

**MACROECONOMIC ADJUSTMENT AND THE POOR IN MADAGASCAR:
A CGE ANALYSIS**

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1. INTRODUCTION

Stabilization and structural adjustment dominated economic policy in sub-Saharan Africa during the decade of the eighties. In Madagascar, as in a number of countries, IMF stand-by agreements in the early eighties were followed by a succession of World Bank and bilateral structural adjustment and sectoral loans designed to restore macroeconomic balances and liberalize markets. Early in the reform process, a contentious debate developed as to whether the policy changes harmed the poor (see UNICEF 1984; Cornia, Jolly, and Stewart 1987). No representative household survey data exists with which to trace the actual evolution of household incomes and expenditures in Madagascar during the eighties. Using available information on prices, household income and expenditure patterns, Dorosh, Bernier, and Sarris (1990) provided evidence suggesting that in Madagascar, the adverse effects of adjustment policies, per se, were more limited. This study, based on computable general equilibrium (CGE) model simulations of external shocks and policy changes, attempts to shed more light on the important linkages between macroeconomic adjustment and welfare of lower income households in Madagascar.

The case of Madagascar is important for several reasons. The immediate cause of the balance of payments crisis of the early eighties is similar to that in a number of other countries of sub-Saharan Africa: a sharp decline in foreign exchange availability. And as in other countries, stabilization efforts included cutbacks in imports of food and a reduction in food subsidies. Unlike in many other developing countries, however, there is evidence that a large share of these subsidies actually reached lower-income urban groups. Finally, Malagasy agriculture is sufficiently diverse to enable an analysis of effects on both smallholder export crop producers and food crop producers.

This paper first presents a brief overview of the economy of Madagascar and a summary of key economic policies in Madagascar in the eighties. A brief description of the CGE model and of the data base follows. In section 3, results of model simulations of major elements of the investment boom, stabilization and structural adjustment policies adopted by Madagascar are presented. Conclusions are found in the final section.

2. THE MALAGASY ECONOMY AND ECONOMIC POLICY IN THE EIGHTIES¹

Madagascar is typical of many low income countries of sub-Saharan Africa with large agricultural and service sectors and a small industrial sector. Less than twenty percent of the population lives in urban areas. Although some large farms managed by parastatals exist, the bulk of agricultural production is carried out by traditional small holders whose average farm size is only 1.15 hectares.² Madagascar's agriculture differs from that of most of sub-Saharan Africa because of the dominance of irrigated land, especially on the densely populated high plateau which ranges from the north to the south in the center of the island. Irrigated area, planted primarily with rice or cotton, accounts for 44 percent of traditional cultivated area nationwide (MPARA 1988). Rice consumption, alone, represents 54 percent of total calorie consumption (FAO 1984).

The relative importance of agricultural exports (mainly coffee, cloves, and vanilla) declined during the 1980s because of declines in world prices of coffee and cloves, yet agricultural exports still accounted for 51.5 percent of Madagascar's total exports in the 1987-89 period³ (down from a share of 65.7 percent in 1980) (World Bank 1986, 1991).

Production of the formal industrial sector is concentrated in import-substitution sectors such as food processing, textiles and beverages, and in nontraded sectors such as water and electricity. Imports of raw materials, energy, and capital goods, make up about 70 percent of the import bill (World Bank 1991). High transport and marketing costs contribute to the large size of the service sector; marketing alone accounted for 21 percent of value added in 1984.

Based on poverty lines for rural and urban households calculated using food requirements and typical expenditure patterns, approximately 37 percent of rural households, 26 percent of households in small urban areas, and 18 percent of households in the seven large urban areas can be classified as poor (Dorosh, Bernier, and Sarris 1990). Nationally, 34 percent of all households are poor, 90 percent of which are in rural areas.

¹ This discussion draws heavily from Dorosh, Bernier, and Sarris (1990) and Dorosh and Bernier (forthcoming).

² Traditional farmers defined in the 1984 Agricultural Census as farmers owning ten or fewer hectares, hiring fewer than 5 full-time, paid workers, and not using any specialized modern equipment or machinery.

³ Including agroindustrial exports such as cloth, preserved meats, and essences of cloves and ylang ylang, the share rises to 62 percent (IMF 1991).

ECONOMIC POLICIES IN THE EIGHTIES

At the start of the eighties, severe macroeconomic imbalances plagued the Malagasy economy. The "investment to the limit" development strategy of the late seventies had led to a huge surge of imports, unsustainable balance of payments deficits, large government budget deficits and accelerating growth in the money supply (Table 1). The current account deficit reached 16.9 percent of GDP in 1981, and inflation jumped from 9.1 percent per year in 1977 to 23.8 percent per year in 1981.

Between 1981 and 1984, macroeconomic adjustment in Madagascar focused largely on stabilization efforts endorsed by the IMF. Aggregate demand was quickly reduced through cuts in public investment and other government expenditures. Initial efforts at liberalization of rice marketing were begun, including a large reduction in the subsidy on rice for consumers. These stabilization efforts proved successful in terms of their major goals: by 1984 inflation had dropped to 10.3 percent per year and the trade deficit was cut to only 5.0 percent of GDP. However, real GDP also fell sharply, by 5.4 percent between 1979-81 and 1982-84.

Structural adjustment reforms aimed at restoring growth enjoyed relatively little success until 1988, the year a major trade liberalization was completed. Thereafter, in 1989 and 1990, Madagascar enjoyed positive growth in per capita GDP for the first time since the unsustainable surge of the investment boom at the start of the decade.

Unfortunately, many of the gains from adjustment unraveled in the early 1990s. A decline in world export prices together with domestic credit expansion contributed to balance of payments difficulties in 1991. More important, political protests led to a temporary closing of the major port, Toamasina, in mid-1991 and marked the beginning of a two year transition to a new constitution and a new democratically elected president. The political uncertainty during this period hindered government development efforts, discouraged private investment and stalled foreign aid inflows.

The major channels by which adjustment policies and external shocks affected the poor are relatively clear. Rice subsidies and large quantities of imports heavily favored urban consumers, especially in the capital city, Antananarivo, to the detriment of producers of rice. The investment boom of the late seventies and the early eighties was concentrated in large industrial projects, spurring economic activity and (especially urban) incomes. And despite changes in the real exchange rate brought about by nominal devaluations and fiscal discipline, real producer prices of export crops changed little during the decade, initially because of increases in the rate of taxation on exports and then later because of a decline in world prices that coincided with, but was independent of, a liberalization in export crop marketing. The magnitudes of the above effects and their interactions are not straightforward, however, and require a more formal analysis, which is the main purpose of this paper.

