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Economic Motors for Poverty Reduction in Madagascar[1]

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1. POVERTY IN PERSPECTIVE

A. Economic trends

Over the past 40 years, living standards tended downwards in Madagascar (Figure 1). Real income per capita has fallen by 40% since 1960 to about $240 per person in 1999.

Over time, with less wealth to available to distribute, the majority of the population has become poorer. During the 1960's, roughly 45% of the population lived below the poverty line. In contrast, data from the 1990's situate the incidence of poverty between 60% and 70% of the population (World Bank, 1996, Razafindravonona et al., 2001).

The economic recovery that began during the second half of the 1990's was punctuated by turbulence and adjustments. Since 1988, Malagasy policy makers have instituted a structural economic reform program aiming to restart economic growth and diminish poverty levels. These policy changes have given rise to substantial shifts in economic incentives. Since the floating of the Malagasy franc (FMG) in 1994, the FMG has devalued by 300%. The inflation rate, which varied between 40% and 60% between 1994 and 1996 was brought down to 10% towards the end of the decade as a result of budgetary discipline and a severe contraction in bank credit (Table 1). The privatization of major public enterprises, including SOLIMA, radically altered the level of public debt. And fiscal reforms aim to double effective tax rates from 7% of GDP in 1996 to 12% at the beginning of the 21st century.

Complementing these public reforms, a surge in private investment contributed to the re-emergence of strong economic growth during the second half of the 1990's. Two privately financed economic motors helped to stimulate economic activity in urban areas – the Export Processing Zone and tourism. Investments in the Export Processing Zone launched significant growth in exports as well as in urban employment. Employment in the Export Processing Zone rose from around 30,000 in 1995 to 110,000 at the end of the decade, a growth rate of 24% per year (Table 11, MaDIO, 1999b ; Korns, 2000). Tourism, the other key motor of economic growth during the late 1990's, grew by 14%[2] per year and contributed to 15% of exports in 1999. In urban areas, the economic multipliers stimulated by newly employed workers in the Export Processing Zone and tourism industries fueled a noticeable rise in the rhythm of economic activity not only in large formal enterprises but also in the informal sector (Ravelosoa, 1999).

In rural areas, in contrast, available indicators are less clear. A series of natural shocks – the locust invasion of 1998 and 1999, Cyclone Eline in 2000, and the delayed rains of 2000 clearly handicapped farmers across Madagascar. On the other hand, favorable rains in 1997 and the rise of world prices for coffee and vanilla at the end of the decade clearly benefited certain categories of rural producers. A shortage of robust motors of economic growth in rural areas has resulted in a general

[2] Foreign exchange earnings expressed in special drawing rights (SDR).

stagnation and continued high level of poverty in rural zones. Overall, the economic recovery of the end of the 1990s seems to have launched a clear macro economic strengthening though one concentrated in urban areas.

The political crisis of 2002 completely reversed the economic gains of the late 1990's. The breakdown in public transport, both road and air travel, combined with rising insecurity brought Export Processing Zone and tourism industries, motors of the prior economic advance, to a screeching halt. Barricaded roads and the destruction of bridges further limited commercial flows of petroleum and agricultural products as well as imports destined for the urban centers in the interior of the country.

B. Evolution of poverty since 1993[3]

The economic slowdown between 1991 and 1996 led to growing poverty, which increased from 70% in 1993 to 73.3% in 1997. But the recovery observed since 1997 has translated into progressive improvement of the situation, the incidence of poverty has dropped back to 70.2% by 1999, a level comparable to that of 1993.[4] This improvement continued until 2001 when the incidence of poverty dropped agail slightly to 69.6% (Table 2).

Rates of poverty have evolved differently across Madagascar's six provinces. The Province of Antananarivo, primary beneficiary of the concentration of the Export Processing Zone there, has seen overall poverty fall from 63.4% en 1993 to 48.3% in 2001. The Province of Tulear followed the national trend with a deterioration in 1997 followed by improvements through 1999 and 2001. The Province of Tamatave witnessed similar trends except in 2001 when poverty rates worsened and fell back to their 1997 levels. In Madagascar's other three provinces (Antsiranana, Fianarantsoa and Mahajanga), persistent rural poverty led to an overall deterioration until 1999. The degradation continued until 2001 in Mahajanga, while the trend reversed in Fianarantsoa and . Antsiranana between 1999 et 2001.

Urban areas have consistently enjoyed lower poverty rates than rural zones. This observation remains true for both the incidence and intensity of poverty, across all provinces. Moreover, the improvements registered between 1997 and 2001 mostly benefited urban dwellers. During this period, the incidence of poverty in urban areas diminished by 13.2%, falling from 57.3% to 44.1%, compared with a fall of only 1.1% in rural areas where the incidence of poverty remained at 77.1% in 2001.

Thus, in spite of recent progress in urban areas, Madagascar remain a very poor country. Poverty reduction remains the top priority of the Malagasy government.

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[3] Improvements were made between 1993 and 2001 in the consumption questionnaires. Supplementary modules were introduced, notably for the evaluation of durable goods and payments in kind. For this reason, the results obtained in the various EPMs of 1993, 1997, 1999 and 2001 are not perfectly comparable. Nevertheless, using 2001 as a base, trends in poverty since 1993 have been established. In order to achieve comparability, the measures for years prior to 2001 have been estimated using comparable trends between the different years. In this way, for example, at the national level in 1993 the incidence of poverty was 70.0%, the comparable rate in 2001 is 70.4% (see Table 2).

[4] Estimates for the year 2000 made by the Directorate of Household Statistics (DSM) of the National Institute of Statistics (INSTAT) by interpolating between the two EPM surveys of 1999 and 2001.

C. Objective: examination of four engines of growth that might benefit poor households

Madagascar's policy makers are clearly searching for ways to resuscitate the economic recovery that began at the end of the 1990's. But given current high levels of poverty, particularly in rural areas, it will no longer suffice to initiate concentrated aggregate growth. It has become necessary, urgent even, to identify economic motors that will facilitate broad-based participation of underprivileged segments of the population. The present study aims to evaluate four potential motors that might prove able to initiate more broad-based growth benefiting poor households more extensively than in the past.

Motor 1. Growth of agricultural productivity: a) rice, b) cassava.

The vast majority of poor Malagasy, over 80% in fact, live in rural areas and work in agriculture. Agriculture, therefore, becomes a crucial determinant of rural incomes. Within agriculture, the two most important sources of caloric intake by poor households, rice and cassava, contribute significantly not only to agricultural household income but also to the price of basic food staples. Only an increase in agricultural productivity can, at the same time, target both the income of poor agriculturalists as well as diminishing the cost of living of poor urban consumers.

Motor 2. Road investments which lower commercial margins.

Madagascar's rural poor often work in isolated zones where the cost of transport raises input costs and lowers the selling price of their commercialized production. Improvements in rural roads diminish transport costs and thereby commercial margins, and thereby benefits remote producers who see their input costs fall along with an increase in output prices received. Simultaneously, urban consumers see a fall in the price of agricultural produce.

Motor 3. Re-ignition of private investment in the Export Processing Zone.

In urban areas, the Export Processing Zone and tourism appear to be the only sectors of the economy capable of triggering rapid growth and job creation for poor urban households. Rapid growth of the Export Processing Zone during the 1990's provided the key motor driving increased urban employment as it contributed fully have of all formal employment growth. Its subsequent contraction, during the political turbulence following the presidential election of 2002, clearly demonstrated, in reverse, its power as a generator of urban income and jobs.

Motor 4. Increased private investment in tourism.

One of the stars of the economic recovery of the late 1990's, the tourism sector, also suffered during the breakdown of security and air transport during 2002. Only minimally exploited to date, Madagascar's natural touristic sites remain one of the country's most underutilized assets. We will investigate, therefore, the impact of increased investment in tourism.

Graphique 1 -- Evolution du produit intérieur brut (PIB) réel par tête à Madagascar

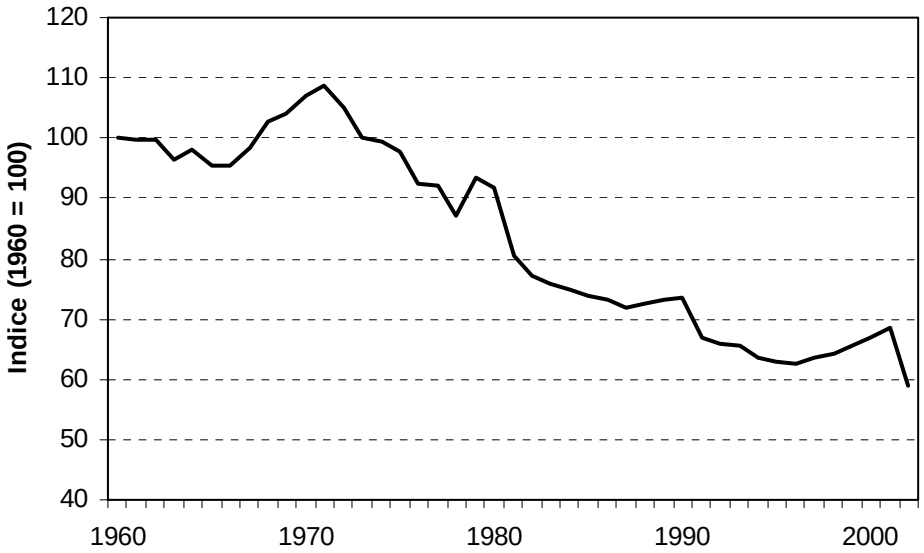

Table 1 -- Macro-economique trends in Madagascar since 1993

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
GDP (annual growth rate)	3.1	-6.3	1.2	2.1	-0.1	1.7	2.1	3.7	3.9	4.7		5.6	-10.9
primary sector	2.1	0.5	1.7	3.2	-0.5	1.9	2.5	1.9	2.1	3.4		4.0	-1.4
secondary	-0.6	-0.4	-1.1	3.3	-1.1	1.8	2.0	4.7	5.3	4.2		4.8	-20.1
tertiary	3.9	-7.7	1.1	2.1	1.2	1.5	2.1	4.6	5.1	5.5		6.1	-12.5
Inflation (annual percentage growth)	11.5	12.9	14.4	12.1	41.7	45.1	17.8	7.3	8.4	9.8		11.9	13.4
Private investment (as % of GDP)	6.9%	4.7%	3.7%	3.7%	4.7%	5.2%	5.0%	5.6%	5.6%	6.1%			
Tax incidence (% of GDP)													
fiscal receipts	9.4%	6.9%	8.6%	8.2%	7.7%	8.3%	8.5%	9.4%	9.8%	11.0%			
current government expenditure	9.1%	9.9%	11.7%	12.1%	12.7%	11.3%	10.5%	10.9%	11.7%	11.1%			

Source: SPPM, STA, INSTAT.

