize	2.1	10.2	3.5	6.3	6.4	4.8
White maize	2.3	3.9	2.6	9.7	8.1	5.0
Rice	6.7	8.6	7.0	1.9	3.4	5.4
Wheat	7.4	8.7	7.7	9.2	9.4	8.4
Subtotal grains	18.5	31.4	20.8	27.1	27.4	23.7
Vegetables, roots	28.2	26.5	36.2	35.8	53.6	49.6
of which cassava	0.0	0.0	0.4	14.5	48.0	21.3
Meat, other food	18.1	19.4	12.2	12.1	n.a.	n.a.
Nonfood	35.5	20.1	32.9	25.0	18.9	26.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total (thousand meticais per person)	865.4	272.0	629.1	51.4	50.4	104.0

Note: Vegetables, roots includes fruits, pulses, sugar and oil, as well. Meat and other food included under vegetables and roots for rural and all Mozambique figures.

Source: Cornell household survey, Mozambique unpublished national accounts tables, and author's calculations.

Table 13 —Mozambique: Per capita consumption of staples (kilograms grain equivalent per year)

	Maputo Nonpoor	Maputo Poor	Maputo Total	South Rural	Mozambique Rural	Mozambique Total
Yellow maize	41.7	65.3	51.1	17.1	17.1	20.2
White maize	31.5	16.6	25.6	26.3	21.6	22.0
Rice	52.2	20.9	39.7	2.6	4.7	7.9
Wheat	59.0	21.8	44.2	3.6	3.6	7.4
Total grains	184.4	124.6	160.6	49.7	47.0	57.5
Cassava			0.37	18.6	60.5	55.2
Total	184.4	124.6	161.0	68.3	107.5	112.7
Population (mns)	1.5	0.9	0.6	3.0	14.7	16.2

Note: Cassava in grain equivalents, estimated as fresh root weight divided by 3.51. (Conversion factor from FAO Food Balance Sheets, computer printouts.)

Source: Cornell household survey, Mozambique unpublished national accounts tables, IMF (1992) and author's calculations.

Table 14 —Mozambique: Base data on Supply and Demand, 1991

	Domestic Production	Imports	Marketing	Total Supply	Maputo Nonpoor	Maputo Poor	Maputo Total	Rural South Consumption	Total Demand
Value(10^9 Mt)									
Yellow maize	0.00	49.12	3.94	53.06	15.62	16.15	31.77	21.29	53.06
White maize	15.07	16.97	7.67	39.70	18.29	6.35	24.64	15.07	39.70
Rice	3.72	42.31	26.22	72.25	54.80	14.54	69.34	2.91	72.25
Wheat	0.00	43.90	43.90	87.79	63.35	15.47	78.82	8.97	87.79
Vegetables	150.52	79.80	91.32	321.64	207.38	58.86	266.24	55.40	321.64
Meat	91.61	26.67	71.64	189.92	151.32	19.90	171.22	18.70	189.92
Export crops	4.80	-10.08	5.28	0.00					
Nonfood	46.50	1076.70		1123.20	277.70	32.60	310.30	38.70	1123.20[c]
TOTAL	312.22	1325.38	249.96	1887.56	788.45	163.88	952.33	161.04	1887.56[c]
Quantity (1,000 Mt)									
Yellow maize	0.0	128.1		128.1	37.7	39.0	76.7	51.4	128.1
White maize	79.3	38.4		117.7	28.5	9.9	38.4	79.3	117.7
Rice	10.1	57.4		67.5	47.1	12.5	59.6	7.9	67.5
Wheat	0.0	106.7		106.7	77.0	18.8	95.8	10.9	106.7

Notes: a Rural South production only.
b Includes marketing margins.
c Includes nonhousehold demand.

Source: Cornell household survey, Mozambique unpublished national accounts tables, IMF (1992) and author's calculations.

from unpublished national accounts worksheets from the Ministry of Plan.[29] Import data for grains are taken from unpublished Ministry of Commerce data on import arrivals by port. The value of imports of other food is estimated to be 0.3 times the value of grain imports.

MODEL PARAMETERS

Three major sets of parameters influence the behavior of the model: own- and cross-price elasticities of demand, income elasticities of demand and supply elasticities.

Demand Parameters

The urban demand parameters derive from econometric estimates of a linear approximation to the AIDS (Almost Ideal Demand System) model using data from the FSC/Cornell University household survey of Maputo (del Ninno and Sahn 1993).[30]

The equation estimated is:

$$w_i = \alpha_i + \sum \gamma_{ij} \ln P_j + \beta_i \ln(X/P) \qquad (6.1)$$

where X is total expenditure, P_j is the price of good j, P is the price index, and w_i is the share of expenditure allocated to good i, ($w_i = P_iQ_i/X$).

For the AIDS model, the price index P is defined as

$$\ln P = \alpha_0 + \sum_j a_j \ln P_j + \tfrac{1}{2} * \sum_i \sum_j \gamma_{ij} \ln P_i \ln P_j \qquad (6.2)$$

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[29] The exception is cassava, for which the average Nampula price (115 Mt/kg) rather than the official price (225 Mt/kg) as in the national accounts was used to value production of the family sector.

[30] The AIDS model is described in further detail in Deaton and Muellbauer (1980a, 1980b).

For the linear approximation to the AIDS model, P is defined as

$$\ln P = \sum_k W_k \ln P_k \qquad (6.3)$$

The uncompensated price elasticities, ϵ_{ij} (that is, the elasticities including both income and substitution effects) from the linear approximate AIDS model are calculated as:[31]

$$\epsilon_{ij} = -\delta_{ij} + \gamma_{ij}/W_i - \beta_i W_j/W_i \qquad (6.4)$$

Del Ninno and Sahn (1993) estimated demand parameters for 11 commodities. For the multi-market model, four of the commodity groups with expenditure elasticities less than one (oil, sugar, and fruits and vegetables, and roots, tubers and pulses) have been aggregated under "vegetables" and two other commodities (meat, fish and dairy, and other foods) have been aggregated as "meat". The aggregate parameters were calculated by summing the econometrically estimated parameters γ_{ij} and β_i and deriving the aggregate elasticities using the new aggregate budget shares. The results are presented in Tables 15 and 16, where a poverty line of 31,904 meticais per capita (del Ninno and Sahn 1993) is used to distinguish between poor and nonpoor households.

Rural demand parameters are equal to those for the urban poor, except for the expenditure elasticity of nonfood which is calculated using the expenditure elasticities for the other food commodities and the estimated budget shares for the rural poor, in accordance with Engel's Law. The estimated price and expenditure elasticities for rural households are presented in Table 17.

Supply Parameters

Due to a paucity of data on supply response in Mozambique agriculture, the matrix of supply elasticities is mainly based on data from other countries and restrictions from economic theory. For white maize, the own-price elasticity of supply of other commodities are chosen to be low in accordance with estimates for other countries (Rao 1989). Own-price elasticities of supply for rice, export crops, and other agriculture are assumed to be 0.25, 0.40, and 0.20, respectively. Cross-price elasticities were chosen so as to respect symmetry of cross-price effects and zero-homogeneity in all prices. The matrix of supply elasticities is shown in Table 18.