Table 1 — Madagascar: Macroeconomic Summary, 1973-1989

| | 1973-1977 | 1978-1980 | 1981-1982 | 1983-1987 | 1988-1989 |
|---|-----------|-----------|-----------|-----------|-----------|
| Real GDP (billion 1984 FMG) | 1,712.90 | 1,797.60 | 1,667.00 | 1,719.00 | 1,880.00 |
| Real GDP per capita (billion 1984 FMG) | 224.30 | 212.10 | 183.60 | 170.30 | 164.60 |
| Average GDP growth rate (percent) | -0.01 | 2.70 | -5.80 | 1.40 | 4.40 |
| Annual percentage change in GDP deflator | | | | | |
| Average | 11.60 | 11.00 | 27.60 | 16.10 | 16.30 |
| End of period | 8.60 | 15.00 | 28.60 | 22.80 | 10.20 |
| Trade deficit/GDP (percent) | | | | | |
| Average | -4.10 | -13.00 | -10.40 | -5.90 | -5.90 |
| End of period | -3.60 | -16.40 | -9.40 | -4.60 | -5.20 |
| Budget deficit/GDP (percent)* | | | | | |
| Average | -3.28 | 10.05 | -9.60 | -3.70 | -5.60 |
| End of period | -6.28 | 14.51 | -7.10 | -3.30 | -7.90 |
| Rice imports (1,000 tons) | | | | | |
| Average | 86.00 | 161.00 | 272.00 | 130.00 | 101.00 |
| End of period | 95.00 | 176.00 | 351.00 | 94.00 | 112.00 |
| Exchange rate (FMG/dollar) | | | | | |
| Average | 233.00 | 217.00 | 311.00 | 683.00 | 1,505.00 |
| End of period | 226.00 | 211.00 | 350.00 | 1,069.00 | 1,465.00 |
| Industrial value added (billion 1984 FMG) | | | | | |
| Average | 252.70 | 267.60 | 204.00 | 203.00 | 241.00 |
| End of period | 262.40 | 265.50 | 197.00 | 22.00 | 250.00 |

Sources: World Bank (1991); IMF (1988, 1991).

* Budget deficit on a commitment basis.

3. MODEL DESCRIPTION⁴

The CGE model used for these simulations is a variant of the "neoclassical structuralist" model originating with Dervis, de Melo, and Robinson (1982) and later applied to Cameroon (Benjamin and Devarajan 1985; Condon, Dahl, and Devarajan 1987) and other developing countries.⁵

A social accounting matrix (SAM) for Madagascar's economy in 1984 is the data base for the model. The SAM is constructed from the 1984 national accounts and input-output table, supplemented by data from national household surveys in 1978 and 1980, an agricultural census in 1984 and smaller surveys of rice producers and consumers in the early 1980s (see Dorosh et al. 1991).

Twenty-seven production activities are specified, producing 15 commodities (Table 2). Given the importance of rice in Madagascar's economy, three separate technologies (activities) are specified for paddy (small farm irrigated, large farm irrigated and upland) and both paddy and milled rice are included as a separate commodities. Separate technologies are modeled for most agricultural activities (large and small farm) and nonagricultural activities (formal and informal sector).

Three types of labor (highly skilled, skilled, and unskilled) are modeled, each with a nonzero elasticity of supply with respect to the real wage. Capital is fixed in the short run and is updated with additions of new investment net of depreciation. Only aggregate capital enters the production functions, but returns to capital are allocated among six types of capital (nonfarm capital in the formal and informal sectors, farm capital/land belonging to small farmers in three regions of the country (the Plateau, East Coast, and West and South zones), and farm capital/land owned by large farmers (1991).

The model specifies eleven institutions: eight households, formal enterprises, government and the Rest of World.⁶ The three urban household groups are classified according to the skill-level of the head of household (which corresponds with income levels as well) (Table 3). Per capita incomes of the urban high income households are nearly seven times those of urban low income

⁴ A complete model description is found in Dorosh (1992).

⁵ The model also draws some of its features from Sarris (1990).

⁶ The published Madagascar SAM (Dorosh et. al., 1991) has 13 institutions. In addition to the 11 institutions listed above, private non-profit institutions (included with high income urban households in the model) and financial enterprises (included with formal sector enterprises in the model) have separate accounts in the full SAM.

Table 2 — Subsectors in Madagascar SAM

| | Gross Value Added | Sectoral Gross Value Added as a Percent of Total GVA |
|-----------------------------------|-------------------|--|
| Primary sector | 568,709 | 35.8 |
| 1 Paddy | 119,036 | 7.5 |
| 1a Small farm irrigated | 44,227 | |
| 1b Large farm irrigated | 58,947 | |
| 1c Upland | 15,682 | |
| 2 Other food crops | 197,855 | 12.5 |
| 3 Export crops | 37,573 | 2.4 |
| 3a Small farms | 27,283 | |
| 3b Large farms | 10,290 | |
| 4 Industrial crops | 11,680 | 0.7 |
| 4a Small farms | 8,030 | |
| 4b Large farms | 3,650 | |
| 5 Livestock and forestry | 202,565 | 12.8 |
| 5a Informal sector | 189,548 | |
| 5b Formal sector | 13,017 | |
| 6 Mining, energy and water | 31,969 | 2.0 |
| 7 Rice milling | 3,807 | 0.2 |
| 7a Informal sector | 0 | |
| 7b Formal sector | 3,807 | |
| 8 Other food processing | 59,944 | 3.8 |
| 8a Informal sector | 12,118 | |
| 8b Formal sector | 47,826 | |
| 9 Textiles | 24,545 | 1.5 |
| 9a Informal sector | 4,391 | |
| 9b Formal sector | 20,154 | |
| 10 Other industry | 44,447 | 2.8 |
| 10a Informal sector | 10,664 | |
| 10b Formal sector | 33,783 | |
| 11 Construction | 42,752 | 2.7 |
| 11a Informal sector | 5,339 | |
| 11b Formal sector | 37,413 | |
| 12 Transportation & communication | 160,758 | 10.1 |
| 12a Informal sector | 130,818 | |
| 12b Formal sector | 29,940 | |
| 13 Commerce | 331,933 | 20.9 |
| 13a Informal sector | 219,161 | |
| 13b Formal sector | 112,772 | |
| 14 Services, private | 188,787 | 11.9 |
| 15 Public administration | 130,301 | 8.2 |
| Total | 1,587,954 | 100.0 |

Source: Dorosh et al.

Table 3 - Household Groups in Madagascar

| Household Group | Population | | Revenue per capita (1,000 FMG) |
|------------------------------|-------------|-----------|--------------------------------------|
| | (thousands) | (percent) | |
| Urban high income | 210.7 | 1.9 | 877.0 |
| Urban middle income | 1,120.8 | 10.9 | 181.2 |
| Urban low income | 291.4 | 3.5 | 126.2 |
| Urban subtotal | 1,622.9 | 16.3 | 172.7 |
| Small farmers/Plateau | 1,910.7 | 20.0 | 102.7 |
| Small farmers/East Coast | 1,996.1 | 20.9 | 104.9 |
| Small farmers/West and South | 1,345.5 | 14.1 | 118.3 |
| Rural rich (all regions) | 2,258.2 | 23.7 | 271.3 |
| Rural poor (nonfarm) | 474.3 | 5.0 | 103.3 |
| Rural subtotal | 7,984.9 | 83.7 | 150.1 |
| All Madagascar | 9,607.8 | 100.0 | 171.8 |

Source: Dorosh et al. (1991).

households. Per capita incomes of the rural poor, comprised of rural small farmers and a small nonfarm rural poor population (5.0 percent of total population), are approximately 40 percent of the national average. Rural small farmers are disaggregated by agroecological zone: Plateau (where irrigated rice is the major crop), East Coast (a region with export crops), and West and South (the rest of the country, where livestock are a dominant source of rural income). Large farmers from throughout the country and rural nonfarm households with a skilled head of household are classified as rural high income households. In the model, all transfers between institutions (including households) have been netted out.

Value added generated by production activity j is specified as a constant elasticity of substitution (CES) production function; quantities of intermediate inputs are modeled as fixed shares of the quantity of output produced. Elasticities of substitution between capital and labor are chosen so as to give conservative magnitudes for elasticities of supply, equal to 0.1 for mining and energy, 0.3 for most formal sector industrial activities (including formal sector construction) and all agriculture except for upland paddy and "other crops," and 0.5 for all other activities (mainly services and informal sector industry).