Table 2 -- Trends in Poverty since 1993

	Incidence				Intensity			
	Level	Variation since 1993			Level	Variation since 1993		
	1993	*1997*	*1999*	*2001*	*1993*	*1997*	*1999*	*2001*
National	**70.4**	**3.3**	**1.3**	**-0.8**	**31.3**	**3.3**	**2.5**	**3.6**
Urban	44.2	13.1	2.0	-0.1	14.7	12.1	3.9	3.6
Rural	76.7	1.5	2.2	0.4	35.1	1.6	3.0	4.7
Antananarivo	63.4	-1.6	-6.3	-15.1	24.8	1.3	-1.8	-3.7
Urban	35.7	9.6	0.9	-7.4	12.9	7.1	1.6	-2.5
Rural	72.4	-4.1	-6.9	-15.7	28.5	-0.1	-2.1	-3.0
Fianarantsoa	76.7	0.9	6.9	6.5	36.1	-1.7	6.5	9.4
Urban	55.7	18.2	-9.1	4.1	17.5	19.6	2.8	8.0
Rural	80.1	-1.7	10.6	7.8	37.2	-5.2	7.8	10.3
Toamasina	81.0	1.9	-6.6	1.3	38.3	5.6	-1.1	5.8
Urban	49.4	20.5	-3.2	10.7	17.9	21.4	2.6	10.5
Rural	86.6	-0.3	-4.7	1.3	42.0	3.2	-0.3	6.2
Mahajanga	47.9	20.6	22.8	24.5	16.5	10.5	17.9	18.7
Urban	31.6	30.9	27.9	18.2	6.7	11.6	13.7	10.6
Rural	51.5	18.4	22.1	26.9	18.7	10.4	19.2	21.2
Toliara	86.6	0.9	-9.5	-10.5	44.5	3.6	-9.1	-5.3
Urban	63.3	2.2	-0.4	-10.0	22.3	12.3	4.8	3.1
Rural	92.4	0.7	-11.1	-9.1	49.5	2.0	-11.7	-6.0
Antsiranana	69.0	2.1	12.4	0.2	29.0	1.9	10.0	0.0
Urban	51.0	-22.5	-18.2	-20.9	15.4	-8.1	-6.5	-6.7
Rural	74.2	5.8	16.9	4.8	32.8	3.0	12.2	1.2

Source: INSTAT, Direction des Statistiques des Ménages.

2. ANALYTICAL METHODS

A. Economic structure: the SAM

In order to evaluate the impact of these four levers on the welfare of poor households, we have constructed a social accounting matrix (SAM) to summarize the structure of the Malagasy economy and the share of assets, production and consumption held by poor households in different regions. As a base year, we have chosen 1999, a well documented year before the political crisis of 2002.

The SAM provides a snapshot of the state of the Malagasy economy in 1999. In order to differentiate among the highly variable situation of poor households across different regions, the SAM distinguishes 14 groups of households, 4 urban plus 10 groups of rural households (Table 3). Among rural households, the SAM distinguishes between small and large farm households in each of four geographic zones as well as among poor and non-poor non-agricultural households. We have constructed the household accounts of the SAM using data from the 1999 Permanent Household Survey which provides income, structure of expenditures and assets of Malagasy households in each region (Table 4). An aggregated version of the SAM is summarized in Figure 2. Annex A provides greater detail.

The structure of production varies considerably across urban and rural, farm and nonfarm households. The composition of agricultural production also varies across different agro-ecological regions. In order to capture these differences, the SAM distinguishes among 33 production activities, of which 10 are agricultural, 12 industrial and 11 services (Table 5). The size and composition of national production comes from national accounts and international flows from the balance of payments. Annex A describes the method used in balancing the SAM and reconciling inconsistencies. It likewise includes principal details of the SAM structure.

B. Analyzing the impact of economic change: the CGE

Having situated the poor regionally, sectorally and structurally in the Malagasy economy, we want to introduce as shocks the four potential motors to see how the snapshot will change as a result. In order to accomplish this, we require an economic model that can trace the behavior of economic agents and the impact of various economic shocks.

Given complex interactions – among economic sectors, regions and institutions – we have used a computable general equilibrium (CGE) model, which captures all these interactions. The model used here is based on Lofgren et al. (2001) which, in turn, follows the neoclassical tradition of Dervis, de Melo and Robinson (1982). Structurally, the model retains the same behavioral assumptions, the same production and consumption functions as the 1995 Malagasy CGE model. (Dissou, 1998). Production technology (Leontief in intermediate inputs and CES[5] in the factors) distributes payments to factors according to their marginal productivity. Households receive income in proportion to their share of ownership of each factor.

[5] Constant Elasticity of Substitution

Households pay taxes and save fixed shares of their income. They spend net income according to an LES[6] consumption function.

In the spirit of neoclassical models, prices float in order to equilibrate all markets. The nominal exchange rate varies in order to clear the foreign exchange market. Similarly, prices of goods and wages adjust in order to clear markets for goods and labor. Give structural unemployment for unqualified urban labor, the nominal wage remains fixed for this category of workers and the unemployment rate varies to equilibrate the unskilled labor market.

The parameters governing household and enterprise responses to changing prices – the elasticities of production and consumption – are taken, wherever possible, from available empirical estimates. For household consumption, the LES consumption function is calibrated to approximate income and own price elasticities of demand estimated empirically by Ravelosoa et al. (1999). The production functions are likewise calibrated in order to obtain output price elasticities in the range of available empirical observations. The exact values of these parameters as well as a detailed exposition of the model are available in Annex B.

The model closure keeps foreign savings fixed. Total investment must adjust according to the availability of local savings. The consumer price index is fixed and becomes the numeraire of the model. Supplementary details are available in Lofgren et al. (2001) and in Annex B.

It is important to emphasize that the model utilized is not dynamic. It compares two situations, the base snapshot of the economy in 1999 with the new equilibrium towards which the economy converges following a given shock. The time horizon of the model, therefore, becomes the time required for adjustment from one state to another. This type of comparative static model is generally considered as being a medium term model give the time necessary for the establishment of a new equilibrium in all markets.

The second qualification to note is that we do not evaluate here the cost of public investment necessary to launch each of the four motors. Frequently, this task is very difficult. For example, the cost of agricultural research necessary to produce a new variety of rice or cassava which will increase productivity by 30% is difficult to estimate. We prefer, therefore, to leave this task to specialists in each field – agriculture, transport, tourism and the export zone – to add to our analysis the cost estimates for each category of investment. To complement this, we offer here an evaluation of the principal economic linkages triggered by each of the four proposed motors together with a comparison which permits identification of the impact of each on poor households, both urban and rural.

[6] Constant Elasticity of Substitution

Figure 2 -- Aggregated SAM (MINI MACS), MADAGASCAR 1999 (billions of FMG)

	Activities			Products			Factors			Institutions				ROW
	A1	A2	A3	P1	P2	P3	L	K	T	Households				
	Ag	Indust	Services	P-Ag	P-Ind	P-Serv	Labor	Capital	Land	HH-Urb	HH-Rur	Ent.	Govt	ROW
Activities														
Agriculture				9,162										
Indust					14,900									
Services						18,692								
Products														
P-Ag	684	3,609	297							2,117	3,281		0	1,589
P-Indust	1,000	5,927	2,640							3,974	6,999		0	2,081
P-Serv	1,112	2,112	3,796	3,234	4,384	491				2,219	1,991		1,836	2,116
Factors														
Labor	2,109	1,631	6,357											
Capital	778	1,561	5,283											
Land	3,479	0	0											
Households														
HH-Urbains							5,184	1,209	307			1,779	228	580
HH-Ruraux							4,913	2,271	3,173			2,596	34	857
Entreprises								4,142					440	0
Govt														172
Direct taxes										184	94	207		
Goods and services	0	60	319	0	578	84								
Import taxes				0	541	601								
Export taxes				0	0	0								
ROW				0	3,795	3,906							326	
Savings										791	1,478	0	-23	631
Total expenditure	**9,162**	**14,900**	**18,692**	**12,396**	**24,199**	**23,773**	**10,097**	**7,622**	**3,479**	**9,286**	**13,843**	**4,582**	**2,840**	**8,027**

	billions of FMG	billions of $ USA
GDP, factor cost	21,198	2.5
+ indirect taxes	2,182	0.3
= GDP, market prices	23,381	2.7
Intermediate inputs	21,177	2.5
Commercial margins	8,109	0.9
Household consumption	20,582	2.4
Govt. current spending	2,863	0.3
Exports	5,787	0.7
Direct taxes	486	0.1
Imports	7,701	0.9
Savings	2,877	0.3
Investment	2,877	0.3

Table 3 – Accounts of the 1999 Madagascar SAM

Activities (33)

Agriculture (10)	**Industry (12)**	**Services (11)**
Paddy	Mining	Construction, formal and informal
Vanilla	Energy and water	Transport, formal and informal
Coffee	Petroleum	Commerce, formal and informal
Other export crops	Rice, formal and informal	Tourism, formal and informal
Industrial crops	Food processing, formal and informal	Other services, formal and informal
Cassava	Textile, formal and informal	Public administration
Other crops	Other mfrt industries, formal and informal	
Livestock	Export Processing Zone	
Fishing		
Sylviculture		

Products (34) *--* Same 33 categories as activities with the addition of une product Noncompetitive Imports.

Factors of production (15)

Labor (4)	**Capital (3)**	**Land (8)**
Labor I Highly qualified	Formal	High Plateau, small and large farms.
Labor II Medium qualification	Informal	East Coast, small and large farms.
Labor III Unqualified	nformel Rural	South, small and large farms.
Labor IV Rural		West, small and large farms.

Households (14)

Urban (4)	**Rural Agricoltural (8)**	**Rural Non-Agricultural (2)**
HH Urban 1. highly qualified	HH High Plateau, small and large farms	HH Rural Nonfarm Poor
HH Urban 2, medium qualification	HH East Coast, small and large farms	HH Rural Nonfarm Rich
HH Urban 3, unqualified male head	HH South, small and large farms	
HH Urban 3, femal head	HH West, small and large farms	

Other institutions

Enterprises (1)	Gouvernement	Rest of world

Table 4 -- Income and expenditure of Malagasy households, 1999

	Income	Population		Expenditure		
	(millions of FMG)	total	%	total	per capita	%
				(millions of FMG)		
HH Urb1	3,460	605,726	4.1	2,920	4.82	14.2
HH Urb2	3,207	1,070,253	7.3	2,921	2.73	14.2
HH Urb3m	2,005	1,201,190	8.2	1,890	1.57	9.2
HH Urb3f	615	376,475	2.6	580	1.54	2.8
HH HPp	2,826	2,965,517	20.3	2,696	0.91	13.1
HH HPg	1,182	771,780	5.3	1,012	1.31	4.9
HH Ecp	1,468	1,826,747	12.5	1,395	0.76	6.8
HH Ecg	1,215	1,118,455	7.6	1,110	0.99	5.4
HH Sp	816	795,296	5.4	722	0.91	3.5
HH Sg	640	420,371	2.9	550	1.31	2.7
HH Wp	1,007	1,080,484	7.4	805	0.75	3.9
HH Wg	784	616,761	4.2	602	0.98	2.9
HH RNFp	1,442	928,287	6.3	1,326	1.43	6.4
HH RNFR	2,463	852,197	5.8	2,054	2.41	10
Total	23,130	14,629,539	99.9	20,582		100

Source: Madagascar SAM, 1999.