A supply elasticity of 0.2, together with the own-price elasticity of demand for white maize (-0.856) and the income elasticity of demand (0.51) from urban poor households, implies a price elasticity of marketed surplus of 3.68. As a consistency check, the following regression of national sales data of maize on

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[31] See Green and Alston (1990).

the official market from 1986 to 1992 was estimated:

$$Q_t = 7.933 + 1.924\ P_t + e_t,\ R2 = 0.495,\ Durbin - Watson\ statistic = (2.214) \qquad (6.5)$$

where Q_t is the natural logarithm official marketed surplus, P_t is the natural logarithm of the producer price, e_t is the error term and the t-statistic is given in parentheses.

The above econometric estimate (1.924) understates the true elasticity of marketed surplus since only official sales are included. Overestimation of the own-price elasticity of demand for white maize or the supply elasticity could also account for the difference in the two estimates.

Table 15 —Mozambique: Urban Nonpoor Demand Elasticities

Quantity	Yellow Maize	White Maize	Rice	Wheat	Vegetables	Meat	Nonagri-culture	Income
	Price							
Yellow maize	0.000	0.026	0.280	0.058	0.581	0.347	0.253	-1.545
White maize	-0.046	-0.826	0.020	0.065	0.255	-0.077	0.214	0.394
Rice	0.022	-0.011	-0.672	0.141	-0.232	-0.276	-0.023	1.051
Wheat	-0.070	0.008	0.145	-1.073	-0.050	-0.084	0.223	0.902
Vegetables	0.021	0.036	-0.042	0.019	-0.545	-0.009	0.089	0.431
Meat	-0.043	-0.045	-0.165	-0.092	-0.225	-0.639	-0.293	1.504
Nonagriculture	-0.088	-0.013	-0.029	0.007	-0.143	-0.097	-0.975	1.338

Table 16 - Mozambique: Urban Poor Demand Elasticities

Quantity	Yellow Maize	White Maize	Rice	Wheat	Vegetables	Meat	Nonagri-culture	Income
	Price							
Yellow maize	-0.552	0.013	0.080	0.014	0.213	0.034	0.026	0.172
White maize	0.004	-0.856	0.016	0.051	0.232	-0.102	0.145	0.510
Rice	0.019	-0.012	-0.668	0.143	-0.237	-0.276	-0.020	1.052
Wheat	-0.065	0.009	0.152	-1.077	-0.047	-0.097	0.228	0.897
Vegetables	0.054	0.031	-0.034	0.013	-0.617	-0.043	0.045	0.551
Meat	-0.166	-0.095	-0.321	-0.176	-0.491	-0.219	-0.514	1.980
Nonagriculture	-0.138	-0.018	-0.033	0.010	-0.189	-0.078	-0.977	1.423

Table 17 —Mozambique: Rural Demand Elasticities

Quantity	Yellow Maize	White Maize	Rice	Wheat	Vegetables	Meat	Nonagri-culture	Income
	Price							
Yellow maize	-0.552	0.013	0.080	0.014	0.213	0.034	0.026	0.172
White maize	0.004	-0.856	0.016	0.051	0.232	-0.102	0.145	0.510
Rice	0.019	-0.012	-0.668	0.143	-0.237	-0.276	-0.020	10.520
Wheat	-0.065	0.009	0.152	-1.077	-0.047	-0.097	0.228	0.897
Vegetables	0.054	0.031	-0.034	0.013	-0.617	-0.043	0.045	0.551
Meat	-0.166	-0.095	-0.321	-0.176	-0.491	-0.219	-0.514	1.980
Nonagriculture	-0.138	-0.018	-0.033	0.010	-0.189	-0.078	-0.977	1.602

Table 18 —Mozambique: Supply Elasticities

	White Maize	Rice	Export Crops	Vegetables	Meat	Nonagri-culture	Fertilizer
				Price			
Quantity							
White maize	0.200	-0.025	-0.025	-0.100	0.000	-0.050	0.000
Rice	-0.101	0.250	0.000	-0.100	0.000	0.001	-0.050
Export crops	-0.079	0.000	0.400	-0.200	0.000	-0.021	-0.100
Vegetables	-0.024	-0.006	-0.015	0.300	0.000	-0.255	0.000
Meat	0.000	0.000	0.000	0.000	0.100	-0.100	0.000

7. MODEL SIMULATIONS

In this section, a number of simulations using the multi-market model are presented. The first set of simulations examine the effects of increased yellow maize imports, a policy designed to increase food consumption and incomes of the poor in Maputo. Sensitivity analysis of key assumptions in the model structure and parameters are performed to test the robustness of the policy implications. A second set of simulations examine the effects of an urban income transfer, an alternative to food aid as a mechanism to reduce urban poverty. The final three sets of simulations, a real exchange rate depreciation, rural recovery, and a combination of the two, unlike the earlier simulations which focus mainly on Maputo, are regional in scope.

The analysis in this paper is based on data for the period April, 1991 to March, 1992, reflecting the situation following a typical, war-time white maize harvest of 327 thousand tons in 1991/92 and a growing awareness of the impending failure of the harvest for early 1992 (the 1992/93 harvest). Although by mid-1993 conditions had changed substantially in Mozambique due to the end of the civil war, a successful harvest[32] and ill-timed, post-harvest deliveries of food aid to rural areas, the major themes of the 1991/1992 analysis (the self-targeting characteristics of yellow maize, the minimal disincentive effects on white maize production of marginal changes[33] in yellow maize imports sold in Maputo, and the impacts of real exchange rate depreciation and increased production on rural and urban incomes) still apply to the current and likely future situations and will be discussed further in Section 8.

INCREASED YELLOW MAIZE IMPORTS

In Simulation 1a, yellow maize imports destined for the Maputo market are increased by 15 percent over the base 1991 level. It is assumed that these imports are funded through additional foreign aid inflows. Spending of the countervalue funds generated through sales of the yellow maize imports is not taken into account here. Since yellow maize is consumed more by poor households than nonpoor households, and because demand by the urban poor is more price elastic, this policy represents one option for increasing real incomes and food consumption for the urban poor.

The price of yellow maize falls sharply as the 15 percent increase in yellow maize supply is sold on the Maputo market (Table 19). Demand for yellow maize by urban nonpoor households is not very responsive to price changes, (i.e. their

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[32] White maize production in 1993/94 is estimated at 533 thousand tons, 48 percent greater than the average harvest from 1982/83 to 1991/92.

[33] Relative to per capita levels in 1991/1992.