Internationally traded goods are treated as imperfect substitutes for goods domestically produced and consumed. A constant elasticity of substitution (CES) aggregation function defines the composite of imports and home goods (Armington 1969). Similarly, a constant elasticity of transformation (CET) aggregation is used to define a composite production good of export goods and goods produced for domestic consumption. Elasticities of substitution and levels of trade and domestic production are given in Appendix Table 1. Madagascar is assumed to be a price taker both for imports and exports.

Incomes of households derive from their ownership of factors of production and access to rents (Table 4). Earnings from highly skilled labor accrue only to the urban nonpoor households. Incomes of the poor derive from unskilled labor, informal sector capital and land. Household consumption is specified as a function of prices and incomes, using a linear expenditure system (LES) formulation. Savings is a linear function of income. Household budget shares and demand parameters are given in Appendix Tables 2 and 3.

Government recurrent and investment expenditures are fixed in real terms. Savings determines the level of private investment. This specification reflects the situation in Madagascar during most of the eighties, when the commercial banks were controlled by the state and allocation of credit for investment was determined largely through rationing. The value of investment by sector of destination j is assumed to be a fixed share of total fixed investment and the composition of capital by activity is likewise fixed.

Quantitative restrictions on the imports of manufactured goods and rice are modeled by fixing imports of these commodities exogenously at the quota levels. The rents generated from these quotas are modeled as accruing to the urban high-income households. In the base run of the model, implicit tariffs on manufactured goods and rice are set at 100 percent and 47 percent, respectively.

Apart from quantitative restrictions on imports of rice and manufactured goods in some model runs, prices adjust to equate supply and demand. Labor markets also clear through adjustment in real wages, though the substantial underemployment in the Malagasy economy in the 1980s is reflected in high elasticities of supply of labor. Savings determines private investment given fixed values of real government investment and government expenditure. The nominal exchange rate and foreign savings are also fixed exogenously, leaving changes in the aggregate price index to bring about movements in the real exchange rate and equilibrium in the Rest of World accounts.

In the dynamic simulations, capital stock is updated each year according to the previous period's net investment by sector. The base level labor supply is also increased exogenously by a constant population growth rate.

4. SIMULATION RESULTS

How did the stabilization and structural adjustment policies of the Malagasy government during the 1980s affect income distribution and the welfare of the poor? To address this question, the CGE model previously outlined is used to simulate key aspects of stabilization and structural adjustment policies. Four model simulations which illustrate the effects of major changes in external conditions and government policy in Madagascar are presented.

The first two simulations focus on the effects of the major stabilization policies adopted in the early 1980s. Simulation 1 models the impacts of a large increase in foreign borrowing and investment and the subsequent stabilization where the foreign debt is repaid. This simulation also illustrates the effects of the investment boom of 1978 to 1981 and the stabilization of 1982 to 1984. Simulation 2 models the impact of the large increase in rice imports in the early 1980s. From these results we can also deduce the effects of the subsequent reduction in rice imports as part of the stabilization effort of 1982 to 1984.

Simulations 3 and 4 model trade policy reform, the centerpiece of the structural adjustment effort in the late 1980s. Simulation 3 shows the effects of a removal of import quotas with no change in foreign capital inflows. Simulation 4, which includes a reduction in foreign capital inflows along with the elimination of quotas, more closely simulates the historical trade liberalization in 1988.

The model emphasizes three major channels through which changes in government policy or external shocks affect income levels and distribution in Madagascar. The level of foreign capital inflows and other factors, which in turn influence the level of aggregate demand, help determine the overall level of economic activity and incomes earned by all household groups. Second, the level of investment spending, heavily concentrated in urban goods and services, has a major influence on the distribution of economic benefits between rural and urban groups. Third, and most important, changes in the real exchange rate, which affect producer and consumer incentives throughout the economy, are shown to be an important determinant of the sectoral distribution of production and the distribution of real incomes of households.

In all the simulations, real government investment and expenditures are exogenous. The base run of the dynamic model fixes foreign savings, real government current expenditures, and real government investment at their 1984 per capita values in each of the six years of the simulation. The base run also keeps quotas on imports of rice and manufactured goods constant on a per capita basis. In the dynamic policy simulations, the model maintains the changes in exogenous variables in real per capita terms over six years, except in simulation 1. The model results presented in the following tables compare the outcomes of simulated policies with the base solution of the model.

INVESTMENT BOOM AND STABILIZATION: SIMULATION 1

In the late 1970s and continuing in the early 1980s, the *investir à outrance* ("invest to the limit") development strategy spurred a large increase in foreign borrowing and imports of capital goods. A balance of payments crisis ensued as interest and principal on the foreign debts came due before the new investments generated sufficient additional foreign exchange. Madagascar rapidly cut imports by tightening import quotas (rather than by a real devaluation or by increasing tariffs).

Simulation 1 illustrates the effects of an investment boom like that of the late 1970s by specifying gross capital inflows of US\$ 50 million (1984) in the first and second years of the simulation, and a gross capital inflow of US\$ 30 million (1984) in year 3 of the simulation (Table 5). Principal and interest (at 5 percent per year) repayments begin in year 2 and increase steadily until the full debt is repaid in year 6. This simulation adjusts the quota on manufactured goods imports each year by an amount equal to 50 percent of the value of the net capital inflow.

In an economy with no quantitative restrictions on trade, a large increase in foreign capital inflows normally leads to a large appreciation of the real exchange rate (i.e., a decrease in the price of traded goods relative to nontraded goods).⁷ As aid inflows are spent in the country (either directly or through the counterpart funds) prices of domestic goods, particularly nontraded goods, tend to rise. Prices of traded goods, which are tied to world prices, rise less, thus reducing the real domestic prices of traded goods. In Madagascar, as in most developing countries, the agricultural sector is the largest producer of traded goods (e.g., rice, export crops, and cotton). Thus, agricultural production and agricultural real incomes tend to decline when the real exchange rate appreciates.

For the Malagasy economy in the late 1970s and early 1980s, however, import quotas for most goods were binding. A higher level of capital inflows enables an increase in the import quota, and much of the increase in demand is channeled into imports instead of nontraded goods. With less change in demand, the rise in the price of nontraded goods is small and the real exchange rate appreciation is limited.

Apart from the loss of quota rents, the major beneficiaries of the investment boom (years 1 to 3 of the simulation) were the urban rich, although all groups gained (Table 6). The effects of the stabilization (years 4 to 6) are the reverse, with the urban rich seeing a larger decline in their real nonrent

⁷ This appreciation, and the negative effects on tradable goods production due to the change in producer incentives, is often referred to as the "Dutch disease" after the decline in the industrial sector of the Netherlands following an increase in natural gas export revenues in the 1970s.

Table 5 - Foreign Capital Inflows for Simulation of Investment Boom and Stabilization

| Simulation Year | Gross Capital Inflow | Interest | Principal Repayment | Net Flow | Debt |
|------------------------|-----------------------------|-----------------|----------------------------|-----------------|-------------|
| 1 | 50.0 | 0.0 | 0.0 | 50.0 | 50.0 |
| 2 | 50.0 | 2.6 | 10.0 | 37.6 | 92.6 |
| 3 | 30.0 | 4.6 | 20.0 | 5.4 | 107.2 |
| 4 | 0.0 | 5.4 | 30.0 | -35.4 | 82.4 |
| 5 | 0.0 | 4.2 | 40.0 | -44.2 | 46.6 |
| 6 | 0.0 | 2.4 | 49.0 | -51.4 | 0.0 |

Source: Model simulations.