Table 5 -- Structure of GDP, Madagascar 1

Branches	GDP
Paddy	7.9
Vanilla	0.3
Coffee	0.5
Other export	0.6
Industrial crops	1.1
Cassava	3.5
Other crops	2.5
Livestock	4.2
Fishing	4.2
Sylviculture	5.3
Mines	0.1
EnergyWater	0.8
Petroleum	0.7
Rice-formal	0.1
Foods-formal	3.8
Foods-informal	2.7
Text-Formal	0.2
Text-Informal	0
Other mftr-formal	2
Other mftr-	0.8
Export Zone	2.2
Construction-for	0.9
Construction-inf	0.8
Transport-for	6.5
Transport-ing	0.7
Commerce-for	19.3
Commerce-inf	4.4
Tourism-for	2.5
Tourism-inf	0.3
Other services-for	13.9
Other services-inf	1.5
Public Admin	5.8
Agriculture	30
Non-Agriculture	70
Total	100

Source: Madagascar SAM, 1999.

3. POTENTIAL MOTORS

A. Agriculture

1. Historical overview

Agricultural growth will form a key pillar in any national growth strategy that aims to simultaneously reduce poverty and sustain widespread growth (PADR, 2000). Given the size of Madagascar's agriculture – producing 30% of GDP and 80% of national employment – it is difficult to see how Madagascar can sustain broad-based equitable growth without a vibrant agricultural sector. As a share of consumer spending, agriculture weighs even more heavily. Poor households direct 60% to 75% of total spending on food purchases. Given that food constitutes the largest component of poor household consumption, the price of food staples – governed in turn by farm productivity – in large part determines the real income of poor households.

Historically, agriculture has not played its role as a motor of economic growth. In past decades, the agricultural growth rate has remained substantially below the rate of population growth (Table 1).

Rice production, which dominates with 50% of agricultural value added and 45% of calories consumed, has stagnated over the past 40 years since independence. Madagascar, a substantial exporter of rice during the 1960's has become, in recent decades, a net importer. Rice yields remain very low (Table 6), around 2 tons per hectare, due to the sparse availability of improved varieties and modern inputs and aggravated by the gradual degradation of Madagascar's large irrigated perimeters at Lac Alaotra and Maravoy (Droy et al., 1998 ; Roubaud, 1997 ; FAOSTAT). More than 80% of increase in rice output have come from area expansion by Madagascar's small farmers, which has led to a gradual expansion of cultivated acreage up hillsides and onto increasingly marginal soils (Bockel, 2002). This expansion into marginal lands exacerbates productivity problems while at the same time accelerating environmental degradation. A boost in rice productivity, therefore, promises to: • boost rural incomes, • moderate staple food prices and therefore improve real incomes of urban and poor consumers who are net purchasers of rice, and • reverse deleterious trends of deforestation and environmental degradation (Minten et al., 1997).

Cassava, the second most important source of calories in Madagascar, contributes 15% of national calories. Among the most vulnerable households, this share increases sharply. Likewise, in the drought-affected South of Madagascar, cassava provides the principal source of calories. Elsewhere, across all other zones, poor households depend more heavily on cassava than do the rich. Across all geographic zones, cassava accounts for a 50% greater share of total food intake among poor households than among the non-poor (Dostie et al., 2000). Among homeless population of Antananarivo, this dependence on cassava is striking (Table 7). Harvested throughout the year, cassava serves as an important seasonal safety net among poor households by permitting them to survive the lean season when rice becomes scarce and rice prices peak. Dried cassava chips transit long distances in Madagascar and serve to cushion seasonal food hunger, particularly during drought

years when traders redirect the flows of dried cassava redirect to target the most drought-affected zones (Dostie et al., 2000). By targeting the most drought-affected households and regions, increased yields among cassava farmers hold the potential to play a key role in improving the welfare of poor Malagasy households.

2. Model simulations

Our model simulates the impact of a 30% productivity increase for both rice and cassava. Even with identical percentage shocks, the absolute change remains twice as large with rice given its larger share in GDP. Since the absolute shocks are not equivalent, we cannot compare absolute changes across the two simulation but rather the relative changes within each.

In both cases, increased agricultural productivity results in increased production, rising GDP, incomes and real consumption of households (Table 8). By rendering agricultural factors of production more productive, new farm technology induces a production boost. In turn, through spillover effects with other sectors of the economy, the production boost increases demand for consumer goods and inputs required in their production, thereby initiating a reallocation of production to other sectors and a general increase in production throughout the economy.

Following a 30% productivity shock, output prices fall, by about 27% for rice and 24% for cassava, far more than the ultimate increase in output which stands at 14% for rice and only 5% for cassava. Because of inelastic demand for these two goods (with own price elasticities of -.7 for rice and -.3 for cassava), prices fall quickly with output gains (see Table B.1). This benefits net consumers of both rice and cassava. The major beneficiaries of these investments in agricultural productivity are, therefore, poor urban households, rural nonagricultural households, and in the case of rice, farm households in the South who profit from the fall in rice price since they do not produce very much rice but rather are net purchases of the grain. Taking total real consumption as our welfare measure, growth in cassava productivity appears to benefit particularly poor urban and rural households, particularly in the South. In response to rising productivity among rice producers, urban households increase their total consumption by 3% to 4%, rural nonfarm households by 2.5% and southerners by around 2%. For households cultivating rice, total consumption rises by between 1% and 2%, that is less than other households because the productivity gains are dampened by the more rapid fall in prices. In practice, these changes occur gradually over a period of years. In this way, the early adopters win by switching to the new technologies, and as prices trend downwards they seek to diversify their production into more profitable alternative niches. By capturing, all at once, changes that would occur gradually over time, the simulations underline two principal facts: • rising agricultural productivity focused on food staples will significantly raise aggregate welfare by increasing productive capacity of Madagascar's natural and human resources; and • net consumers of rice and cassava will be the principle beneficiaries of this increased farm productivity.

Table 6 -- Agricultural Trends in Madagascar

	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991-1995	1996-2000
Rice								
cultivated area ('000 ha)	843	986	1,042	1,147	1,183	1,142	1,166	1,191
yield (kg/ha)	1.9	1.8	1.9	1.8	1.8	2.0	2.1	2.1
production per capita (kg/year)	268.6	269.6	258.9	237.6	212.0	200.7	186.5	165.1
Cassava								
cultivated area ('000 ha)	165	178	195	249	323	338	346	355
yield (kg/ha)	6.1	6.4	6.3	6.2	6.0	6.7	6.8	6.7
production per capita (kg/year)	172.8	172.0	164.5	178.4	198.0	200.7	179.5	157.2

Source: FAOSTAT.

Table 7 -- Food Consumption of Malagasy Households, 1999

	HH1 HH Urb1	HH2 HH Urb2	HH3 HH Urb3m	HH4 HH Urb3f	HH5 HH HPp	HH6 HH HPg	HH7 HH Ecp	HH8 HH Ecg	HH9 HH Sp	HH10 HH Sg	HH11 HH Wp	HH12 HH Wg	HH13 HH RNFp	HH14 HH RNFr
Per capita consumption (000 FMG)	4.8	2.7	1.6	1.5	0.9	1.3	0.8	1.0	0.9	1.3	0.7	1.0	1.4	2.4
Food consumption														
food expenditure (000 FMG)	1.6	1.3	0.9	0.9	0.7	0.9	0.6	0.8	0.7	1.1	0.6	0.7	0.8	1.1
as % of total expenditure	33.9%	46.2%	56.9%	60.9%	73.5%	72.0%	81.2%	81.3%	81.5%	81.2%	75.6%	71.8%	52.9%	44.4%
Rice consumption														
kg per person	109.5	106.1	94.8	93.8	81.1	111.2	75.5	112.5	36.7	46.1	68.3	95.3	78.4	108.8
as % of total expenditure	4.5%	7.8%	12.1%	12.2%	17.8%	17.0%	19.8%	22.7%	8.1%	7.1%	18.3%	19.5%	11.0%	9.0%
Cassava consumption														
kg per person	9.6	9.4	26.4	26.3	49.7	56.2	49.7	56.2	78.6	151.1	49.7	11.2	49.7	14.1
as % of total expenditure	0.2%	0.3%	1.7%	1.7%	5.5%	4.3%	6.5%	5.7%	8.7%	11.6%	6.7%	1.1%	3.5%	0.6%
Ratio of kgs rice to kgs cassava*	11.4	11.2	3.6	3.6	1.6	2.0	1.5	2.0	0.5	0.3	1.4	8.5	1.6	7.7

* Among homeless in Antananarivo, this ratio falls to 1.3 (Razafimanantena, 2000).

Source: Madagascar SAM 1999.

Table 8 -- Simulated Impact of Investments in Agricultural Productivity

	Base value	Productivity increase	
		rice	cassava
1. Shock			
productivity increase	-	30%	30%
shocked sector as % of GDP	-	8.0%	3.5%
2. Impact on production (billions of FMG)			
rice	2,151	14.6%	2.5%
cassava	857	2.2%	5.4%
other crops	646	7.6%	3.8%
3. Impact on producer prices			
rice	1	-26.9%	-4.7%
cassava	1	-9.0%	-24.0%
other crops	1	-9.1%	-4.8%
4. Impact on real consumption of households (billions of FMG)			
HH1 - urban highly qualified	2,920	2.9%	1.4%
HH2 - urban medium qualification	2,921	4.0%	1.8%
HH3 - urban unqualified, male headed	1,890	3.6%	1.5%
HH4 - urban unqualified, female headed	580	4.0%	1.7%
HH5 - small cultivators, High Plateau	2,696	1.2%	0.4%
HH6 - large cultivators, High Plateau	1,012	-0.9%	0.4%
HH7 - small cultivators, East Coast	1,395	1.3%	0.1%
HH8 - large cultivators, East Coast	1,110	1.7%	0.2%
HH9 - small cultivators, South	722	1.7%	1.8%
HH10 - large cultivators, South	550	2.2%	2.3%
HH11 - small cultivators, West	805	1.0%	0.3%
HH12 - large cultivators, West	602	0.4%	-0.7%
HH13 - rural non-agricultural, poor	1,326	2.5%	1.2%
HH14 - rural non-agricultural, rich	2,054	2.5%	0.9%
5. Macroeconomic impact (billions of FMG)			
GDP	23,381	2.0%	0.9%
total consumption	20,582	2.3%	1.0%
demand for unskilled urban labor	1,526	3.1%	1.6%
exports	5,787	0.5%	0.4%
imports	-7,701	0.3%	0.3%
trade balance	-1,914	0.0%	0.0%
real exchange rate	1	2.3%	1.4%
6. Government impact (billions of FMG)			
revenues	2514.4	3.7%	2.0%
budget surplus-1	-22.8	18.5	3.2
budget surplus-2	-22.8	70.7	28.5

* Surplus-1 assumes that civil servant salaries rise at the same rate as in the private sector. Surplus-2 keeps all public expenditure fixed at the base level.