Table 19 —Increased Yellow Maize Imports[a]; Simulation Results

Simulation	1a	1b	1c	1d	1e	1f
			(Percentage change)			
Production						
White maize	0.10	0.07	0.04	0.08	0.07	-0.82
Rice	0.12	0.09	0.16	0.10	0.09	0.60
Export crops	0.23	0.17	0.26	0.18	0.17	0.62
Vegetables	-0.45	-0.36	-0.45	-0.37	-0.36	-0.36
Meat	0.37	0.29	0.38	0.29	0.29	0.31
Consumption						
Yellow maize total	8.98	8.98	8.98	8.98	8.98	8.98
Urban nonpoor	0.82	8.07	0.80	0.56	8.13	3.85
Urban poor	28.71	21.70	28.73	12.50	21.64	11.17
Rural	0.00	0.00	0.00	12.49	0.00	11.08
White maize total	-0.21	-0.13	0.03	-0.36	-2.37	-0.55
Urban nonpoor	1.46	1.17	1.72	0.51	-5.65	0.29
Urban poor	-0.92	-0.68	-0.66	-0.62	-7.38	-0.63
Rural	-0.73	-0.54	-0.49	-0.64	-0.56	-0.84
Rice	-1.77	-1.36	-1.77	-1.11	-1.36	-1.01
Wheat	2.51	1.99	2.51	1.26	1.99	1.14
Nominal incomes						
Urban nonpoor	-0.43	-0.36	-0.42	-0.34	-0.36	-0.28
Urban poor	-0.43	-0.36	-0.42	-0.34	-0.36	-0.37
Rural	-0.40	-0.36	-0.44	-0.38	-0.36	-0.95
Prices						
Yellow maize	-37.07	-30.28	-37.10	-19.63	-30.22	-18.46
White maize	-0.36	-0.36	-0.67	-0.36	-0.36	-4.89
Rice	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
Wheat	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
Vegetables	-1.55	-1.23	-1.58	-1.30	-1.23	-1.62
Meat	3.80	2.94	3.84	2.93	2.93	3.12
Nonagriculture	-0.43	-0.36	-0.42	-0.34	-0.36	-0.36
Real incomes						
Urban nonpoor	0.20	0.19	0.21	0.01	0.19	0.18
Urban poor	3.63	2.96	3.65	1.89	2.95	2.11
Rural	-0.07	-0.06	-0.08	2.53	-0.06	2.30
Rent	-0.32	-0.24	-0.32	-0.13	-0.24	-0.12
White maize imports	-0.86	-0.56	0.00	-1.27	-7.40	0.00

Source: Model simulations.

Notes:

1a. Base Simulation: 15 percent increase in imports sold on the Maputo market. (Econometric estimates for urban household demand parameters.)
1b. Own-price elasticity of demand for yellow maize by urban non-poor households changed from 0.0 to -0.2.
1c. Fixed white maize imports.
1d. Increased rural consumption of yellow maize.
1e. Greater cross-price elasticities of demand between yellow and white maize.
1f. Simulations (1c), (1d) and (1e) combined.

demand is price inelastic), so the increased supply of yellow maize must be consumed almost entirely by the urban poor. The yellow maize market clears with a 37.1 percent decrease in the yellow maize price and a 28.7 percent increase in yellow maize consumption by the urban poor.

Changes in the yellow maize price affect markets for other commodities as well, by increasing the demand for wheat, meat and nonagricultural goods and lowering demand for substitutes for yellow maize: white maize, rice, and vegetables, roots and pulses. Prices of nontradable vegetables, roots, and pulses tend to fall with reduced demand shifting production incentives away from these goods, towards tradable agricultural commodities and nonagricultural production. Production of white maize, rice, and export crops rise slightly (0.1 to 0.2 percent) while production of vegetables, roots, and pulses falls by 0.5 percent.

This gain in production takes place in spite of a small appreciation of the real exchange rate (a reduction in the price of tradables relative to nontradables). Because the cost of the incremental yellow maize imports is small on a macroeconomic scale, 2.1 million dollars,[34] the real exchange rate appreciates by only 0.4 percent. (Although the price of vegetables, roots, and pulses falls, this is outweighed by an increase in the prices of other nontradable goods such as nonagricultural goods and meat.)

The increase in yellow maize imports thus has little effect on the white maize market. The 37.1 percent decrease in the yellow maize price, in itself, leads to only a 0.9 percent decrease in demand for white maize by the urban poor (and a 1.5 percent increase in demand by the urban nonpoor).[35] The small real exchange rate appreciation only slightly lowers white maize prices relative to prices of tradable goods in general. But the decline in the price of vegetables, roots, and pulses as demand shifts towards yellow maize outweighs the effects of the real exchange rate appreciation and actually leads to a slight increase in incentives for production of white maize.

The net effect of the changes in prices and agricultural production is to increase real incomes of the urban poor rise by 3.6 percent, mainly because of lower food prices. Real incomes of the urban nonpoor increase only slightly since these households consume relatively little yellow maize. Because the terms of trade shifts against rural households as the prices of vegetables, roots and pulses and grains fall, real incomes of rural households fall slightly (-0.1 percent).

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[34] The 15 percent increase in yellow maize imports is equal to 11,500 tons of yellow maize, valued at $182.6 per ton c.i.f.

[35] For the urban non-poor, yellow maize is not a substitute for white maize. The cross-price elasticity of white maize demand with respect to the price of yellow maize is negative, but small in absolute magnitude, i.e. demand for white maize rises as the price of yellow maize falls.

SENSITIVITY ANALYSIS

A key parameter determining the extent of a fall in yellow maize prices with additional imports is the own-price elasticity of demand for yellow maize by urban households. Simulation 1b shows the effects of a change in the own-price elasticity of demand for yellow maize by the urban nonpoor from 0.0 in Simulations 1a to -0.2.[36] As demand for yellow maize by the poor becomes price-responsive, their consumption of yellow maize rises by 8.1 percent with the increase in yellow maize supply. Consumption of yellow maize by the poor thus rises less (by 21.7 percent instead of 28.7 percent as in Simulation 1a) and the price of yellow maize falls less steeply (-30.3 percent versus -37.1 percent in Simulation 1a). Since yellow maize is less effectively targeted, real incomes of the urban nonpoor rise by 3.0 percent (compared with 3.6 percent in Simulation 1a). Effects on supply and rural incomes are dampened since the fall in yellow maize prices and the resulting shift in demand away from nontraded food crops are smaller.

Assuming that white maize imports are fixed in the short run (due to problems in information flows or other market imperfections) changes the analysis little (Simulation 1c). The white maize price is 0.3 percent lower than in Simulation 1a as imports are not permitted to fall with the decrease in demand. Production of white maize increases by 0.04 percent compared with a 0.10 percent increase in Simulation 1a.

All of the above simulations have assumed that yellow maize sold in Maputo is consumed only by urban households and does not find its way into rural markets. Relaxing this assumption, Simulation 1d shows the effects of yellow maize being supplied throughout the region so that the same price holds for all consumers. This extreme assumption provides an upper bound for the magnitude of the effects of leakages outside the Maputo market. In practice, if yellow maize were released only in the Maputo market, prices in rural market would be higher than in Maputo due to transport and other marketing costs.

Consumption of yellow maize rises by 12.5 percent for both urban and rural households. Real incomes increase by 2.5 percent for rural households, but the 1.9 percent gain for urban nonpoor households is substantially less than in Simulation 1a (3.6 percent).

Increasing the cross-price elasticities between yellow and white maize has a bigger impact on the white maize market. For Simulation 1e, the adjusted own-

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[36] The income elasticity of demand for yellow maize is also adjusted upward to -1.345 so as to maintain homogeneity of degree 0 in prices and incomes. Engel's Law (the sum of the income elasticities weighted by the budget shares must equal unity) is satisfied by reducing the income elasticity of non-food from 1.338 to 1.321. Finally, zero homogeneity in prices and incomes for non-foods is satisfied by reducing the own-price elasticity from -0.975 to -0.950. With these adjustment, symmetry of the cross-price effects is no longer maintained, however.

price elasticities of demand for yellow maize from Simulation 1b are used, and the cross-price elasticity of demand for white maize with respect to a change in the yellow maize price is increased from -0.046 to 0.150 for the urban nonpoor and from 0.004 to 0.200 for the urban poor.[37]

White maize demand now falls by 2.4 percent, and white maize imports fall by 7.4 percent as urban consumers substitute towards yellow maize. The spillover effects of increased yellow maize imports on the white maize market are still small, however, mainly because Maputo accounts for only a small share (11 percent) of national consumption and 33 percent of regional consumption of white maize. A 10 percent decrease in Maputo's demand for white maize would only represent a 3.3 percent decline in the region's demand for white maize.[38] Moreover, because the white maize price remains tied to world prices, domestic production of white maize is almost unchanged. The change in consumption of yellow maize and real incomes of the urban poor are essentially identical to those in Simulation 1b.