Table 6 - Investment Boom and Stabilization: Simulation Result 1

| | Simulation 1 | | |
|------------------------------|-----------------|--------|---------------|
| | Investment Boom | | Stabilization |
| | Year 1 | Year 3 | Year 6 |
| Real GDP | 2.62 | 0.69 | -3.27 |
| Private consumption | 3.16 | 0.82 | -3.10 |
| Total real investment | 18.79 | 3.10 | -26.56 |
| Private investment | 28.89 | 4.80 | -41.67 |
| Government investment | 0.00 | 0.00 | 0.00 |
| Government consumption | 0.00 | 0.00 | 0.00 |
| Government revenue | 1.99 | 0.36 | -2.19 |
| Real exchange rate | -4.33 | -1.17 | 3.03 |
| Exports (mn \$) | -1.71 | -0.46 | 0.83 |
| Imports (mn \$) | 9.67 | 1.41 | -8.94 |
| Foreign savings/GDP | 1.49 | 0.24 | -1.32 |
| Sectoral production | | | |
| Agriculture | 1.15 | 0.21 | -1.38 |
| Industry | 3.06 | 1.20 | -5.06 |
| Formal | 3.81 | 1.99 | -6.63 |
| Informal | 2.21 | 0.26 | -2.96 |
| Services | 1.80 | 0.81 | -2.15 |
| Formal | 6.15 | 1.62 | -6.17 |
| Informal | 0.16 | 0.65 | -0.66 |
| Public administration | 0.01 | 0.02 | -0.01 |
| Total | 2.02 | 0.77 | -2.87 |
| Household incomes | | | |
| Urban I (high-income) | | | |
| Total income | 1.08 | 2.70 | -2.23 |
| Nonrent income | 19.88 | 1.40 | -14.09 |
| Urban II (middle-income) | 4.83 | 0.97 | -5.83 |
| Urban III (low-income) | 2.55 | 0.55 | -3.25 |
| Small farm Plateau | 2.60 | 0.56 | -2.69 |
| Small farm East | 2.65 | 0.49 | -3.15 |
| Small farm West/South | 2.55 | 0.47 | -2.59 |
| Large farm rural high-income | 4.34 | 0.37 | -4.28 |
| Nonfarm rural low-income | 3.05 | 0.35 | -2.98 |
| Total | 3.12 | 0.91 | -3.48 |

Source: Model simulations.

incomes than the poor. Three major mechanisms determine these results: direct income effects of changes in capital inflows, investment spending linkages, and variations in the real exchange rate.

Increased foreign savings (the inflow of foreign capital) increase the pool of funds available for government expenditures and investment, thus raising aggregate demand. Given the high level of underemployment of labor, particularly unskilled labor, the supply of many goods and services, especially nontraded goods and services, is relatively elastic. Thus, an increased demand for these goods will elicit an increase in supply with a relatively small increase in price. This effect of increased aggregate demand on output is partly responsible for the 2.6 percent increase in real GDP per capita in year 1.⁸

Increased foreign savings also add to the pool of total savings in the economy, enabling an 18.8 percent rise in total investment in year 1, which translates into increased demand for investment goods and services. Historically, investment spending (apart from certain large irrigation projects) has been heavily concentrated in urban areas, both in terms of the location of investments and in terms of the composition of investment goods (largely urban construction services and to a lesser extent domestic industrial goods).⁹ In response to increased investment demand, industrial output (which here includes construction), grows by 3.1 percent, and demand for highly skilled and moderately skilled labor increases so that real wage rates rise by 2.6 and 0.8 percent, respectively. Returns to formal sector capital also increase, along with increased dividends paid to urban high-income households. Because of this investment spending bias, urban households with skilled and highly skilled labor tend to gain more in real nonrent incomes than other households. Real incomes of the urban II households (those with skilled heads of households) rise by 4.8 percent, compared with the national average gain of 3.1 percent. Apart from the change in quota rents, real incomes of urban I (highly skilled) households, rise by 19.9 percent.

The increase in the quota on imports of manufactured goods helps to limit the appreciation of the real exchange rate resulting from the increased capital inflow. Thus, the real exchange rate appreciates by only 4.3 percent in the first year. In general, the real exchange rate appreciation has the expected effects on traded and nontraded sectors. Output of the nontraded services sector rises by 1.8 percent while agriculture (a mix of traded rice and export crops with nontraded crops and livestock) increases by only 1.2 percent.

⁸ See Dorosh (1993) for sensitivity analysis regarding the elasticity of labor supply. Even with labor supply fixed, real GDP and personal incomes rise by 1.3 and 1.7 percent, respectively, as labor resources are reallocated toward higher productivity industrial sectors.

⁹ Purchases of imported intermediate and capital goods also account for much of the investment spending.

Table 7 shows the contribution of the various income components to changes in real household incomes in simulation 1. Increased wages from highly skilled labor increase nominal incomes of the urban nonpoor by 4.5 percent and larger dividends raise nominal incomes by 10.3 percent. The decline in rents, given a partial relaxation of the foreign exchange constraint with increased capital inflows, reduces nominal incomes of the urban nonpoor by 13.0 percent. Thus total nominal incomes of these households increase by only 2.0 percent and real incomes rise by just 1.1 percent.

Nominal income gains are roughly similar for small farmers in all agroecological zones, although slightly smaller for those on the east coast, since returns to land and capital on export crop production are dampened by the real exchange rate appreciation. Real incomes of small farmers on the east coast actually increase slightly more than do those of other small farmers because the price of their consumption bundle rises less. As the direction of new net capital inflows reverses after year 3 (modeling the effects of stabilization measures), the economy contracts and real incomes decline. By year 6 of the simulation, real GDP is down by 3.3 percent vis à vis year 6 of the base run, and investment has fallen by 26.6 percent. (Relative to year 1 of the investment boom, investment in year 6 is lower by 31.5 percent.) The real exchange rate in year 6 depreciates by 3.0 percent relative to the base run, helping to limit the reduction in agricultural output to -1.4 percent but worsening incentives for services, which fall by 2.2 percent.

With the exception of urban I households, all household incomes (per capita) decline continuously after year 1 of the simulation.¹⁰ And for all households except the urban nonpoor, real per capita income in year 6 of the simulation is lower than in year 1 of the base SAM. The present value of the per capita income streams (using a 10 percent discount rate) in simulation 1 is about 0.1 percent lower to 0.2 percent higher than in the base run for all household groups except the urban nonpoor. For these households, the discounted per capita income stream is 0.9 percent higher in simulation 1 than in the base run.

This simulation of increased foreign capital inflows, increased investment expenditures, and subsequent stabilization suggests that the urban high- and middle-income households benefited the most from the investment boom in the late 1970s. The skilled labor of these groups was in demand by the construction and manufacturing industry to produce investment goods. Apart from the loss of quota rents, the percentage gain for urban high-income households was more than six times the national average. Lower-income households (especially rural households) benefited less from the investment boom, as the negative effects of the real exchange rate appreciation somewhat offset the benefits of the increase in aggregate demand on employment.

¹⁰ Real per capita income for urban I households declines continuously after year 2 of the simulation.