Source: simulations.

B. Road investments which lower commercial margins

1. Historical review

Madagascar's road network has deteriorated badly since independence in 1960. Total mileage has fallen by 20% between 1969 and 2000 (Ministry of Transport). Though the mileage under paved roads has grown from 2,600 kilometers en 1960 to 5,800 in 2000, the network of secondary and tertiary roads has fallen from 35,000 to 24,000 kilometers and their quality has deteriorated considerably. For this reason, large parts of the country remain inaccessible in the rainy season, including the province of Antsiranana and the fertile farmland of the coast north-east of Mahajanga. National highway 44, which links the breadbasket of Lac Alaotra to Moramanga and on to Antananarivo has not been paved since the 1970s despite four successive presidents who have wanted to do so (Bockel, 2002). The road barricades and deliberate destruction of bridges during the political crisis of 2002 further aggravated this historical deterioration.

Since at least the time of the monarchy, Malagasy authorities have invested in roads. But the sudden fall in government resources during the 1970's and 1980's has not permitted sufficient maintenance. Consequently, the national road network has deteriorated significantly. Various infrastructural investment programs, financed largely by donors through a series of national highway projects, have began to address this problem though without resources sufficient to completely reverse the downward spiral. Local maintenance initiatives have also improved the quality of certain secondary roads, but their total distance remains limited (Projet CAP, 1999).

High transport costs constrain economic activities as well as access to public services. Economically, the poor condition of Madagascar's road network imposes high costs on households living in remote and isolated zones. In these remote locations, transport costs can be as much as five times higher in more accessible areas (Table 9). High transport costs, in turn, raises trader costs and hence commercial margins. Combined with lower levels of competition in remote area, these high costs place severe downward pressure on prices offered by traders for agricultural prices. Consequently, producers prices of rice are, on average, 20% lower in isolated areas. High commercial margins likewise lead to higher prices for agricultural inputs imported into these zones. For this reason, while over one-fourth of farmers apply chemical fertilizers in accessible zones, less than 1% do so in the isolated rural areas. Utilization rates are 10 times higher in the more accessible rural areas (Table 9). High transport costs also constrain access to social services. Transport costs account for 50% of direct costs of a visit to a health clinic (Razafindravonona et al. 2002, Table 24). These high costs limit access by the poor who seek medical services only in 32% of cases where they fall sick (Glick et Razakamanantsoa, 2001, Table 14). High transport cost constrains not only farm production but also the health and physical strength of Malagasy workers.

Investments in Madagascar's road network would lower agricultural input costs, increase their application and boost producer prices. At the same time, consumer prices in urban areas would fall as a result of the shrinking commercial

margin. The following simulations aim to quantify the production and welfare gains that would likely ensue.

2. Model simulations

Road investments – which will reduce amortization, fuel, labor time and other running costs – will normally also reduce commercial margins. For this reason, our simulations introduce a productivity shock of 20% in the commercial sector. This diminishes commercial margins by roughly 18% after all other price adjustments play out. The fall in margins permits at the same time a rise in producer prices and a fall in consumer prices. The boost in producer prices becomes most important for agricultural products[7] and food industries, both of which bear large transport margins. The rise in producer prices boosts producer incentives between 1% and 4% (Table 10). Therefore the quantity of commercial services demanded rises by roughly 5%, driven by the fall in costs and a rise in other economic activity which in turn requires transport and delivery services. These interactions across the economy succeeds in raising GDP by 3.9%.

Rural households win, in particular, because the benefit from a simultaneous rise in producer prices while at the same time the price of urban-produced consumer goods fall. Their real consumption rises by 5% to 10% (Table 10). Urban households gain as prices of consumption goods fall. However, those who depend on commercial services for their livelihood bear falling incomes. Therefore, on average, non-poor urban households become net losers as pressure on commercial margins lowers their incomes.

Government wins when the general level of economic activity increases. In this simulation, tax revenues rise by 1.8% while the current budget deficit of 23 billion FMG evaporates in favor of a surplus of 14 billion FMG.

This simulation, because it is very general, influences all sectors of the Malagasy economy. In practice, however, the repair and upgrading of specific roads will benefit the affected zones most heavily. For this reason, the impact of each major road project will require a regional analysis. The present simulation, because of it's more general character, serves to indicate the general order of impacts following road investments. These turn out to be very positive for poor rural households in particular. This suggests that public investments in roads which will open up economic flows with isolated regions offers one of the most powerful motors available for benefiting poor rural households.

[7] The impact on paddy appears small because the majority of production is consumed onfarm by subsistence farmers and does not enter into commercial circuits.

Table 9 -- Economic Consequences in Isolated Regions

	Accessibility quintiles				
	most remote	4	3	2	closest
Transport cost as % of rice price	27%	20%	20%	7%	5%
Paddy price (FMG/kg)	1,196	1,368	1,277	1,269	1,418
Application of chemical fertilizers (kg/are)	0.04	0.13	0.08	0.44	0.36
Application of organic fertilizers (kg/are)	0.23	0.44	1.29	2.19	9.95
Subsistence consumption as percent of total food consumption	48%	38%	37%	38%	0%

Source: Stifel, Minten and Dorosh (2002).

Table 10 -- Simulated impact of road investments

	Base value	After increased productivity in commerce
1. Shock		
productivity increase	-	20%
shocked sector as % of GDP	24%	
2. Impact on production (billions of FMG)		
paddy	2150.5	0.0%
vanilla	72.7	1.3%
cassava	856.7	3.0%
industrial crops	301.7	4.0%
food processing industries	4598.9	5.4%
3. Impact on commercial margins (consumer price - producer price)		
paddy	-	-1.9%
vanilla	-	-10.1%
cassava	-	-2.8%
industrial crops	-	-9.4%
food processing industries	-	-6.0%
4. Impact on real household consumption (billions of FMG)		
HH1 - urban highly qualified	2,920	-0.2%
HH2 - urban medium qualification	2,921	-2.7%
HH3 - urban unqualified, male headed	1,890	-0.8%
HH4 - urban unqualified, female headed	580	-1.6%
HH5 - small cultivators, High Plateau	2,696	5.3%
HH6 - large cultivators, High Plateau	1,012	6.3%
HH7 - small cultivators, East Coast	1,395	7.7%
HH8 - large cultivators, East Coast	1,110	7.1%
HH9 - small cultivators, South	722	10.5%
HH10 - large cultivators, South	550	18.8%
HH11 - small cultivators, West	805	7.8%
HH12 - large cultivators, West	602	6.5%
HH13 - rural non-agricultural, poor	1,326	4.6%
HH14 - rural non-agricultural, rich	2,054	6.0%
5. Macroeconomic impact (billions of FMG)		
GDP	807	3.9%
total consumption	20,582	3.6%
demand for unskilled urban labor	1,526	-1.9%
exports	5,787	2.9%
imports	-7,701	2.2%
trade balance	-1,914	0.0%
real exchange rate	1	0.6%
6. Government impact (billions of FMG)		
revenues	2514.4	1.82%
budget surplus-1	-22.8	14.2
budget surplus-2	-22.8	23.0

* Surplus-1 assumes that civil servant salaries rise at the same rate as in the private sector. Surplus-2 keeps all public expenditure fixed at the base level.

Source: simulations.

C. Investment in the Export Processing Zone

1. Historical review

Madagascar's export processing zone offers a set of fiscal incentives for private investments in specific export-oriented activities. Qualified enterprises benefit from exemption on all trade duties and taxes, reimbursement on any value added tax paid and certain preferential treatment on specific taxes such as the IBS and IRCM.

Since 1990, activities within the export processing zone have grown continuously, until the abrupt cessation of trade during the aftermath of the presidential election of 2002 (Table 11). Low cost and high productivity of Malagasy labor confers a comparative advantage in certain highly labor intensive industries. In 2001, the export processing zone included 307 enterprises operating in a range of different activities though dominated by garment production. Malagasy manufacturing has undoubtedly received a shot in the arm from the expansion of the export processing zone firms.

Launching of these enterprises has required a total investment of 1,575 billion FMG, and they employ 110,000 workers. Textile firms provide the lion's share of employment, accounting for 84% of total jobs in the zone. The political turbulence of 2002 brought activities to an abrupt standstill in many firms and pushed 80,000 workers onto unemployment rolls. The subsequent return to normalcy, spurred by strong community of interest and commitment by public and private sectors, has succeeded in re-establishing a climate of confidence within the business community. Local observers anticipate a progressive re-establishment of activities within the export processing zone.

In 2001, the export processing zone generated total value added of 447 billion FMG, up substantially from 127 billion in 1995. This accounts for 11% of industrial value added and for 1.6% of GDP. With 110,000 employees in 2001, the sector disbursed 332 billion in salaries.

Given the external orientation of these flows, the export processing zone plays a significant role in Madagascar's commercial balances. Exports from the export processing zone attained 1,368 billion FMG in 2001 or about 16% of total exports. Madagascar's eligibility under the US Africa Bill from the year 2000 onward has contributed to this impressive performance.

Rapid recent progress together with continued prospects for growth going forward make this sector a potentially very powerful instrument for promoting employment, foreign trade and overall economic growth. Thus, the export processing zone has become a key motor not only of economic growth but also a key element of Madagascar's strategy for poverty reduction.

2. Model simulations

a. A reduction of 70% in export processing zone investments

This simulation was conducted to measure the impact of the abrupt fall in activities of the export processing zone during the political crisis of 2002 or, more generally, to evaluate the impact of departure of these industries for any reason at all. A second simulation will examine the opposite case, that is a continued growth in export processing zone investments and activity.

The reduction in export processing zone activities was modeled as a decrease in capital used in these enterprises. A 70% reduction in capital used causes their production to fall by 67.5%. This reduction will have an impact on the demand for local and imported intermediate goods, particularly in the case of garment industries. The volume of demand for local textile products will fall by 31.5% bringing about a 5.9% fall in their price and a 23.5% fall in quantities produced (Table 12).

At the macroeconomic level, GDP falls by 1.6%. Fiscal revenues, in turn, diminish by 1.2% as a result of slowing overall economic activity in activities linked to the export processing zone. The government budget deficit worsens by 19.4 billion FMG. Given the export orientation of the zone, Madagascar's total volume of exports falls by 11.3%. On the other hand, demand for imported inputs falls as well and the volume of total imports tumbles by 8.5%. The trade deficit grows by 9.9% and as a result the real exchange rate depreciates.