Finally, Simulation 1f shows the combined effects of fixing white maize imports (Simulation 1c), allowing the additional yellow maize imports to be sold in rural areas (Simulation 1d), and using the new parameters from simulation 1e, in order to set an upper bound on the likely disincentive effects on white maize. White maize prices fall 4.9 percent and white maize production falls by 0.82 percent. Consumption of yellow maize by the urban poor and rural households increases by 11.2 and 11.1 percent, respectively, and the 21.0 percent drop in yellow maize price contributes to a 2.1 percent increase in real incomes for the urban poor and a 2.3 percent increase for the rural households.

Thus, under a wide range of assumptions on model parameters and structure, a policy of open market sales of increased yellow maize imports is an effective self-targeting mechanism for increasing real incomes and food consumption of the Maputo poor. The key parameters driving this result are the own-price

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[37] Adjustments to other parameters are also made to maintain symmetry of the cross-price effects and to satisfy Engel's Law. The new elasticities are as follows:

	Urban poor	Urban nonpoor	Rural
ϵ^D (wmz,ymz)	0.200	0.150	0.200
ϵ^D (ymz,wmz)	0.138	0.073	0.138
η^Y (ymz)	0.112	-0.166	0.112
η^Y (wmz)	0.314	0.198	0.314
η^Y (non-agric)	1.463	1.361	1.463

[38] The model here assumes that Maputo is fully integrated only with the Southern region of Mozambique. If white maize from other regions of Mozambique also fed into the Maputo market, the effects of changes in Maputo demand on white maize production would be even smaller.

elasticities of demand for yellow maize, which are larger in magnitude for the poor than for the nonpoor and the relatively small share of Maputo in regional consumption of white maize. Cross-price effects on the white maize market are small, even with a change from the econometrically estimated parameters and fixed white maize imports.

COUNTERVALUE FUNDS AND THE COST OF THE SUBSIDY

Until recently yellow maize has been sold to consignees at below market clearing levels in a misguided attempt to subsidize consumers. The government has sacrificed potential revenues from countervalue funds by selling at a low price yet the subsidy has not reached the intended consumers. Results from the 1991/92 FSA/Cornell household survey of Maputo show, however, that most yellow maize was purchased in the open market (dumbanenge) at an average price of 414.2 Mt/kg, 50.6 percent above the official NSA price of 275 Mt/kg (Sahn and Desai 1993).

Selling yellow maize at a market clearing price would thus increase government revenues from countervalue funds. Paradoxically, there is a tradeoff, between potential countervalue funds and the level of maize imports. As yellow maize imports increase, the open market price (the price paid by consignees) falls, reducing potential countervalue funds.

Table 20 shows the effects of changes in the level of yellow maize imports on the implicit subsidy to yellow maize consumers, potential countervalue funds and the marginal costs and benefits. Costs are measured in two ways. The first measure is simply the c.i.f. value of the yellow maize imports. The second measure of costs is the net financial cost to the government of using yellow maize food aid to reduce urban poverty, equal to the difference between the c.i.f value of yellow maize imports (plus any government costs associated with the sale of the yellow maize to consignees) and the countervalue funds generated. Benefits are measured in terms of the change in real incomes of the target group (the urban poor).

Assuming a 30 percent marketing markup between c.i.f. and retail and a parallel market exchange rate of 2200 meticais/dollar, the observed market price of yellow maize (414.2 Mt/kg) is 16.9 percent below the border price of yellow maize at the retail level (498 Mt/kg). With a 15 percent increase in yellow maize sold in Maputo (Simulation 1a), the market price falls by 18.5 percent to level 47.7 percent below the border price. Potential countervalue funds are now 34.1 billion meticais, a decrease of 6.8 billion meticais from the base level potential countervalue funds. The decrease in potential countervalue funds occurs despite an increase in maize sold because with a price-inelastic demand, the percentage fall in market price (-18.5 percent) is greater than the percentage increase in total sales in Maputo (15.0 percent). The 15 percent increase in imports (11,500 tons) has a CIF value of 4.4 billion meticais (2.1 million dollars). With the marginal increase in real incomes of urban poor

Table 20 —Benefits and Costs of Increased Food Aid to Maputo

	Change in Yellow Maize Imports	
	10 percent	15 percent
CIF value of imports (bn meticais)	52.06	53.53
Countervalue funds (bn meticais)	35.9	34.1
(change)	-4.9	-6.8
Price subsidy to consumers with respect to border price	39.7	47.7
Change in real incomes of the urban poor		
(billion meticais)	4.34	5.90
(percent change)	2.7	3.6
Marginal cost		
(import cost, CIF, million dollars)	1.40	2.10
(import cost, CIF, billion meticais)	2.94	4.41
(financial cost, billion meticais)	4.94	6.75
Benefit/cost ratios		
Real incomes/import cost	1.47	1.34
Real incomes/financial cost	0.88	0.87

Source: Model simulations.

households equal to 5.9 billion meticais, the marginal benefit/cost ratio is 1.34.

In terms of the financial cost to the government, the marginal cost of the 15 percent increase in yellow maize sold in Maputo is 6.75 billion meticais, as the potential countervalue funds fall from 40.81 billion meticais historically to only 34.06 billion meticais with higher yellow maize sales. The drop in total countervalue funds occurs because the government receives less money on all its sales of yellow maize, not just on the additional 15 percent. In terms of real incomes, the marginal benefits to urban poor households of 5.90 billion meticais are equal to 87 percent of the financial cost to the government, (i.e. the marginal benefit-cost ratio of the increase in yellow maize imports sold in the Maputo market is 0.87).

Thus, reducing the amount of yellow maize sold actually increases the countervalue funds generated. If the government's objective were to maximize countervalue revenues, it would act as a monopolist and lower imports of yellow maize until the marginal revenue from countervalue funds was equal to the marginal cost (the c.i.f. price).[39] Of course, the actual objectives of food aid policy of the Mozambican government are a mix of poverty alleviation and generation of revenues. Nonetheless, the loss of these potential countervalue revenues represents a real opportunity cost of the policy.

TARGETED INCOME TRANSFERS

An alternative policy for increasing the real incomes and food consumption of the urban poor is a direct income transfer, such as that of GAPVU (*Gabinet de Apoio a Populacao Vulneravel*). In the latter case, targeting to lower income households is done on the basis of the nutritional status of the household's children and the recommendation of local authorities. Simulation 2 (Table 21) shows the effects of an income transfer program of equal value as the domestic c.i.f. price of imported yellow maize in Simulation 1. It is assumed that two-thirds of the transfer is accurately targeted to the poorest 50 percent of Maputo households.[40] Moreover, administrative costs equal to 25 percent of the total size of the program are deducted from the size of the net transfer. As in Simulation 1, the financing for this policy intervention is provided through additional foreign aid.