Table 7 - Breakdown of Household Income Changes: Simulation 1 (Investment Boom)

| | Urban Non- poor | Urban Middle | Urban Poor | Small Farmer Plateau | Small Farmer East Coast | Small Farmer West/South | Rural Non- poor | Rural Nonfarm Poor | All Households |
|-------------------------|-----------------------|-----------------|---------------|----------------------------|-------------------------------|-------------------------------|-----------------------|--------------------------|-------------------|
| Highly skilled labor | 4.512 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.789 |
| Skilled labor | 0.143 | 5.941 | 0.000 | 0.000 | 0.000 | 0.000 | 0.691 | 0.000 | 0.833 |
| Unskilled labor | 0.043 | 1.905 | 5.234 | 5.464 | 5.444 | 4.774 | 2.370 | 4.422 | 3.083 |
| Informal capital | 0.000 | 1.579 | 3.001 | 0.721 | 0.719 | 0.632 | 3.815 | 3.993 | 1.784 |
| Land - Plateau | 0.000 | 0.000 | 0.000 | 1.782 | 0.000 | 0.000 | 0.000 | 0.000 | 0.226 |
| Land - East Coast | 0.000 | 0.000 | 0.000 | 0.000 | 1.644 | 0.000 | 0.000 | 0.000 | 0.219 |
| Land - West/South | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.532 | 0.000 | 0.000 | 0.259 |
| Land - Large farm | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.002 | 0.000 | 0.940 |
| Dividends | 10.327 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.807 |
| Rents | -13.020 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -2.278 |
| Total | 2.004 | 9.425 | 8.235 | 7.967 | 7.807 | 7.938 | 9.878 | 8.416 | 7.662 |
| Change in national CPI | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 |
| Real income change I | -2.407 | 4.692 | 3.554 | 3.298 | 3.145 | 3.270 | 5.126 | 3.727 | 3.006 |
| Change in household CPI | 0.914 | 4.386 | 5.545 | 5.232 | 5.027 | 5.259 | 5.307 | 5.212 | 4.408 |
| Real income change II | 1.081 | 4.827 | 2.549 | 2.599 | 2.647 | 2.545 | 4.341 | 3.045 | 3.117 |

The simulation results also suggest that just as the investment boom benefited urban households the most, the stabilization policies that cut back foreign capital inflows and government investment likewise hurt these same households the most. The investment boom itself, however, was unsustainable. The large increase in foreign capital inflow in the form of loans could not continue indefinitely: the stabilization effort was inevitable.

Finally, although the calculations of the present value of the income streams for many household groups under the investment boom followed by stabilization scenario than in the base run, the present value measure may not adequately reflect people's perception of their own welfare. From a political economy standpoint, if expectations of higher incomes are raised during the investment boom period, the subsequent decline may lead to more dissatisfaction with government policies than the base scenario where a long-term trend is maintained.

INCREASED RICE IMPORTS: SIMULATION 2

Not all of the increase in foreign savings in the late 1970s was spent on imported capital goods. Rice imports also increased substantially in this period: imports in 1980 were nearly double those in 1984. Simulation 2 models a 90 percent increase in rice imports funded by an increase in foreign savings of equal value (Table 8).

As in simulation 1, the increase in foreign savings permits an increase in investment. The value of the additional rice imports is added implicitly to government total revenues, as parastatals sold the imports, reducing government borrowing and increasing availability of loans to parastatals for investments. Total investment rises by 7.1 percent in year 1 of this scenario, although real GDP declines by 0.1 percent, in part due to disincentive effects on rice production. Real incomes rise by 0.2 percent on average.

Although investment demand increases, the continued quotas on manufactured goods inhibit production of the formal manufacturing sector, which requires imports of intermediate goods. Thus, industrial output falls by 0.4 percent (compared to a gain of 3.1 percent in simulation 1 with an increase in total investment of roughly twice the magnitude). The gains in real incomes for urban households due to the investment spending bias thus are limited.

Changes in relative prices play a major role in the effects of increase rice imports. As domestic rice prices fall, domestic paddy production declines by 5.4 (6.0) percent in year 1 (year 6). Net supply (production plus imports) increases, however, and rice consumption increases by 1.7 percent in year 1 and 1.1 percent in year 6. In this simulation, the value of additional rice imports exactly matches the increase in foreign savings, so that no large gain is seen in foreign exchange available for other imports. The real exchange rate depreciates slightly as the decline in rice prices depresses prices of competing nontraded food commodities as well.

Table 8 - Increased Rice Imports: Simulation Result 2

| | Simulation 2 Increased Rice Imports | |
|------------------------------|--|--------|
| | Year 1 | Year 6 |
| Real GDP | -0.08 | 0.06 |
| Private consumption | 0.26 | 0.37 |
| Total real investment | 7.10 | 8.03 |
| Private investment | 10.92 | 12.60 |
| Government investment | 0.00 | 0.00 |
| Government consumption | 0.00 | 0.00 |
| Government revenue | 2.62 | 2.00 |
| Real exchange rate | 0.99 | 0.46 |
| Exports (mn \$) | 0.11 | 0.12 |
| Imports (mn \$) | 6.32 | 6.26 |
| Foreign savings/GDP | 0.83 | 0.85 |
| Sectoral production | | |
| Agriculture | -1.28 | -1.55 |
| Industry | -0.38 | -0.04 |
| Formal | 0.28 | 1.18 |
| Informal | -1.22 | -1.65 |
| Services | 0.12 | 0.50 |
| Formal | -0.42 | 0.10 |
| Informal | 0.44 | 0.88 |
| Public administration | 0.02 | 0.02 |
| Total | -0.41 | -0.20 |
| Household incomes | | |
| Urban I (high-income) | | |
| Total income | 1.65 | 2.58 |
| Nonrent income | -0.76 | -1.06 |
| Urban II (middle-income) | 0.66 | 0.43 |
| Urban III (low-income) | 1.51 | 0.77 |
| Small farm Plateau | -0.11 | -0.22 |
| Small farm East | -0.03 | 0.03 |
| Small farm West/South | -0.48 | -0.47 |
| Large farm rural high-income | -0.59 | -0.67 |
| Nonfarm rural low-income | 2.09 | 0.80 |
| Total | 0.20 | 0.31 |

Source: Model simulations.

Not surprisingly, the household groups that do not produce rice benefited most from the large increase in rice imports in the late 1970s. Urban households and the nonfarm rural poor enjoy the largest increase in real incomes, since the decline in rice prices brings about a more significant reduction in the cost of their consumption basket (1.7 and 1.9 percent, respectively), while their incomes are not directly tied to rice farming (Table 9). Given that the rice imports in this simulation are funded through additional foreign borrowing, the net effect of the rice import policy on rural farmers is minimal, since the effects of greater aggregate demand offset the adverse effects of lower rice prices (and thus lower returns to land) for producers. Of course, without a change in foreign capital inflows, a policy of increased rice imports would have no positive aggregate demand effects and rural producers would bear the brunt of lower producer prices.