The depreciation of the Malagasy franc makes exports more competitive abroad. Producer prices in extractive industries, export crops and tourism grow by 29.8%, 16.5% and 10%, respectively, eliciting output growth in these three branches. The subsequent boost in output proves smaller than the price changes given supply elasticities less than one. Production of export crops (vanilla, coffee and cloves) grows by 4%. Tourism enjoys an increase of about 10% in total volume.

In the real world, as in the model, unskilled urban workers are mobile across branches of the economy. Therefore, the slowdown in the export processing zone and formal textile industry leads to unemployment among these workers. Demand for unskilled workers falls 65.4% in the export processing zone and by 44.3% in textile the formal industry. Other sectors absorb some of this loss. Most strikingly, labor demand rises by 148% in mining and by 19% in formal tourism.

Urban households absorb the biggest reduction in welfare, with income falls of 5.7%, 6.9% and 4% for households with highly, medium and unqualified workers, respectively. Real consumption falls by 1.9%. On the other hand, welfare of rural farm households remains largely unaffected.

b. Investments increase capital in the export processing zone by 50%

The interest of this simulation is to see the impact of expansion in the export processing zone resulting from a surge in private investment in that sector. An increase of 50% in productive capital in this sector increases the volume of production by 40.3%. The expansion of activity in the export processing zone stimulates

increased demand for local and imported intermediate goods, particularly textile products. As a result, the prices of formal textile products increase by 6.6%. This, in turn, stimulates an increase of 9% in their volume of production.

At the macroeconomic level, benefits accrue as well since the expansion of the export processing zone stimulates other sectors of the economy through consumption spending of workers as well as increased demand for productive inputs. GDP grows by 0.8%. Meanwhile, tax revenues grow by 2% as a result of growing activity in many sectors of the economy. The government deficit nearly disappears, assuming a freeze in salary levels. If, on the other hand, civil servant salaries float upwards with private sector wages, the deficit worsens because of growing costs as well as the appreciation of the FMG which reduces import values and therefore tariff receipts (Table 12).

Because of its export orientation, growth in the export processing zone yields significant benefits in foreign exchange earnings. Overall, exports grow by 6.5%. Working in the opposite direction, demand for imported inputs and the volume of total imports grows by 4.9%. The trade balance improves by 4.8% while the real exchange rate appreciates.

This foreign exchange rate appreciation reduces the FMG value of exports by 10% in the mining sector, by 8% among agricultural export crops and 5% in the tourism sector. This fall in FMG prices, in turn, reduces production in each of the affected branches. Volumes sold in informal tourism falls by 17.7%, formal tourism by 4.8% and export crops by 2.5%.

Worker mobility leads to a shifting of workers from the shrinking and into the growing sectors of the economy. Thus, we see an increase of 35.2% in unskilled labor employed in the export processing zone and 28.4% in formal textiles. This comes at the expense of other sectors, particularly mining, which see a fall of 55.9% employment in unskilled workers.

An assessment of household welfare indicates that urban households gain most from growth in the export processing zone. As a result of increasing jobs and wages in urban areas, where the bulk of the export processing zone firms have chosen to locate, urban household incomes grow between 2% and 4%. Conversely, the appreciation of the FMG, which penalizes other export commodities, depresses incomes among producers of export crops. Farmers on the East Coast absorb the biggest fall as their vanilla, coffee, litchis and cloves fetch them fewer FMG than before.

Table 11-- Trends in Madagascar's Export Processing Zone

	1995	1,996	1997	1998	1,999 *est.*	2000 *est.*	2001 *est.*
Number of enterprises in the Export Processing	98	209	241	259	267	283	307
of which							
Textile industries	64	104	120	127	135	149	164
Wood-based industries	8	16	18	22	22	22	22
Food industries	5	26	29	31	31	32	33
Others	21	63	74	79	79	80	88
Employment	29,600	36,700	38,400	56,200	*64,100*	*81,000*	*110,000*
(% of total manufacturing jobs)	20.0	23.0	20.2	24.1	*25.8*	*27.5*	*29.5*
Salaries (billions of FMG)	66	104	117	176	*202*	*237*	*332*
(% of total manufacturing)	15.3	20.0	17.9	20.5	…	…	…
Value added (billions of FMG)	127	156	250	304	*328*	*360*	*447*
(% of total manufacturing)	9.3	10.2	12.6	13.1	…	…	…
Exports (billions of FMG)	392	590	747	1,031	*1,157*	*1,236*	*1,368*
(% of total manufacturing)	38.5	50.8	49.9	54.7	…	…	…
Imports (billions of FMG)	191	293	370	468	*512*	*599*	*735*
(% of total manufacturing)	13.1	23.7	21.9	27.7	…	…	…

Source: Enquête Annuelle dans l'industrie, INSTAT / and estimates INSTAT.

Table 12 -- Simulated impact of changes in the Export Processing Zone

	Base value	Investment reduction	Investment increase
1. Shock			
productivity increase	-	-70%	50%
shocked sector as % of GDP	2.2%	-	-
2. Impact on production (billions of FMG)			
export processing zone	1,563	-67.5%	40.3%
formal textiles	179	-23.5%	9.0%
mining	99	28.5%	-25.4%
3. Impact on producer prices			
export processing zone	1	9.9%	-4.8%
formal textiles	1	-5.9%	6.6%
mining	1	29.8%	-10.0%
4. Impact on real household consumption (billions of FMG)			
HH1 - urban highly qualified	2,920	-6.1%	3.2%
HH2 - urban medium qualification	2,921	-6.8%	3.6%
HH3 - urban unqualified, male headed	1,890	-3.7%	1.9%
HH4 - urban unqualified, female headed	580	-4.7%	2.5%
HH5 - small cultivators, High Plateau	2,696	0.0%	-0.1%
HH6 - large cultivators, High Plateau	1,012	0.0%	-0.1%
HH7 - small cultivators, East Coast	1,395	1.1%	-0.6%
HH8 - large cultivators, East Coast	1,110	2.6%	-1.3%
HH9 - small cultivators, South	722	0.2%	-0.2%
HH10 - large cultivators, South	550	-0.4%	0.2%
HH11 - small cultivators, West	805	0.6%	-0.4%
HH12 - large cultivators, West	602	0.4%	-0.3%
HH13 - rural non-agricultural, poor	1,326	0.6%	-0.4%
HH14 - rural non-agricultural, rich	2,054	0.6%	-0.3%
5. Macroeconomic impact (billions of FMG)			
GDP	23,381	-1.6%	0.8%
total consumption	20,582	-1.9%	1.0%
demand for unskilled urban labor	1,526	-3.1%	1.5%
exports	5,787	-11.3%	6.5%
imports	-7,701	-8.5%	4.9%
trade balance	-1,914	0.0%	0.0%
real exchange rate	1	9.9%	-4.8%
6. Government impact (billions of FMG)			
revenues	2,514	-1.2%	2.0%
budget surplus-1	-22.8	19.4	-45.7
budget surplus-2	-22.8	-51.7	-6.0

* Surplus-1 assumes that civil servant salaries rise at the same rate as in the private sector. Surplus-2 keeps all public expenditure fixed at the base level.

Source: simulations.

D. Investment in the tourism indsutry

1. Historical overview

Madagascar's rich natural beauty and unique ecology offer tourist attractions of extraordinary richness, with which few countries can compete. With its long, sandy, picturesque coastline, Madagascar possesses almost limitless tourist potential. Cultural sites abound as well among its numerous prehistoric sites including eggs and bones of dinosaurs. Madagascar's indigenous plants, such as ravinala, carnivorous plants and numerous varieties of orchids, attract serious botanists and plant lovers alike. Its lemurs, giant tortoises and chameleons attract not only tourists but also serious research biologists. Added to this wealth of flora and fauna, its beaches and natural escarpments and caves offer a wide variety of potential attractions.

Why then does Madagascar not figure more prominently among the famous tourist destinations of the world. Historically, this slow start can be explained by the tight limitations on external exchanges under the Second Republic when security controls held priority over tourism development[8]. . In addition, geographic isolation has played a clear role. Madagascar lies far from both Europe and North America, origin of most of the world's tourists. A serious shortage of tourist infrastructure, such as hotels, roads and other means of internal transport, remain limited as well. Despite the presence of major interior rivers, inland water transport remains limited to only the north-south axis served by the Pangalan Canal on the East Coast. Rail transport serves only the central and eastern parts of the country. Chilly external relations with certain western countries has tarnished Madagascar's reputation in the eyes of potential visitors. In contrast, globalization of international transport has steadily diminished transport costs. As a result, the number of foreign visitors coming to Madagascar more than tripled between 1990 and 2001.

Growing demand in the tourism sector has spurred the interest of private investors. Between 1993 and 1996, the value of investments in this sector has grown rapidly (Table 13). Several explications have been advanced to explain the abrupt 30% fall in investment in 1997 and 1998. Most likely, political uncertainty involved in any regime change has made potential investors cautious. In addition, the falloff following the spectacular increases of 1995 and 1996 might be explained by the sluggish rate of improvement in ancillary sectors on which tourism ultimately depends, for instance road transport, security and health. Nevertheless, tourism created 7,700 jobs new jobs between 1993 and 2001, representing a growth of 79%.

Overall, tourism accounts for 7.6% of Madagascar's export earnings. Its contribution to foreign exchange earnings has grown steadily since 1995, doubling between 1996 and 2001 (when computed in SDRs). Measured in FMG, tourism revenues have tripled.

[8] Fear of entry by foreign mercenaries.

2. Model simulations

In order to evaluate the probable impact of increased investment in the tourism sector, we have simulated a doubling of capital in formal tourism. An increase of this magnitude would require 314 billion FMG (measured in 1999 FMG). In reality, given steady government withdrawal from productive sectors, we expect that these investment funds would need to be financed from private sources.

The simulation results project that investments of this magnitude would increase production by 88%. Due to linkage effects with other sectors of the economy, the impact on other services is likewise considerable (Table 14).

Because of the Madagascar's better off households hold most of the capital in formal tourist industry, they become the primary beneficiaries of a surge in tourism. The impact on household consumption diminishes as one moves down the income scale. In spite of this, real consumption of poor households does rise by 2.2%. In rural areas, the consumption gains vary between 0.9% and 1.6%. Large landowners on the East Coast and in the South remain the major exceptions, with a drop of –0.3% and a slight increase of 0.3%, respectively. Overall, total consumption rises by 1.9%.

Elsewhere, this investment boom fuels export gains of 3.4% and a corresponding increase in imports of 2.6%. The real exchange rate, which balances the trade flows, improves by 6.6%. GDP grows as well, by 1.6%.

Government revenues, though they increase in the tourism sector, fall elsewhere. Most notably, the exchange rate appreciation reduces the FMG value of imports and hence of import duties, a principal source of government revenues. As a result, government revenues fall by 1.2%.