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[39] As long as the price elasticity of demand is less than 1 in absolute magnitude, there is no maximum solution. In practice, as supply decreases and the price rises, demand becomes more price elastic (the absolute magnitude of the price elasticity increases). The econometric analysis provides estimates only for a small portion of the demand curve and do not give an indication of the overall elasticity for a large change in quantity or price.

[40] This target population is broadly consistent with GAPVU's selection criteria.

Table 21 — Effects of an Income Transfer; Simulation Results

	Simulation 2
Production	
White maize	-0.06
Rice	-0.04
Export crops	-0.09
Vegetables	0.04
Meat	0.06
Consumption	
Yellow maize total	0.00
Urban nonpoor	0.19
Urban poor	-0.19
Rural	0.00
White maize total	0.22
Urban nonpoor	0.09
Urban poor	0.95
Rural	0.18
Rice	0.25
Wheat	0.32
Real incomes	
Urban nonpoor	-0.08
Urban poor	1.45
Rural	0.01
Rent	0.09
Yellow maize price	0.78
Nonagricultural goods price	-0.32
Exchange rate	-0.36
White maize price	-0.36
White maize imports	0.80

Source: Model simulations.

Naturally the transfer leads directly to gains in real incomes of urban poor households (1.5 percent). Despite a gain in transfer income, real incomes of the urban nonpoor fall slightly (-0.1 percent) due to price effects (especially an increase in the price of meat). As transfer income is spent on both food and nonfood commodities, the prices of nontradable commodities tend to rise. Prices of tradable commodities, tied to world market prices, do not rise; instead, increased demand (and reduced domestic supply) of these commodities results in greater net imports. Since the magnitude of the transfer program is the same as that of the c.i.f. value of yellow maize imports in Simulation 1, the effects on the real exchange rate are again negligible.

Given the fixed supply, there is little change in demand for yellow maize in this simulation. Thus compared with Simulation 1, more of the increase in household incomes is spent on local nontraded food commodities. With increased demand, output of these commodities increases slightly while output of traded food commodities (white maize, rice and export crops) falls by less than 0.1 percent. Demand for white maize, rice and wheat rise as well —consumption of white maize by the urban poor increases by 1.0 percent.

Apart from the issue of countervalue funds generated, the transfer policy is a less efficient mechanism for improving the welfare of the Maputo poor than is a policy of increased yellow maize imports (Simulation 1a). Higher administrative costs and leakages of benefits outside the target group are the main reasons for this result.

Considering countervalue funds changes the analysis somewhat. On the margin, starting from the existing level of yellow maize imports, an additional increase in supply for Maputo will result in a decline in countervalue funds. In this case, the marginal benefit/cost ratio (the value of the additional real incomes of the urban poor divided by the net additional cost of the policy, including changes in countervalue funds generated), is approximately equal for both policies.

Is then a policy of cutting back on yellow maize imports to Maputo and using the funds saved to finance a transfer scheme superior to the current situation? The answer depends critically on the administrative costs of the transfer scheme, estimates which are beyond the scope of this paper. It should be kept in mind, however, that if yellow maize imports are reduced substantially, the own-price elasticity of demand becomes more elastic, thereby reducing, and at some point reversing, the marginal loss of potential countervalue funds generated through yellow maize sales.

REAL EXCHANGE RATE DEPRECIATION

Simulation 3 models the effect of a reduction in net foreign exchange inflows of 20 percent that lead to a real depreciation of 25.1 percent (Table 22). As a result, real prices of tradable goods rise by the same percentage in general. Higher prices for these goods reduce demand and spur increased

Table 22 — Real Exchange Rate Depreciation and Rural Recovery; Simulation Results 3, 4 and 5

	Simulation 3 Real Exchange Rate Depreciation	Simulation 4 Rural Recovery	Simulation 5 Simulations 3 and 4 Combined
Production			
White maize	2.59	21.75	24.91
Rice	1.43	21.75	23.49
Export crops	3.41	23.53	27.74
Vegetables	1.40	14.89	16.50
Meat	-0.06	19.50	19.44
Consumption			
Yellow maize total	0.00	0.00	0.00
Urban nonpoor	1.69	-15.97	-14.51
Urban poor	-1.63	15.44	14.03
Rural	0.00	0.00	0.00
White maize total	-9.03	1.37	-7.70
Urban nonpoor	-9.49	1.59	-8.04
Urban poor	-9.65	0.81	-8.94
Rural	-8.79	1.36	-7.42
Rice	-4.48	10.63	5.66
Wheat	-11.41	10.13	-2.40
Real incomes			
Urban nonpoor	-0.92	8.95	7.84
Urban poor	-2.53	13.63	10.66
Rural	0.22	11.54	11.94
Rent	-0.01	-0.20	-0.27
Yellow maize price	14.35	-25.73	-15.71
Nonagricultural goods price	8.89	6.15	15.58
Exchange rate	25.10	0.00	25.10
White maize price	25.10	0.00	25.10
White maize imports	-33.04	-40.73	-75.41

Source: Model simulations.

production so that net imports of these goods fall. Imports of white maize fall by 33.0 percent. Imports of rice and wheat fall by 5.5 and 11.4 percent, respectively, while exports of agricultural products rise by 3.4 percent.

Production of tradable goods rises significantly. White maize production increases by 2.6 percent, rice production increases by 1.4 percent and export crop production increases by 3.4 percent. Agricultural incomes rise in real terms, but nonagricultural incomes, fall in terms of overall purchasing power as prices of tradable goods rise. Real incomes of the urban poor and nonpoor fall by 0.9 percent and 2.5 percent, respectively. Rural incomes are essentially unchanged, rising by 0.2 percent, as the decline in real nonagricultural income offsets the gains in agricultural income.

These simulation results imply that a cutback in foreign aid with the ensuing real exchange rate depreciation is likely to increase real agricultural incomes and thus benefit or at least not severely harm the rural population. Urban groups are likely to suffer more.

It should be noted that the model simulation is only a partial equilibrium result. Nonagricultural output is held fixed in the model and thus private nonagricultural incomes are likewise fixed in terms of the price of nonagriculture. Moreover, the government sector is not modeled and there is no direct linkage between inflows of foreign capital and changes in aggregate demand. Thus the negative effects on real incomes may well be overstated.

RURAL REHABILITATION

With the end to the civil war and the re-establishment of rural security in Mozambique, it is hoped that many *deslocados* will be able to return to rural areas and begin farming again. Some of the effects of such an occurrence are modeled in Simulation 5. Agricultural production is exogenously increased by 20 percent leading to shifts and prices and incomes. The final increase in agricultural production is determined endogenously by the model.

The large increase in agricultural production leads to reduced net imports for traded crops and lower prices for nontraded crops. Exports of agricultural products rise by 23.5 percent in this simulation and imports of rice increase by 8.7 percent as the direct impact of increased domestic supply is offset by the gains in demand arising from increased real incomes.[41] White maize production increases by 21.8 percent, resulting in a 40.7 percent drop in white maize imports.