While increasing imports of rice does increase real incomes, this policy leads to lower overall growth. Comparing year 1 of simulations 1 and 2, using foreign capital inflows to finance rice imports instead of manufactured goods and other diverse imports results in lower overall investment and real GDP growth.¹¹ Real income gains for the rural nonfarm poor and the urban poor, both large net consumers of rice, enjoy similar gains in real incomes in the two scenarios. Other household groups see larger gains in real incomes with the investment boom scenario. These results are largely derived from the larger production disincentives arising from imports of a highly tradable commodity (rice) compared with imports of goods that are less perfect substitutes for domestic production (imported manufactured goods).¹²

TRADE LIBERALIZATION: SIMULATIONS 3 AND 4

Though a key to Madagascar's economic reforms, trade was not liberalized until 1988, six years after stabilization efforts were begun in earnest. Until that time, import licenses and import quotas were used to control the outflow of foreign exchange. In simulation 3, the quota on manufactured imports is removed and the import tariff is kept at its 1984 value of 19.3 percent. Since foreign savings are held constant in this simulation, changes in the real exchange rate and the level of investment dominate the results (Table 10).

With the quota (and implicit import tariff) removed, imports of manufactured goods rise by 15.4 percent in year 1 and domestic production of manufactured goods falls by 2.5 percent. Quota rents are of course eliminated, sharply

¹¹ Real GDP increases under the investment boom scenario (simulation 1, year 1), while it falls slightly in year 1 of the rice import scenario and is only slightly higher by year 6.

¹² Sensitivity analysis on the impact of using a higher degree of substitutability of imported and domestic rice in the model simulations results in a slightly greater decline in paddy production (-5.7 percent in year 1 compared with -5.4 percent in year 1 of simulation 2 above) and a smaller rise in rice consumption and real incomes (for most households) (see Dorosh 1993).

Table 9 - Breakdown of Household Income Changes: Simulation 2 (Increased Rice Imports)

| | Urban Non- poor | Urban Middle | Urban Poor | Small Farmer Plateau | Small Farmer East Coast | Small Farmer West/South | Rural Non- poor | Rural Nonfarm Poor | All Households |
|-------------------------|-----------------------|-----------------|---------------|----------------------------|-------------------------------|-------------------------------|-----------------------|--------------------------|-------------------|
| Highly skilled labor | -0.107 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.019 |
| Skilled labor | -0.008 | -0.312 | 0.000 | 0.000 | 0.000 | 0.000 | -0.036 | 0.000 | -0.044 |
| Unskilled labor | -0.006 | -0.252 | -0.692 | -0.723 | -0.720 | -0.631 | -0.313 | -0.585 | -0.408 |
| Informal capital | 0.000 | 0.274 | 0.520 | 0.125 | 0.125 | 0.110 | 0.662 | 0.692 | 0.309 |
| Land - Plateau | 0.000 | 0.000 | 0.000 | -1.347 | 0.000 | 0.000 | 0.000 | 0.000 | -0.171 |
| Land - East Coast | 0.000 | 0.000 | 0.000 | 0.000 | -0.914 | 0.000 | 0.000 | 0.000 | -0.122 |
| Land - West/South | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -1.150 | 0.000 | 0.000 | -0.118 |
| Land - large farm | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -2.002 | 0.000 | -0.627 |
| Dividends | 0.796 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.139 |
| Rents | 2.720 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.476 |
| Total | 3.396 | -0.291 | -0.172 | -1.944 | -1.509 | -1.672 | -1.690 | 0.108 | -0.583 |
| Change in national CPI | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 | 4.520 |
| Real income change I | -1.075 | -4.603 | -4.489 | -6.185 | -5.769 | -5.924 | -5.942 | -4.222 | -4.883 |
| Change in household CPI | 1.717 | -0.940 | -1.661 | -1.834 | -1.482 | -1.20 | -1.108 | -1.941 | -0.781 |
| Real income change II | 1.651 | 0.656 | 1.514 | -0.112 | -0.028 | -0.478 | -0.589 | 2.089 | 0.199 |

Table 10 - Trade Liberalization: Simulation Results 3 and 4

| | Simulation 3 Liberalization | | Simulation 4 Liberalization with 20% Reduction in Foreign Savings | |
|------------------------------|--------------------------------|--------|--|--------|
| | Year 1 | Year 6 | Year 1 | Year 6 |
| Real GDP | 2.76 | 6.56 | 2.39 | 5.92 |
| Private consumption | 1.56 | 4.40 | 0.83 | 3.48 |
| Total real investment | 18.99 | 38.01 | 16.55 | 34.01 |
| Private investment | 29.20 | 59.63 | 25.45 | 53.36 |
| Government investment | 0.00 | 0.00 | 0.00 | 0.00 |
| Government consumption | 0.00 | 0.00 | 0.00 | 0.00 |
| Government revenue | 9.25 | 16.56 | 10.06 | 16.92 |
| Real exchange rate | 11.81 | 18.01 | 15.32 | 21.02 |
| Exports (mn \$) | 6.99 | 12.94 | 8.36 | 13.97 |
| Imports (mn \$) | 5.89 | 10.92 | 3.87 | 8.66 |
| Foreign savings/GDP | 0.00 | 0.00 | -0.42 | -0.43 |
| Sectoral production | | | | |
| Agriculture | 1.61 | 3.12 | 1.53 | 2.94 |
| Industry | 2.88 | 8.80 | 2.48 | 7.91 |
| Formal | 3.86 | 12.71 | 3.41 | 11.48 |
| Informal | 1.78 | 3.57 | 1.44 | 3.13 |
| Services | 1.66 | 4.90 | 1.40 | 4.39 |
| Formal | 5.81 | 12.32 | 4.93 | 11.05 |
| Informal | 0.09 | 2.51 | 0.07 | 2.24 |
| Public administration | -0.06 | -0.04 | -0.07 | -0.05 |
| Total | 2.03 | 5.67 | 1.78 | 5.12 |
| Household incomes | | | | |
| Urban I (high-income) | | | | |
| Total income | -11.49 | -8.29 | -13.62 | -10.66 |
| Nonrent income | 23.89 | 35.83 | 21.25 | 32.61 |
| Urban II (middle-income) | 4.51 | 9.83 | 3.83 | 8.82 |
| Urban III (low-income) | 2.04 | 4.77 | 1.63 | 4.20 |
| Small farm Plateau | 2.76 | 5.30 | 2.42 | 4.82 |
| Small farm East | 4.28 | 8.29 | 4.23 | 7.99 |
| Small farm West/South | 2.80 | 5.05 | 2.50 | 4.63 |
| Large farm rural high-income | 4.15 | 6.58 | 3.52 | 5.91 |
| Nonfarm rural low-income | 2.61 | 4.22 | 2.11 | 3.71 |
| Total | 1.07 | 3.87 | 0.32 | 2.94 |

Source: Model simulations.

reducing the real incomes of urban I households by 11.5 percent. Demand is shifted toward imported manufactured goods, from other goods in the economy, so that the price of nontradable goods falls relative to the price of tradable goods. The real exchange rate depreciates by 11.8 percent in year 1 (18.0 percent relative to the base run in year 6).

When relative prices are higher, more tradable goods are produced. Exports increase by 7.0 percent in dollar terms, permitting an increase in imports of 5.9 percent. Revenues from import tariffs and export taxes increase as well, so government revenues rise by 9.3 percent in real terms. Since government real expenditures are held fixed in the simulation, the increased government revenues add to total savings. These additional funds enable investment to increase by 19.0 percent in year 1. Real GDP increases by 2.8 percent in year 1, and since investment is 19 to 38 percent higher each year, the capital stock grows faster than in the base run and real GDP in year 6 is 6.6 percent higher than in year 6 of the base run.