Table 13 -- Trends in tourism in Madagascar, 1990 to 2001

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Tourists	52,923	34,891	53,655	55,355	65,839	74,619	82,681	100,762	121,207	138,253	160,071	170,208
annual change (%)	35.9	-34.1	53.8	3.2	18.9	13.3	10.8	21.9	20.3	14.1	15.8	6.3
Rooms	...	3,040	...	3,750	4,000	5,000	6,066	6246	6637	7,207	7,779	8,435
Capacity utilization	73	38.9	52	55	53	55	57	57	58	60	63	66
Average length of stay	12.4	9.6	8.1	11	11	10.3	16	15	20	20	20	20
Foreign exchange earnings (DTS)	29.8	20	26.6	27.8	32.9	41.5	44.6	52.9	65.5	72.9	92	90.2
annual change (%)	36.7	-32.9	33	4.5	18.3	26.1	7.5	18.6	23.8	11.3	26.2	-2

Source: Ministry of Tourism, BCRM.

Table 14 -- Simulated impact of a doubling of investment in the tourism sector

	Base value	Anticipated impacts
1. Shock		
productivity increase	-	100%
shocked sector as % of GDP	2.8%	-
2. Impact on production (billions of FMG)		
tourism, formal plus informal	836	65.6%
other formal services	4,373	-0.4%
other informal services	435	0.3%
3. Impact on producer prices		
tourism, formal plus informal	1	-7.2%
other formal services	1	1.0%
other informal services	1	1.5%
4. Impact on real household consumption (billions of FMG)		
HH1 - urban highly qualified	2,920	3.6%
HH2 - urban medium qualification	2,921	2.7%
HH3 - urban unqualified, male headed	1,890	2.2%
HH4 - urban unqualified, female headed	580	2.2%
HH5 - small cultivators, High Plateau	2,696	1.5%
HH6 - large cultivators, High Plateau	1,012	1.4%
HH7 - small cultivators, East Coast	1,395	0.9%
HH8 - large cultivators, East Coast	1,110	-0.3%
HH9 - small cultivators, South	722	1.6%
HH10 - large cultivators, South	550	3.0%
HH11 - small cultivators, West	805	1.2%
HH12 - large cultivators, West	602	1.0%
HH13 - rural non-agricultural, poor	1,326	0.9%
HH14 - rural non-agricultural, rich	2,054	1.3%
5. Macroeconomic impact (billions of FMG)		
GDP	23,381	1.6%
total consumption	20,582	1.9%
demand for unskilled urban labor	1,526	2.4%
exports	5,787	3.4%
imports	-7,701	2.6%
trade balance	-1,914	0.0%
real exchange rate	1	-6.6%
6. Government impact (billions of FMG)		
revenues	2,514	-1.2%
budget surplus-1	-22.8	-78.9
budget surplus-2	-22.8	-52.4

* Surplus-1 assumes that civil servant salaries rise at the same rate as in the private sector. Surplus-2 keeps all public expenditure fixed at the base level.

Source: simulations.

4. IMPLICATIONS FOR POVERTY REDUCTION

The four motors evaluated in this paper each generate different outcomes. Two in particular – agricultural research and road investments – directly target poor rural households. In addition, any activity that stimulates productivity in the production of basic food staples will likewise benefit poor urban consumers. The two other motors – the export processing zone and tourism – favor primarily urban households, both poor and non poor. Given its more dispersed nature, tourism also generates significant benefits for the rural poor. Thus, each motor has a different role to play in the national battle for poverty reduction.

The question of how to set priorities will hinge on a comparison weighing measured benefits of each motor with its costs. Recall that the analyses presented here trace only the probable *impacts* of each of the four investment shocks. The question of *costs* must be considered in order to complete the process of formulation, selection and programming public policy choices. We leave it to specialists in each technical area to add estimates of cost envisaged for each specific case considered.

While awaiting these complementary data, we can say with certainty that the spark plugs that will make each motor run are investments – in infrastructure, technology and equipment. If one wishes to change the dynamics currently under way, then someone must invest. They must invest to assure the financial , human and technical means that will permit workers to become more productive in the future.

Both public and private actors have a role to play. Agricultural research and road investments remain public goods. Because they cannot capture the full benefit of these investments, private firms will never invest sufficiently in these activities. But in the export processing zone and in tourism, the principal investors will be private. The role of public authorities will be limited to assuring a stable, favorable investment climate and providing the infrastructure – air transport, efficient customs services, ports and roadways – necessary to ensure the smooth functioning of these export activities.

The consolidation of an enabling environment favoring private investment in the export processing zone and tourism sectors constitutes a key campaign in the battle against poverty in Madagascar. A parallel campaign in a broad-based attack on poverty will require targeting a series of strategic public investments. These will demand a series of more detailed evaluations to enable selection of specific priority investments. In the agricultural realm, rice and cassava dominate as key priorities in any battle against poverty. For rural roads, however, government cannot tackle all sites at once. Therefore, it will be necessary to examine regionally which are most apt to trigger important production responses in rural zones. An evaluation of costs and comparison with anticipated benefits will enable necessary prioritization of public road investments.

A private-public partnership of this nature which succeeds in igniting these four motors would form the core of a powerful four-cylinder economic growth

engine. Working in combination, these four activities could achieve an appreciable reduction in both rural and urban poverty in Madagascar.

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ANNEX A.
THE SOCIAL ACCOUTING MATRIX (SAM) 1999

1. Structure

The SAM distinguishes 16 different household groups, four urban, eight rural and agricultural, the last two rural non-agricultural. Urban households are classified according to the qualification of the household head and among the unqualified according to gender of the household head. Among the rural farming households, the SAM distinguishes between small and large land-owning households using 0.4 hectares per person as the cutoff. Rural nonfarm households are divided into two groups according to their income level, in turn largely a function of their assets -- human, land and financial.

The distribution of income and expenditures vary considerably among the different household groups. Highly qualified urban households, who constitute only 4% of the population, account for 14% of total expenditure (Table A.4). Urban and non-agricultural rural households earn the majority of their income from wages and financial capital, both directly and in the form of transfers from enterprises. In contrast, rural households depend primarily on their labor and land (Table A.5). The households least well endowed with financial and human capital earn less and, in general, they spend a larger share of their income on food and less on services (Table A.6).[9]

The SAM distinguishes among 34 different productive activities, 10 agricultural, 12 industrial, 11 services and one non-competitive import (Table 1).[10] The disaggregation of value added, production and payments to factors across activities is presented in Table A.1. [11] Among the majority of secondary and tertiary activities, the SAM separates out formal and informal segments. In general, informal activities use more labor-intensive technologies (Table A.2). [12] Each activity produces a corresponding product. In addition, the SAM distinguishes one category of non-competitive imports – including automobiles, trucks and certain electronic products – for which local substitutes do not exist (Table A.3).

The SAM includes twenty-two factors of production, including four categories of labor (one rural and three urban), three categories of capital (one formal and two informal), and eight categories of land..[13] Urban labor is further disaggregated by qualification, and financial capital is divided into three groups including rural, informal urban and formal urban. The SAM divides Madagascar into four geographic

[9] Full details are available in Table A.8.
[10] The analysis presented in this study groups together formal and informal rice milling. This grouping proves necessary because the national accounts do not value hand pounding of rice, yet the CGE requires a positive value for each activity.
[11] Tables A.9 and A10 supply additional information of the sectoral allocation of factor payments.
[12] Tables A.11 and A.12 describe in greater detail the structure of value added by activity.
[13] The analysis distinguishes between formal capital used in commerce and in other sectors. This facilitates allocation of earnings from formal commerce in rural areas and its distribution across a broad constellation of rural households. Commercial capital pays its earnings directly to households, whil other capital accounts pay this to enterprises which then redistribute earnings to households as dividends.

regions – the High Pleteau, the East Coast, the South and the West. For each region, it distinguishes between small and large farms, again using as the dividing line 0.4 hectares per capita.

2. Data

The SAM was constructed using data from several sources. The activity accounts come primarily from the national accounts. The national accounts of 1999 supply the structure of value added by activity. The input-output coefficients as well as commercial margins come from the input-output (IO) table of the detailed national accounts of 1995 (INSTAT, 1998). The disaggregation into formal and informal sectors has been designated according to shares obtained from the Industrial Survey and Employment Surveys of INSTAT. Import values, exports, transfers and capital flows come from the Balance of Payments. Analysis of customs data permitted a detailed breakdown of international trade by product. Total government tax receipts by source come from the l'Opération Générale du Trésor (OGT). The subsequent allocation of taxes across production is straightforward with taxes such as the Taxe sur les Produits Pétroliers (TPP) and import duties which are available from the computerized records of the Customs Department. All other indirect taxes were allocated according to the sectoral shares used in the 1995 Madagascar SAM.

Household accounts were constructed from the Enquête Prioritaire auprè des Ménages (EPM) of 1999. This source furnished detailed information on factor allocation and direct tax payments across household groups. It likewise permitted us to allocate final consumption of all 34 products across the 14 household groups.

The capital and rest of world accounts come from data provided in the Balance of Payments for 1999.

3. SAM construction and reconciliation of data inconsistencies

a. Product balances

Construction of the SAM begins with the Cadrage Macroéconomique which provides the economic aggregates that must be respected. These include GDP, the trade balance, household and government savings and consumption. The allocation of GDP across activities comes directly from the national accounts. Then, we calculate the intermediate input to value added ratios and commercial margins for each activity using the most recent detailed input-output table produced for the 1995 national accounts. These ratios, together with the absolute value added from the national accounts, permit calculation of the absolute amount of intermediate inputs in each production activity. Import and export values together with indirect taxes are then inserted in the SAM to complete the activity and product column accounts.

These product account totals allow us to proceed to the first major balancing check where we confirm that the total supply of each good (the sum of each column in the SAM) equals the product demand (the row totals for each product):

$$VAi + Aij + Ci + Ti + Mi = Ei + Gi + Ki + CHi \quad (1)$$

This identity permits us to calculate aggregate household consumption (Chi) as a residual from equation 1. This estimate provides the first major coherency test in which we compare the Chi calculated as residuals from equation 1 with the structure of aggregate household consumption coming out of the national household survey (Enquête EPM). An ocular comparison of these two consumption profiles revealed certain anomalies, some negative consumption values, some clearly too high or too low. In these cases, the analytical team proceeded to make adjustments, normally to the value added allocation across activities within the major national accounts groupings (while still respecting the national account categories). Occasionally, the team judged it more appropriate to make adjustments to the input-output table or commercial margins. At the end of this step, the team had balanced the product accounts.

b. Balancing the household accounts

The SAM account activities pay out value added to factors in fixed shares determined by rental values of land together with labor and capital shares obtained from INSTAT enterprise surveys. Household ownership of the various factors – land, labor and capital – then determine their share of receipts from each factor. Government and rest of world accounts complete the payments (transfers out and direct taxes) and receipts (transfers in) of households. The allocation of direct taxes, transfers and receipts across household groups was done according to shares computed from the national household survey (EPM) . Consumption of each product likewise came from shares computed by the EPM.