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[41] Note also that local production of rice accounts for only 43.8 percent of total rice consumption in the 1991 base data, the rest being supplied by imports. Thus a 20 percent increase in local production represents only an 8.8 percent increase in total supply (if imports are unchanged).

Real incomes of the urban poor and nonpoor rise by 13.6 and 9.0 percent, respectively due to lower prices for nontraded agriculture, with only a 6.2 percent increase in the price of nonagricultural consumer goods. Rural real incomes rise by 11.5 percent, less than the 20 percent increase in agricultural output because the price of nontradable goods falls and because the gain in nonagricultural real incomes is small.

This simulation does not capture many other likely impacts of rural rehabilitation including likely increases in nonagricultural rural production and changes in the real exchange rate arising from massive shifts in production. The major thrust of the results is clear, however. That is, urban households also benefit from rural rehabilitation as food prices of nontradable goods fall. These benefits for Maputo households materialize only if marketing linkages between rural producers and the Maputo markets function well so that the additional local production can reach the city. Moreover, the importance of markets runs both ways. Azam and Faucher (1988), cited in Section 3, provide evidence that the availability of consumer goods in rural areas is an important factor promoting agricultural marketed surpluses.

REAL EXCHANGE RATE DEPRECIATION AND RURAL RECOVERY COMBINED

In Simulation 5, the combined effects of a real exchange rate depreciation and rural recovery are combined. The result is large increases in real incomes for all households. Rural households gain most (11.9 percent), as the benefits of the real exchange rate depreciation add to the gains from the rural recovery. The total gain in export crop production is 27.7 percent, compared to only 16.5 percent for nontradable agriculture (vegetables, roots and pulses). The gain for the urban poor is again larger than for the urban nonpoor as a 15 percent decline in the yellow maize price, due to demand shifts towards meat and rice, has a larger positive effect on their real incomes.

8. POLICY IMPLICATIONS: PRELIMINARY OBSERVATIONS

Mozambique's economy has undergone dramatic changes in recent years. The legacy of the colonial period, civil war, and low levels of institutional development following Independence combined with a serious vulnerability to climatic conditions and inappropriate policies to produce a chronic state of economic crisis during the early and mid 1980s. Radical economic reform initiated in 1987, involving liberalization, stabilization, and sectoral adjustment, did much to introduce greater flexibility and stability in the Mozambican economy.

A central aspect of the reform process has been the large inflows of foreign aid, particularly food aid, in order to provide direct poverty relief during the process of transition to a market economy. Aid inflows amounted to as much as 59.2 percent of GDP in 1989, (World Bank 1992a), with important implications for the exchange rate and agricultural incentives. As the economy stabilizes, and the long civil war ends, what role should food aid play in poverty alleviation and the country's development? What do changes in overall aid levels imply for agricultural incentives and rural recovery?

The modeling analysis presented here attempts to shed light on these policy issues. The preliminary simulation results presented in this paper should be interpreted cautiously, given the uncertainties surrounding the base data and parameter estimates for rural areas. Moreover, the analysis in this paper is based on data for the period April, 1991 to March, 1992, a period in which the white maize harvest of 327 thousand tons in 1991/92 was typical of those in Mozambique during the civil war. By mid-1993 conditions had changed substantially in Mozambique due to the end of the civil war, a successful harvest and ill-timed, post-harvest deliveries of food aid to rural areas. Nevertheless, several major themes of the 1991/1992 analysis apply to the current and likely future situations.

The simulations suggest that increased yellow maize imports are an effective self-targeting mechanism for increasing real incomes and food consumption of poor households in Maputo. Because poor households tend to consume more yellow maize and are more price-responsive than are nonpoor households, an increase in yellow maize supplied to Maputo above the per capita levels of 1991/92 leads to larger percentage gains in real incomes and yellow maize consumption for the poor than for the nonpoor.

The spillover effects of increased yellow maize sales in Maputo are small. The econometrically estimated substitution effects of changes in yellow maize prices on white maize demand are minimal (given the ratio of yellow and white maize prices in 1991/92). Also potential substitutes for yellow maize, in particular white maize, are imported (often across land borders), so any reductions in net aggregate demand for these products result first in lower imports and not in lower domestic prices for producers. Moreover, the additional

foreign capital inflows to fund a 30 percent increase in yellow maize imports to Maputo (as in Simulation 1) are likewise small on a macroeconomic scale, resulting in a real exchange rate appreciation of less than 1 percent, so that producers of tradable goods are not significantly affected.

It is important to note that this analysis applies to commercial sales of yellow maize food aid in Maputo, not to emergency relief food aid delivered to rural areas as occurred in late 1992 through mid-1993. Unfortunately, much of the emergency food aid destined for rural areas arrived late, after the successful white maize harvest in early 1993. Thus, yellow maize food aid ended up for sale in rural markets in mid-1993, while post-harvest market prices for white maize were low. Cutbacks in yellow maize emergency food aid to rural areas are clearly appropriate, given the successful harvest in 1993. What the simulation analysis shows, however, is that reductions in yellow maize supply in the Maputo market risk substantial losses in real incomes of the urban poor.

Cutbacks in foreign aid and the resulting real devaluations have potentially larger effects. A 20 percent reduction in net foreign savings and the resulting real exchange rate depreciation affects urban households much more severely than rural households (Simulation 4). As foreign aid inflows are cut back, agricultural price incentives are likely to improve, a situation benefitting rural producers but reducing real incomes for net purchasers of food unless nonagricultural income also rises. The implication is that as foreign aid inflows are cut back and the real exchange rate depreciates, policy interventions such as continued yellow maize imports or income transfers may be necessary to prevent serious reductions in real incomes of the urban poor.

Fortunately, rural rehabilitation holds forth promise for urban households as well as the rural population as well. Increases in agricultural production raise rural incomes and by reducing food prices, benefit urban households. Efficient marketing linkages are the key to ensuring that rural production increases are possible and that rural production reaches urban markets to lower food prices there.

As the civil war ends and rural security is restored, linkages between rural producers, urban consumers and world markets will become increasingly important in determining domestic supply, demand and prices for food in Mozambique. Moreover, markets for key food commodities are inter-related both because of substitution possibilities on the demand side and competition for productive resources (labor and land) on the supply side. Accounting for these linkages will be an important part of effective food policy analysis to help insure that rehabilitation and economic recovery in Mozambique leads to improved food security.

APPENDIX 1
ANALYSIS OF BORDER PRICES

Appendix Table 1.1 —Mozambique: Border Prices, 1991

		Rice	White Maize	Yellow Maize	Wheat Flour
		US$ per ton			
World Price	a	280.0	150.4	123.6	131.9
Sea Freight	b	40.0	40.0	40.0	40.0
Insurance	c	4.2	2.3	1.9	2.0
CIF	d	324.2	192.7	165.5	173.9
Port Charges	e	10.0	10.0	10.0	10.0
Landed Price	f	334.2	202.7	175.5	183.9
IPP at coast	g	334.2	202.7	175.5	183.9
Exchange Rate (Mts/$)		1434.5			
		Meticais per kilogram			
IPP at coast	h	479.4	290.7	251.7	263.8
Wholesale Margin	i	66.3	50.0	46.6	19.9
Milling Costs		32.0			67.1
Extraction Rate					0.8
Wholesale IPP	j	545.7	340.7	298.3	468.0
Retail Margin	k	51.6	35.2	31.8	
Retail IPP	l	597.3	375.9	330.1	
Retail Maputo	m	1163.4	641.6	414.2	318.5
Retail/Border (NRP)	o	94.8	70.7	25.5	-31.9
IPP at coast	f	479.4	290.7		
Transport-Wholesale	p	19.9	19.9		
Milling		25.0			
Extraction Rate		66.7			
Price Unmilled	q	317.8	310.6		
Marketing Margin	r	86.3	85.2		
IPP Producer	s	231.5	225.4		
Official Prod Price		257.0	190.0		
Official/Border (NRP)		11.0	-15.7		

Source: World Bank 1989 and authors' calculations.