Apart from those households that suffer a loss of rents, all households enjoy significant gains in real incomes as a result of trade liberalization. Urban households with skilled labor again gain most from the surge in investment spending. Nonrent incomes of urban I households rise by 23.9 percent; urban II household incomes rise by 4.5 percent. Rural per capita incomes rise between 2.6 and 4.3 percent, and small farmers on the east coast who produce export crops gain the most. Land on the east coast and formal sector capital are the only two factors of production for which nominal returns rise in this simulation (Table 11). Thus liberalizing trade, even without a change in foreign capital inflows, increases total output (a gain in efficiency) and improves income distribution (a gain in equity).

Historically, a reduced trade deficit accompanied the trade liberalization in 1987 and 1988. In simulation 4, foreign savings are reduced by 20 percent. In this scenario, the depreciation of the real exchange rate in year 1 increases to 15.3 percent. Smaller capital inflows reduce the funds available for investment compared with those in simulation 3, but because of the increase in government tax revenues, investment still increases by 16.6 percent. With less of a boost in earnings from the construction sector, urban incomes increase less dramatically than in simulation 3. Real incomes of urban II households increase by 3.8 percent in year 1 compared with 4.5 percent in simulation 3. With reduced capital inflows, small farmers on the East Coast see only a small decline in real incomes vis à vis simulation 3, because the greater real exchange rate depreciation raises the real price of export crops and thus the returns to land (in real terms) on the east coast (Table 12). Rural households still gain from 2.1 to 4.2 percent in year 1 of simulation 4 relative to the base run.

These simulations of trade liberalization (with and without reduced foreign capital inflows), a cornerstone of the structural adjustment measures undertaken in Madagascar, show that these policies tended to benefit rural households, especially export crop producers. Government revenues increase in these simulations, so that with government recurrent expenditures held in check, the

Table 11 - Breakdown of Household Income Changes: Simulation 3 (Trade Liberalization, no change FSAV)

| | Urban Non-poor | Urban Middle | Urban Poor | Small Farmer Plateau | Small Farmer East Coast | Small Farmer West/South | Rural Non-Poor | Rural Nonfarm Poor | All Households |
|-------------------------|----------------|--------------|------------|----------------------|-------------------------|-------------------------|----------------|--------------------|----------------|
| Highly skilled labor | -2.084 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.365 |
| Skilled labor | -0.084 | -3.489 | 0.000 | 0.000 | 0.000 | 0.000 | -0.406 | 0.000 | -0.489 |
| Unskilled labor | -0.041 | -1.849 | -5.080 | -5.304 | -5.284 | -4.634 | -2.301 | -4.293 | -2.992 |
| Informal capital | 0.000 | -1.263 | -2.401 | -0.577 | -0.575 | -0.505 | -3.053 | -3.195 | -1.427 |
| Land - Plateau | 0.000 | 0.000 | 0.000 | -1.456 | 0.000 | 0.000 | 0.000 | 0.000 | -0.185 |
| Land - East Coast | 0.000 | 0.000 | 0.000 | 0.000 | 0.131 | 0.000 | 0.000 | 0.000 | 0.017 |
| Land - West/South | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -2.066 | 0.000 | 0.000 | -0.211 |
| Land - large farm | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.113 | 0.000 | -0.036 |
| Dividends | 5.946 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.040 |
| Rents | -28.563 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -4.997 |
| Total | -24.827 | -6.601 | -7.481 | -7.337 | -5.729 | -7.206 | -5.872 | -7.488 | -9.644 |
| Change in national CPI | -10.561 | -10.561 | -10.561 | -10.561 | -10.561 | -10.561 | -10.561 | -10.561 | -10.561 |
| Real income change I | -15.950 | 4.428 | 3.443 | 3.605 | 5.403 | 3.751 | 5.242 | 3.436 | 1.025 |
| Change in household CPI | -15.072 | -10.632 | -9.335 | -9.822 | -9.601 | -9.733 | -9.622 | -9.843 | -10.597 |
| Real income change II | -11.486 | 4.511 | 2.044 | 2.756 | 4.283 | 2.799 | 4.149 | 2.612 | 1.065 |

Table 12 - Breakdown of Household Income Changes: Simulation 4 (Trade Liberalization)

| | Urban Non- poor | Urban Middle | Urban Poor | Small Farmer Plateau | Small Farmer East Coast | Small Farmer West/South | Rural Non- poor | Rural Nonfarm Poor | All Households |
|-------------------------|-----------------------|-----------------|---------------|----------------------------|-------------------------------|-------------------------------|-----------------------|--------------------------|-------------------|
| Highly skilled labor | -3.565 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.624 |
| Skilled labor | -0.133 | -5.525 | 0.000 | 0.000 | 0.000 | 0.000 | -0.643 | 0.000 | -0.775 |
| Unskilled labor | -0.059 | -2.621 | -7.203 | -7.520 | -7.492 | -6.571 | -3.262 | -6.086 | -4.243 |
| Informal capital | 0.000 | -1.863 | -3.542 | -0.851 | -0.849 | -0.745 | -4.502 | -4.713 | -2.105 |
| Land - Plateau | 0.000 | 0.000 | 0.000 | -2.133 | 0.000 | 0.000 | 0.000 | 0.000 | -0.271 |
| Land - East Coast | 0.000 | 0.000 | 0.000 | 0.000 | -0.266 | 0.000 | 0.000 | 0.000 | -0.035 |
| Land - West/South | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -3.024 | 0.000 | 0.000 | -0.309 |
| Land - large farm | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.922 | 0.000 | -0.289 |
| Dividends | 3.773 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.660 |
| Rents | -28.753 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -5.030 |
| Total | -28.737 | -10.010 | -10.745 | -10.504 | -8.607 | -10.340 | -9.329 | -10.799 | -13.021 |
| Change in national CPI | -13.282 | -13.282 | -13.282 | -13.282 | -13.282 | -13.282 | -13.282 | -13.282 | -13.282 |
| Real income change I | -17.822 | 3.774 | 2.926 | 3.204 | 5.391 | 3.392 | 4.559 | 2.863 | 0.301 |
| Change in household CPI | -17.505 | -13.325 | -12.176 | -12.622 | -12.313 | -12.527 | -12.412 | -12.639 | -13.301 |
| Real income change II | -13.615 | 3.825 | 1.630 | 2.424 | 4.226 | 2.500 | 3.520 | 2.106 | 0.323 |

trade liberalization increases total savings and investment in the economy. The size of the decline in foreign capital inflows largely determine total investment and the extent of the real exchange rate depreciation.

5. CONCLUSIONS

Together, the four simulations of macroeconomic policy changes in the 1980s suggest that stabilization and structural adjustment policies in Madagascar did not adversely affect the bulk of the poor, that is the rural poor. An inflow of foreign savings benefited all household groups to some extent, but the investment boom benefited the urban households the most, largely because of patterns of investment spending. Stabilization measures such as a decline in foreign savings and reduced rice imports had their largest negative impact on urban households, and, in the case of a decline in rice imports, on rice deficit rural households as well. Trade liberalization improved both efficiency and equity, redistributing income away from those who had captured quota rents and boosting incentives to produce tradable goods, an important income source in rural areas.