At this point, the team proceeded with its second big balancing test, a check on the balance between household income – factor payments received (Fhf), dividends paid by enterprises (Nh) and net transfers received (TFRh) – and their expenditures, including commodity consumption (Ch), savings (Sh) and payment of direct taxes (Th):

(2) $$Fhf + Nh + TFRh = Ch + Sh + Th$$

The comparison of revenues and expenditures gave rise to a second analysis of the inevitable discrepancies that emerged. In cases where the difference between first-cut estimate of expenditure and revenue was small (less than 5%), we equilibrated the relevant household accounts by adjusting net transfers (TFRh). Larger disparities required a review and reallocation of factor payments to households. The resulting balance in the household accounts led to a complete set of balanced SAM accounts.

As a final test, the detailed SAM (the MEGA MaCS) was aggregated back and the totals compared with the baseline point of departure from the government's Cadrage Macro-économique. This verification reassured us that the highly detailed SAM faithfully respects the major economic aggregates, GDP, national savings, investment, imports, exports and the trade balance of the official national cadrage.

Table A.1 -- Structure of value added, Madagascar SAM 1999

Activities	GDP	Production at market prices	Labor	Capital	Land
Paddy	7.9	5	5.9		30.9
Vanilla	0.3	0.2	0.3		1
Coffee	0.5	0.2	0.4		1.5
Other export crops	0.6	0.3	0.6		2
Industrial crops	1.1	0.7	0.8		4.3
Cassava	3.5	2	3.2		12.3
Other crops	2.5	1.5	2.1		9.3
Livestock	4.2	4.9	2	1.1	17
Fishing	4.2	3.2	2.9	7.7	
Sylviculture	5.3	3.4	2.6	1.4	21.6
Mining	0.1	0.2	0.1	0.2	
Energy/Water	0.8	1.1	0.5	1.6	
Petroleum	0.7	0.6	0.4	1.3	
Rice-For	0.1	5.4	0.1	0.3	
Food processing-For	3.8	6.3	2.4	7.3	
Food processing-Inf	2.7	4.5	4.8	1.2	
Textile-For	0.2	0.4	0.1	0.3	
Textile-Inf	0	0.1	0	0	
Other Manuf-For	2	4.2	1.4	3.6	
Other Manuf-Inf	0.8	1.7	1.5	0.2	
Ex Proc Zone	2.2	3.7	2.4	2.9	
Construction-For	0.9	3.7	0.9	1.3	
Construction-Inf	0.8	3.1	1.4	0.3	
Transport-For	6.5	7.4	4.6	11.9	
Transport-Inf	0.7	0.8	1.3	0.2	
Commerce-For	19.3	14.8	16.2	32.2	
Commerce-Inf	4.4	3.3	7.9	1.7	
Tourism-For	2.5	1.7	2.1	4.1	
Tourism-Inf	0.3	0.3	0.7	0.1	
Other services-For	13.9	10.2	19.3	13.2	
Other services-Inf	1.5	1	2.9	0.4	
Public Admin	5.8	4.3	8.1	5.5	
Agriculture	30	21.4	20.9	10.2	100
Non-Agriculture	70	78.6	79.1	89.8	
Total	100	100	100	100	100

Source: Madagascar SAM, 1999.

Table A.2 -- Allocation of value added and intermediate consumption

Activities	Shares of total production			Allocation of value added				Elasticity
	value added	production inputs	total	labor	capital	land	total	of substitution
Paddy	77.8	22.2	100	35.7		64.3	100	0.5
Vanilla	92.6	7.4	100	46.1		53.9	100	0.4
Coffee	92.8	7.2	100	45.9		54.1	100	0.4
Other export crops	92.5	7.5	100	45.9		54.1	100	0.4
Industrial crops	78.1	21.9	100	36		64	100	0.6
Cassava	87.5	12.5	100	42.9		57.1	100	0.7
Other crops	82.2	17.8	100	39.2		60.8	100	0.8
Livestock	42.1	57.9	100	23.4	9.5	67.1	100	1.0
Fishing	65.1	34.9	100	33.3	66.7		100	1.0
Sylviculture	77.4	22.6	100	23.4	9.5	67.1	100	0.9
Mining	18.4	81.6	100	31.1	68.9		100	0.7
Energy/Water	37.7	62.3	100	31.1	68.9		100	0.7
Petroleum	57.4	42.6	100	31.1	68.9		100	0.7
Rice-For	1.3	98.7	100	30.8	69.2		100	0.9
Food processing-For	31	69	100	30.6	69.4		100	1.0
Food processing-Inf	30.3	69.7	100	84	16		100	0.2
Textile-For	19.2	80.8	100	39.8	60.2		100	0.5
Textile-Inf	18.9	81.1	100	81.4	18.6		100	0.2
Other Manuf-For	24	76	100	34	66		100	0.6
Other Manuf-Inf	23.4	76.6	100	89	11		100	0.1
Ex Proc Zone	29.8	70.2	100	52	48		100	0.3
Construction-For	12.7	87.3	100	49.2	50.8		100	0.7
Construction-Inf	12.4	87.6	100	85	15		100	0.2
Transport-For	45.2	54.8	100	34	66		100	1.0
Transport-Inf	44.4	55.6	100	88	12		100	0.1
Commerce-For	66.9	33.1	100	40	60		100	1.0
Commerce-Inf	66.1	33.9	100	86	14		100	0.2
Tourism-For	75.1	24.9	100	40	60		100	0.7
Tourism-Inf	64.6	35.4	100	90	10		100	0.1
Other services-For	69.9	30.1	100	66	34		100	0.4
Other services-Inf	73.8	26.2	100	90	10		100	0.1
Public Admin	67.1	32.9	100	66	34		100	0.2
TOTAL	50.5	49.5	100	33.1	12.2	54.7	100	

Source: Madagascar SAM, 1999.

Table A3 -- Imports and exports

	Structure of trade		Structure of demand	Exports as % of	Imports as % of
	exports	imports		production	total demand
Paddy			4.3		
Vanilla	1.9		0	94.2	
Coffee	2.6		0	92.9	
Other export	3.5		0	94.3	
Industrial crops	0.4		0.8	5.4	
Cassava			1.8		
Other crops	3.5		1	28.1	
Livestock	0.4		6.1	0.7	
Fishing	13.9		1.8	45.3	
Sylviculture	1.2		4.2	2.9	
Mining	3.8	0.2	0.3	71.9	36.8
Energy/Water			1.1		
Petroleum	0.9	14.7	2.8	19.8	86.1
Rice-For	0.1	2.6	4.7	0.3	8.9
Food processing-	0.7	4.9	7.8	1.2	14.4
Food processing-			5.4		
Textile-For		13.6	2.9		87.4
Textile-Inf			0.1		
Other Manuf-For	3.5	13.3	7.1	8.4	42.1
Other Manuf-Inf			2.4		
Ex Proc Zone	27			100	
Construction-For			2.9		
Construction-Inf			2.4		
Transport-For	12.1	7	5.6	22.2	19
Transport-Inf			0.6		
Commerce-For		4.2	12.4		5.2
Commerce-Inf			2.6		
Tourism-For	12.4	2.2	0.4	96.9	89.2
Tourism-Inf	2.1		0	99.6	
Other services-	10	14.1	9.2	13.2	23.4
Other services-Inf			0.8		
Public Admin			3.4		
Importcompl		23.2	5		100
Agriculture	27.5		20	12.7	
Non-Agriculture	72.5	100	80	11.8	23.5
Total	100	100	100	12	18.8

Source: Madagascar SAM, 1999.

Table A.4 -- Summary of household accounts, Madagascar SAM 1999

	Income	Direct taxes (millions of FMG)	Savings	Population total	Population %	Total expenditure (millions of FMG)	Expenditure per capita	Expenditure %
HH Urb1	3460.3	115.5	424.8	605,726	4.1	2920	4.82	14.2
HH Urb2	3206.8	36.7	248.8	1,070,253	7.3	2921.3	2.73	14.2
HH Urb3m	2004.7	23	92.2	1,201,190	8.2	1889.5	1.57	9.2
HH Urb3f	614.6	9.2	25.3	376,475	2.6	580.1	1.54	2.8
HH HPp	2825.9	13.4	116.5	2,965,517	20.3	2696	0.91	13.1
HH HPg	1182.2	6.9	163.4	771,780	5.3	1011.9	1.31	4.9
HH Ecp	1468.2	8.7	64.7	1,826,747	12.5	1394.8	0.76	6.8
HH Ecg	1215.2	2.1	103.5	1,118,455	7.6	1109.6	0.99	5.4
HH Sp	815.5	3.4	90.4	795,296	5.4	721.7	0.91	3.5
HH Sg	639.6	10	79.9	420,371	2.9	549.7	1.31	2.7
HH Wp	1007	3.9	197.8	1,080,484	7.4	805.3	0.75	3.9
HH Wg	784.4	6.3	176.3	616,761	4.2	601.8	0.98	2.9
HH RNFp	1441.7	6.4	109.3	928,287	6.3	1326	1.43	6.4
HH RNFR	2463.4	32.9	376.6	852,197	5.8	2053.9	2.41	10

Source: Madagascar SAM, 1999.

Table A.5 -- Sources of income by Malagasy households, 1999

Sources de revenu	HH1 HH Urb1	HH2 HH Urb2	HH3 HH Urb3m	HH4 HH Urb3f	HH5 HH HPp	HH6 HH HPg	HH7 HH Ecp	HH8 HH Ecg	HH9 HH Sp	HH10 HH Sg	HH11 HH Wp	HH12 HH Wg	HH13 HH RNFp	HH14 HH RNFr
Labor 1 - Urb qualif	26	5.5	4	8.3										
Labor 2 - Urb medium	6.9	54	16.7	24.3										
Labor 3 - Urb unqual	1.4	4.6	51.6	48.2										
Labor 4 - Rural					45.8	32.3	48.4	42.6	41.9	31.7	48	40.1	23.3	13.4
Capital formal	15	8.2	5.5	1.9	12.9	12	7.6	11.3	6	4	6.6	14.5	15.8	12.7
Capital informal urban	1.8	3.8	5	3.5										
Capital informal rural					0.9	0.5	0.8	0.6	1	0.3	0.9	0.5	10	20.5
Land 1 - HP small	0.1	0.4	1.2	0.7	19.2								2.8	1.3
Land 2 - HP large	0.2	0.3	1.7	0.6		30.5							1	1.6
Land 3 - EC small	0.1	0.3	0.8	0.2			29						1.6	0.7
Land 4 - EC large	0	0.2	0.8	0.5				36.4					1	0.5
Land 5 - S small	0.1	0.4	0.9	0.6					26.3				1.7	0.5
Land 6 - S large		0	2.1	1.4						59.4			2.2	0.6
Land 7 - W small	0	0.2	0.8	1.3							25.6		0.5	0.2
Land 8 - W large	0.2	0.1	0.6	1.3								32	0.3	0.2
Enterprises	37.5	13.6	2.2		15.5	18.5	10.9	3.6	15.6	0.9	10.2	5.6	30.3	41.4
GOV	3.2	2	1.7	3.2			0.3		0.6	1.5				0.6
ROW	7.6	6.3	4.5	4.1	5.8	6.2	3	5.5	8.6	2.2	8.7	7.4	9.5	5.8
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Madagascar SAM, 1999.