Notes: World prices, from aid shipments, Ministry of Commerce data; consumer Prices, Michigan State University Maputo survey data; producer prices, official producer price; marketing margins and transport costs, World Bank (1989).

a. World commodity prices in US$/ton; b. Sea freight at $40/ton; c. Insurance 1.5%; d. Border price given by import price = CIF = (a + b + c); e. Port charges $10/ton; f. Landed price US$/ton (d + e); g. Import parity price (IPP) at coast in US$/ton (f + g); h. Import parity price (IPP) at coast in MT/kg (h * exchange rate/1000); i. Transport costs from port to wholesaler (200 km @ .046 mt/kg/km); j. IPP to wholesaler; k. Processing cost for rice (5%); l. IPP raw product = j for maize, beans, sorghum; (j - k)/1.5 for paddy rice; m. Consumer Prices: Michigan State University Maputo survey data; n. Wholesale price of wheat flour; o. Nominal rate of protection p. Trader marketing margin of 5%; q. Unmilled price = ([IPP-coast] + [Transport - wholesale] - [Milling]) * ⅔ (Extraction rate); r. Bags (6.7 mts/kg), storage (3 mts/kg), and transport (10 mts/kg); s. IPP producer = (0.95 * [Milled price] - 19.7 * [Exch Rate]/663)/1.12.

APPENDIX 2
EFFECTS OF A CHANGE IN FOREIGN CAPITAL INFLOWS ON THE REAL EXCHANGE RATE[42]

For simplicity, the economy is aggregated into three sectors: nontraded (home) goods, import goods and export goods. World prices in foreign currency of export and import goods are given by P_x^w and P_m^w, and are assumed fixed. Choosing appropriate units, P_x^w and P_m^w can both be set equal to 1. The domestic prices of export and import goods (P_x and P_m) are:

$$P_x = E * P_x^w \tag{1}$$

and

$$P_m = E * P_m^w,$$

where E is the nominal exchange rate expressed in units of domestic currency per unit of foreign currency. Choosing appropriate units, P_x^w and P_m^w can both be set equal to 1, so that $P = P_m + P_x + E$. Then, letting the price of home goods be the numeraire ($P_h = 1$), P becomes the relative price of traded goods to home goods ($P/P_h = P$). The real exchange rate, e, is defined as

$$e = E/P_h = E \tag{3}$$

Supply of home goods (Q_h), exported goods (Q_x), and importable goods (Q_m) are assumed to functions of relative price $P(= P/P_h)$. Demand for the three types of goods (D_h, D_x, and D_m) is a function of the relative price P and total real income.

The value of total production, Y, is given by

$$Y = P_x Q_x + P_m Q_m + P_h Q_h = P * (Q_x + Q_m) + Q_h. \tag{4}$$

Total income, YT, is equal to the value of domestic production, Y, plus the transfer T.

$$YT = Y + T. \tag{5}$$

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[42] This exposition is based on the model in Dornbusch (1975). For a similar model using duality theory see Khan and Ostry (1992).

Recalling that $P_{\underline{x}}^{w}$ and $P_{\underline{m}}^{w}$ are both equal to one, the trade balance in world prices ($\bar{B}_m$) is:

$$\bar{B} = P_x^w * (Q_x - D_x) - P_m^w * (D_m - Q_m) = X - M, \tag{6}$$

where X is exports and M is imports.

Total income must equal total expenditures in the economy:

$$Q_h + P_x Q_x + P_m Q_m + T = D_h + P_x D_x + P_m D_m, \tag{7}$$

where T is the value of a foreign transfer, expressed in terms of home goods. In equilibrium, supply of home goods is equal to demand ($Q_h = D_h$), so that equation 6 reduces to:

$$P_x Q_x + P_m Q_m + T = P_x D_x + P_m D_m,$$

or

$$T = -(P_x Q_x - P_x D_x) + (P_m D_m - P_m Q_m) = -B, \tag{8}$$

where B is the trade balance expressed in units of domestic currency. For simplicity, assume that there is no domestic consumption of exportables ($D_x = 0$) and no domestic production of importables ($Q_m = 0$). Equation 8 then becomes:

$$T = -P_x X + P_m M = -P * (X - M) = -P * \bar{B} = -B \tag{9}$$

The effects of a change in transfers on the real exchange rate is found by differentiating the trade balance (in foreign currency) equation (equation 6):

$$\begin{aligned} d\bar{B} = {} & \partial X/\partial P dP - \partial M/\partial P dP - \partial M/\partial (YT)[\partial YT/\partial Y dY + \partial YT/\partial T dT] \\ & - \partial X/\partial P (P/X) X (dP/P) - \partial M/\partial P (P/M) M (dP) - \partial M/\partial (YT)[1 * dY + 1 * dT] \\ & - X * e_x * dP/P - M * \epsilon_m^* * dP/P - m(dY + dT), \end{aligned} \tag{10}$$

where $\epsilon_x = \partial X/\partial P \;\; P/X$ is the export supply elasticity, $\epsilon_m^* = \partial M/\partial P \;\; P/M$ is the compensated import demand elasticity and $m = dM/d(YT)$ is the marginal propensity to import.

From the definition of the value of production (equation 4),

$$\begin{aligned} &= \partial Q_h/\partial P\, dP + P\, \partial Q_x/\partial P\, dP + Q_x\, dP \\ &= Q_x\, dP, \end{aligned} \tag{11}$$

since the sum $\partial Q_h/\partial P + P\, \partial Q_x/\partial P$ is equal to zero by the envelope theorem.[43]

Using the definition of T from equation 9,

$$dT = -P\, d\bar{B} - \bar{B}\, dP. \tag{12}$$

Equation 10 thus becomes

$$\begin{aligned} \partial \bar{B} * (1 - m) &= X * \epsilon_x * dP/P - M * \epsilon_m^* * dP/P - m(Q_x\, dP - \bar{B}\, dP) \\ &= X * \epsilon_x * dP/P - M * (\epsilon_m^* + m) * dP/P, \end{aligned} \tag{13}$$

since

$$Q_x\, dP - \bar{B} dP = (Q_x - Q_x + M)\, dP = M\, dP \tag{14}$$

Thus the percentage change in the real exchange rate resulting from a change in the foreign transfer is:

$$d\theta/\theta = dP/P = d\bar{B} * (1 - m)/[X * e_x^* * dP/P - M * (e_m^* + m * dP/P)]. \tag{15}$$

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[43] Intuitively, $P_h Q_h + PQ_x$ represents the profit maximized value of production. A small change in the relative price has no effect on the value of production since the values of marginal products of the two goods are equal at this point.