Three key mechanisms largely determine the impact of macroeconomic policies on household incomes in these simulations: the real exchange rate, the level of investment and aggregate demand effects. Real exchange rate changes, whether caused by changes in trade policy, foreign capital inflows or other factors, to a large extent determine production and consumption incentives in the economy. Policies leading to depreciations of the real exchange rate tend to benefit the agricultural sector and small farmers, who constitute the bulk of the poor in Madagascar. Increased government savings and total investment, on the other hand, tend to benefit higher income, urban households who gain most from gains in the industrial and construction sectors. These latter effects result from an urban bias in the destination of investment as well as in the composition of investment goods, factors held fixed in the model simulations.¹³ Investment concentrated more heavily in rural activities, using more unskilled labor and local materials, is likely to have a more positive effect on alleviating poverty. Finally, given the assumption of relatively elastic supplies of nontraded goods in the Malagasy economy due to considerable underemployment of unskilled labor, there are positive multiplier effects resulting from an increase in aggregate demand, from whatever the source.

In most of the simulations, urban high income households, not the poor, are more affected by policy changes and external shocks than are other household groups. Urban high income households, because they own significant amounts of two of the most scarce resources in the Malagasy economy, capital and skilled labor, see major changes in their incomes from policy-induced changes in the formal sector and the levels of investment. That these households were among the biggest beneficiaries of the investment boom and the biggest losers from the contraction in the economy in the stabilization period suggests one major reason

¹³ See Pryor (1990) for a discussion of urban bias in Madagascar's long-term economic development.

why adjustment policies were initially so strongly resisted in Madagascar, as in other countries of sub-Saharan Africa.

Sectoral and household level interventions can of course offset the negative effects of macroeconomic and other policies on income distribution. But interventions such as food subsidies and income transfers can be expensive and difficult to target and administer. Although tax policies can be used to adjust relative prices of key goods in favor of the poor, targeting and enforcement can be problematic.

The urban bias in development policy effects is not unchangeable, however. Investment can be more concentrated in rural areas where the bulk of the poor live and in labor-intensive urban activities. More unskilled-labor intensive means of capital construction can be used to increase demand for labor supplied by poor households. An appropriate blend of fiscal, monetary and exchange rate policies can prevent real exchange rate appreciations that hurt the rural poor. The investment boom of the late seventies did not greatly benefit the poor and rice policies, while benefitting the urban poor, had little positive impact on small farmers who constitute the bulk of Madagascar's poor.

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Appendix Table 1 - Trade Levels and Parameters, Madagascar 1984

| | Domestic | | | Elasticity of Substitution |
|-----------------------|------------|---------|---------|-------------------------------|
| | Production | Exports | Imports | |
| (billion FMG) | | | | |
| Paddy | 168.2 | 0.0 | 0.0 | 2.0 |
| Other food crops | 237.9 | 2.0 | 3.7 | 0.9 |
| Export crops | 43.3 | 35.2 | 0.0 | 5.0 |
| Industrial crops | 14.2 | 0.0 | 0.0 | 2.0 |
| Livestock | 250.1 | 10.1 | 0.0 | 0.9 |
| Energy | 80.2 | 7.4 | 66.3 | 0.9 |
| Milled rice | 170.0 | 0.0 | 18.0 | 5.0 |
| Processed food | 322.2 | 12.9 | 8.6 | 0.9 |
| Textiles | 73.5 | 6.7 | 11.3 | 0.9 |
| Manufactures | 122.6 | 1.8 | 130.9 | 0.7 |
| Construction | 88.2 | 0.0 | 0.0 | 0.4 |
| Transport | 266.6 | 33.8 | 24.5 | 0.4 |
| Commerce | 346.8 | 0.0 | 0.0 | 0.4 |
| Private services | 298.0 | 3.4 | 26.0 | 0.4 |
| Public administration | 180.4 | 0.0 | 0.0 | 0.4 |
| Total | 2662.1 | 113.5 | 289.2 | n.a. |

Source: Dorosh (1994).

Appendix Table 2 - Household Budget Shares, Madagascar 1984

| | Urban I | Urban II | Urban III | Small Farm Plateau | Small Farm East Coast | Small Farm South and West | Rural Rich | Rural Nonfarm Poor |
|----------------------------------|------------|-------------|--------------|-----------------------|--------------------------|------------------------------|---------------|-----------------------|
| 1. Paddy | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2. Other food crops | 6.32 | 11.31 | 12.97 | 28.22 | 20.37 | 22.55 | 21.26 | 26.33 |
| 3. Export crops | 0.00 | 0.00 | 0.00 | 0.00 | 3.27 | 0.12 | 0.37 | 0.00 |
| 4. Industrial crops | 0.00 | 0.00 | 0.00 | 0.00 | 2.07 | 2.69 | 0.45 | 0.00 |
| 5. Livestock/fishing | 0.66 | 1.63 | 1.85 | 3.01 | 5.02 | 5.02 | 9.65 | 5.02 |
| 6. Mines/energy/water | 3.08 | 7.70 | 8.85 | 0.45 | 0.45 | 0.45 | 0.54 | 0.45 |
| 7. Rice | 3.63 | 17.44 | 23.68 | 18.64 | 15.32 | 12.96 | 12.00 | 19.42 |
| 8. Processed food | 14.33 | 14.47 | 12.76 | 19.50 | 23.32 | 26.03 | 24.34 | 18.60 |
| 9. Textiles | 3.01 | 2.93 | 3.09 | 6.74 | 6.74 | 6.74 | 7.54 | 6.75 |
| 10. Manufactures | 25.00 | 8.13 | 4.70 | 3.09 | 3.09 | 3.09 | 3.08 | 3.09 |
| 11. Construction | 3.56 | 1.57 | 3.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 12. Transport/communications | 10.00 | 3.71 | 2.26 | 12.64 | 12.64 | 12.64 | 13.12 | 12.64 |
| 13. Commerce | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 14. Private services | 30.02 | 30.61 | 26.33 | 7.70 | 7.70 | 7.70 | 7.65 | 7.70 |
| 15. Public services | 0.40 | 0.49 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Total expenditures (billion FMG) | 178.54 | 169.07 | 34.27 | 198.67 | 210.60 | 161.83 | 479.86 | 46.14 |

Appendix Table 3 - Household Demand Parameters

| | Urban I | Urban II | Urban III | Small Farm Plateau | Small Farm East Coast | Small Farm South and West | Rural Rich | Rural Nonfarm Poor |
|--|------------|-------------|--------------|-----------------------|--------------------------|------------------------------|---------------|-----------------------|
| 1. Paddy | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2. Other food crops | 0.39 | 0.64 | 0.63 | 0.77 | 0.61 | 0.46 | 0.55 | 0.79 |
| 3. Export crops | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.50 | 0.50 | 0.50 |
| 4. Industrial Crops | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.50 | 0.50 | 0.50 |
| 5. Livestock/fishing | 0.80 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 6. Mines/energy/water | 0.80 | 1.00 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| 7. Rice | 0.20 | 0.50 | 0.60 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| 8. Processed food | 1.00 | 1.20 | 1.50 | 1.50 | 1.50 | 1.50 | 1.40 | 1.50 |
| 9. Textiles | 1.00 | 1.20 | 1.50 | 1.50 | 1.50 | 1.50 | 1.40 | 1.50 |
| 10. Manufactures | 1.30 | 1.30 | 1.50 | 1.50 | 1.50 | 1.50 | 1.80 | 1.50 |
| 11. Construction | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 12. Transport/communications | 1.00 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| 13. Commerce | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 14. Private services | 1.00 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.20 |
| 15. Public services | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frisch parameter (marginal propensity to save) | -1.6 | -2.5 | -3.5 | -3.5 | -3.5 | -3.5 | -2.0 | -3.5 |