The value of this expression is most easily seen by considering that $Q_h = \partial R(P_h, P_x)$ and that $Q_x = \partial R(P_h, P_x)/\partial P_x$, where $R(P_h, P)$ is the revenue function.

$$\begin{aligned} \partial Q_h/\partial P + P\, \partial Q_x/\partial P &= P_h\, \partial^2 R/\partial P_h \partial P_x + P_x \partial^2 R/\partial P_x^2 \\ &= P_h\, \partial^2 R/\partial P_x \partial P_h + P_x\, \partial^2 R/\partial P_x^2 \\ &= P_h\, \partial Q_x/\partial P_h + P_x\, \partial Q_x/\partial P_x = 0\ , \end{aligned}$$

by Euler's Law since the demand functions Q_x are homogeneous of degree 0 with respect to price.

APPENDIX 3
EQUATIONS OF THE MOZAMBIQUE MULTI-MARKET MODEL

SUPPLY, DEMAND, AND INCOMES

Domestic production of commodity i, X_i, is modeled as a function of the base level of production $X0_i$ and domestic producer prices PP_j:

$$X_i = X0_i * (1 + \sum \epsilon^s_{ij} * [PP_j/PP0_j - 1]) \quad (1)$$

The elasticities of supply, $\epsilon^s_{i,j}$, determine the price-responsiveness of production to changes in the prices of the output and competing activities.

Household consumption of commodity i is a function of prices faced by the household and household income (Y_h). For urban households, consumption is determined by consumer prices (equation 2). Rural household consumption is determined by producer prices for agricultural commodities produced in rural areas (equation 3).[44]

$$UC_i = UC0_i * (1 + \sum \epsilon^D_{i,j,h} * [PC_j/PC0_j - 1] + \eta_{i,h} * [Y_H/Y0_h] - 1) \quad (2)$$

$$RC_i = RC0_i * (1 + \sum \epsilon^D_{i,j,h} * [PP_j/PP0_j - 1] + \eta_{i,h} * [Y_H/Y0_h - 1]) \quad (3)$$

Total consumption of each commodity, CD_i is simply the sum of the demands by all households:

$$CD_i = \sum UC_i + RC_i \quad (4)$$

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[44] In most of the simulations, a logarithmic formulation is used instead of the percentage change equations above (equations 1,2 and 3). The equations are as follows:

$$X_i = X0_i * \prod (PP_j/PP0_j)^{\epsilon^s_{ij}} \quad (1a)$$

$$UC_i = UC0_i * \prod (PC_j/PC0_j)^{\epsilon^D_{i,j,h}} * (Y_h/Y_h0)^{\eta_{i,h}} \quad (2a)$$

$$RC_i = RC0_i * \prod (PP_j/PP0_j)^{\epsilon^D_{i,j,h}} * (Y_h/Y_h0)^{\eta_{i,h}} \quad (3a)$$

Production of nonagricultural goods is fixed (exogenous) in the model. Nonagricultural incomes for each household, $YNAG_h$ are assumed to change only according to a change in the consumer price of nonagricultural goods.

$$YNAG_h = YNAG0_h * PC_{NA}/PC0_{NA},$$

Agricultural income for household h is simply the sum of the gross value of production of each crop times the share of production by household h, w_{ih}. In the model, w_{ih} for urban households is nonzero only for vegetables and meat.

$$YAG_h = \sum PP_i * X_i * w_{ih} \quad (6)$$

PRICES

For tradable goods, the border price is determined as the world price in dollars converted to meticais by the exchange rate and adjusted for tariffs and taxes.

$$PM_i = PW_i * ER * (1 + tm_i) \quad (7)$$

The variability of the world price of tradable goods is determined by the level of Mozambique's import demand or export supply and the world price elasticity, ϵ_i^m,t. For the model simulations in this paper, ϵ_i^m,t is set to a large number (99999), so that world prices are exogenous.

$$M_{it} = M0_{it} * (1 + \epsilon_{i,t}^{M} * [PW_{it}/PW0_{it} - 1]) \quad (8)$$

The consumer price for tradable goods is then determined by the border price and marketing costs, $trmarg_i$. For goods for which import quotas are binding, $trmarg_i$ is endogenous, and includes the markup due to rents:

$$PC_{it} = PM_{it} * (1 + trmarg_i) \quad (9)$$

Producer prices are related to consumer prices by a marketing margin, $marg_i$, which is fixed for all commodities except yellow maize (as is discussed below).

$$PC_i = PP_i * (1 + marg_i) \quad (10)$$

MARKET CLEARING

Given the base levels of consumption, production, incomes and prices, the model solves for new values of all endogenous variables so that total supply equals total demand for each commodity.

$$X_I - C_I - M_I \tag{11}$$

For tradable goods, except yellow maize, domestic prices are determined by world prices and the exchange rate (equations 7 and 9), and net imports M_I are endogenous. For "nontradable goods," net imports are very small relative to total supply and are fixed exogenously. Domestic prices of nontradables adjust to clear the markets.

For yellow maize, imports are fixed exogenously and the marketing costs on tradables, $trmarg_{44}$, is made endogenous to reflect rents in addition to normal marketing costs.[44]

MODEL CLOSURE AND THE REAL EXCHANGE RATE

The above equations determine a complete partial equilibrium system of equations. In this system, the exogenous exchange rate determines the price level of the economy. An increase in the exchange rate will result only in an increase in all domestic prices of equal magnitude.

In order to simulate changes in the real exchange rate, some other price or nominal value must be held fixed. Two equations are added to define price index for nontradables, *PNT*. First, an index of the price of nonagricultural nontradables, PNT_{NA} is defined as part of a weighted average making up the domestic price of nonagricultural goods, PC_{NA}.

$$PC_{NA} - PNT_{NA}^{\alpha^{NA}} * (ER*[1+TM_{NA}] * PWM_{NA})^{(1-\alpha^{NA})} \tag{12}$$

where TM_{NA} is the tariff on nonagricultural tradables, PWM_{NA} is the world price of nonagricultural tradables and α_{NA} is the share of nontradables in total nonagricultural expenditures. The price index of nontradables *PNT* is then defined as a weighted average of the price index of nonagricultural nontradables (PNT_{NA}) and the prices of vegetables and meat.

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[44] Rents arise when an import quota is fixed below the level of imports that would be demanded in the absence of the quota. In the case of yellow maize food aid, these rents are captured either by the Mozambican government (if the yellow maize is auctioned) or by consignees (if they are able to purchase the yellow maize at a price below market value).

$$PNT = PNT_{NA}^{\beta_1^{NT}} * PC_{(vegs)}^{\beta_2 NT} * PC_{(meat)}^{(1 - \beta_1^{NT} - \beta_2^{NT})} \quad (13)$$

By fixing the domestic price of nontradables, $_{PNT}$, a change in the nominal exchange rate results in a change in the real exchange rate of the same proportion.

Finally, an equation is added that determines the level of the real exchange rate given a change in foreign savings and a fixed price of nontradables.

$$ER = ER0 * CHFSAV * (1 - \beta)/(X * [1+\epsilon_x] - P_m M * [1 + \eta^m]) \quad (14)$$

where the change in foreign savings (*CHFSAV*) is equal to the change in the trade balance ($P_m M - X$). β is the income elasticity of demand for imports, ϵ_x is the export supply elasticity and η^m is the import price elasticity of demand.

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