Table A.6 -- Structure of consumption of Malagasy households, 1999

Products	HH1 HH Urb1	HH2 HH Urb2	HH3 HH Urb3m	HH4 HH Urb3f	HH5 HH HPp	HH6 HH HPg	HH7 HH Ecp	HH8 HH Ecg	HH9 HH Sp	HH10 HH Sg	HH11 HH Wp	HH12 HH Wg	HH13 HH RNFp	HH14 HH RNFr
Paddy														
Vanilla	0	0	0	0	0.1	0.1	0	0	0	0	0.1	0	0	0
Coffee	0	0	0.1	0.1	0.1	0.1	0	0	0.1	0.1	0.1	0	0	0.1
Other export crops	0	0	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1	0.1	0	0	0.1
Industrial crops	0	0	0.1	0.1	0.1	0.1	0.3	0.2	0.1	0.2	0.2	0.2	0.2	0.1
Cassava	0.2	0.3	1.7	1.7	5.5	4.3	6.5	5.7	8.7	11.6	6.7	1.1	3.5	0.6
Other crops	0.8	1.2	1.8	2	2.5	2.5	1.3	1.8	3.1	3	1.7	2.6	1.9	1.4
Livestock	10.6	12.9	13.1	14.2	12.1	15.2	20	17.6	16.5	5.7	10.7	11.9	12.7	12.2
Fishing	2.1	3.1	3.7	4.3	1.9	4	1.4	2.7	2.8	4.1	5.9	8	3.3	2
Sylviculture	6.1	9.1	9.2	11.2	1.6	0.6	0.1	0.5	3.1	1.6	0.8	2	9.1	6.3
Mining	0.3	0.3	0.2	0.3	0	0	0	0	0	0	0.1	0	0.1	0.2
Energy/Water	0.1	0.2	0.1	0.1	0			0	0		0.1	0.2		
Petroleum	0.5	0.4	0.3	0.4	0.4	0.3	0.5	0.6	0.4	0.4	0.7	1	0.3	0.6
Rice-For	4.5	7.8	12.1	12.2	17.8	17	19.8	22.7	8.1	7.1	18.3	19.5	11	9
Food processing-For	13.5	15.5	17	18.4	15.7	14.9	14.9	16	17.8	29.7	15	14.8	10.5	16.2
Food processing-Inf	2.2	5.3	7.3	7.9	17.7	13.7	16.9	14.7	24.2	19.7	17	13.6	9.7	2.6
Textile-For	3.1	3.3	2.8	2.3	4.1	4.4	5.3	4.8	6.5	5.3	5.3	3.7	1.9	5.2
Textile-Inf	0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.1
Other Manuf-For	2	1.9	1.1	1.1	0.8	0.9	0.7	1	0.7	0.6	1.1	1.6	1.1	1.7
Other Manuf-Inf	0.7	1.2	1.4	1.5	1.4	1.5	1.2	1.6	1.1	1	1.9	2.7	1.8	1.5
Ex Proc Zone														
Construction-For	8.6	4.8	3.9	1.6	2.2	2	0.5	1	0.3	0.1	1.4	1.1	2	4.2
Construction-Inf	11.1	6.2	5	2.1	2.8	2.6	0.6	1.3	0.4	0.1	1.8	1.4	2.5	5.4
Transport-For	11.7	9.6	7.5	7.2	6.7	8.5	5.1	3.9	2.4	3.4	5.9	9.3	16.9	18.8
Transport-Inf	0.4	1.1	1.1	1.1	1.4	1.7	1	0.8	0.5	1.4	1.2	1.3	3.4	0.7
Commerce-For														
Commerce-Inf														
Tourism-For	4.8	1.3	0.8	1.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3
Tourism-Inf	0	0	0											
Other services-For	13.7	14	8.9	8.6	4.6	4.7	2.9	2.5	2.4	4.3	3.4	3.1	7.1	10.3
Other services-Inf	0.2	0.3	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.4	0.4	0.3
Public Admin														
Importcompl	2.8	0.2	0.1	0.1	0	0	0.1	0.1	0	0	0.1	0.1	0.1	0.2
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Madagascar SAM, 1999.

ANNEX B.
THE COMPUTABLE GENERAL EQUILIBRIUM (CGE) MODEL FOR MADAGASCAR 1999

1. Structure

The 1999 Madagascar CGE model is based on the model developed by Lofgren et al. (2001) which summarizes all the equations of the model. Established in the neoclassical tradition of Dervis, de Melo and Robinson (1982), the model considers producers to be profit maximizers who pay out returns to factors of production according to their marginal productivity. Production technology, like the 1995 Madagascar CGE model, is constant elasticity of substitution (CES) in the factors and fixed share (Leontief) in intermediate inputs.

Imports are considered imperfect substitutes for domestically produced goods. The degree of substitutability is defined by a constant elasticity of substitution (CES) Armington function. In the same way, we suppose that production destined for the local market is an imperfect substitute for exports. A constant elasticity of transformation (CET) function defines this rate of transformation.

The model includes sixteen institutions, 14 household groups, private enterprises and government. Households and enterprises earn income in proportion to their ownership of specific productive assets. They pay direct taxes and save at fixed rates out of current income. Enterprises pay retained profits out as dividends to households. Net transfers to households by the rest of the world are exogenous and fixed in dollar terms. Households spend on consumption goods according to a linear expenditure system (LES). Government receives revenues from direct taxes, indirect taxes, import duties and transfers. The model fixes government consumption in real terms.

2. Closure

In the simulations, foreign savings is fixed and total invest varies along with the volume of savings available.[14] The consumer price index, being fixed, becomes the numeraire of the model. In this way, the nominal exchange rate (which in this case also becomes the real exchange rate, give that the domestic price index is fixed) varies in order to equilibrate the foreign exchange market.

Closure in the labor market assumes mobility across sectors and full employment. For three categories of labor – rural, highly qualified and medium qualification urban labor – even though the quantity of labor is fixed, the quantity demanded can vary across activities. The wage rate then varies in order to equilibrate supply and demand for each category of labor. In contrast, we model unqualified urban labor with unemployment and a fixed wage rate. In this setting, the

[14] Other model closures are also possible. These are described in greater detail by Lofgren et. al. (2001).

employment (and unemployment) rate becomes endogenous in order to equilibrate supply and demand of unqualified urban workers.

Capital is fixed by sector. With land, total supply is fixed. Land allocation to export crops, livestock and sylviculture is also fixed, while cultivators can change allocation of land planted in paddy, cassava and other crops, with the exception of export crops.

3. Parameters

The LES consumption function is calibrated in order to approximate income and price elasticities calculated econometrically by Ravelosoa et al. (2000).[15] Given that the LES does not permit inferior goods, the parameters for inferior goods (such as cassava in urban areas) are set to approximate an income elasticity of zero. The elasticities as well as the corresponding Frisch[16] parameters are summarized in Tables B.1 and B.2.

The production functions are calibrated in order to generate supply elasticities within normal empirical ranges. For agricultural crops, these normally concentrate between 0.3 and 0.5 in Madagascar.[17] Most nonagricultural sectors are modeled as being more elastic than agriculture, with informal sectors normally more elastic than the formal. Supply elasticities, themselves functions of the elasticity of substitution, are summarized in Table B.3.

The rate of substitution between traded and domestically consumed goods (CES) also varies by sector. Domestic consumption of gasoline, rice and tourism are modeled as being highly substitutable with their imported equivalents. In contrast, transport and manufactured products are only very imperfect substitutes. In the same way, the CET elasticities petroleum products, rice and tourism as well as export crops are high, which signifies large potential for substitution between domestically produced goods sold either locally or on export markets (Table B.3).

[15] Note that in these general equilibrium simulations other factors are not necessarily constant. Therefore, changes in quantities are not in general equal to amounts that would be implied in a partial equilibrium world by the change in price and the price elasticity of demand.

[16] The Frisch paramter reflects the share of subsistence consumption necessary to the survival of a household as a share of total consumption.

[17] For a complete list of model parameters, see Lofgren et al. (2001).

Table B.1 -- Income elasticities of demand

	Household groups in the SAM													
	urban households, by qualification				rural farm households								rural non-agricultural	
	high	medium	low	low	High Plateau		East Coast		South		West		poor	rich
			male	female	small	large	small	large	small	large	small	large		
Firsch paramters	-1	-1	-1.8	-1.8	-1.8	-1.25	-1.8	-1.25	-1.8	-1.25	-1.8	-1.25	-2	-1.25
Income elasticity														
Paddy	0.00	0.20	0.50	0.50	0.75	0.40	0.75	0.40	0.80	0.80	0.75	0.40	0.75	0.40
Vanilla	0.50	0.80	0.60	0.60	1.30	0.90	1.30	0.90	0.80	0.80	1.30	0.90	1.30	0.90
Coffee	0.50	0.80	0.60	0.60	1.30	0.90	1.30	0.90	0.80	0.80	1.30	0.90	1.30	0.90
Other export crops	0.50	0.80	0.60	0.60	1.30	0.90	1.30	0.90	0.80	0.80	1.30	0.90	1.30	0.90
Industrial crops	0.05	0.70	1.00	1.00	0.40	0.20	0.40	0.20	0.80	0.80	0.40	0.20	0.40	0.20
Cassava	0.05	0.05	0.05	0.05	0.30	0.50	0.30	0.50	0.80	0.80	0.30	0.50	0.30	0.50
Other crops	0.50	0.50	1.10	1.10	0.60	0.50	0.60	0.50	0.50	0.50	0.60	0.50	0.60	0.50
Livestock	1.20	1.40	1.50	1.50	1.70	1.70	1.70	1.70	1.80	1.80	1.70	1.70	1.70	1.70
Fishing	1.00	1.70	1.10	1.10	1.30	1.60	1.30	1.60	0.50	0.50	1.30	1.60	1.30	1.60
Sylviculture	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Mining	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Energy/Water	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Petroleum	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Rice-For	0.05	0.20	0.50	0.50	0.75	0.40	0.75	0.40	0.80	0.80	0.75	0.40	0.75	0.40
Food processing-For	1.10	0.30	1.20	1.20	0.80	0.80	0.90	0.90	0.90	1.00	0.80	0.80	0.80	0.80
Food processing-Inf	1.10	0.30	1.20	1.20	0.80	0.80	0.90	0.90	0.80	0.90	0.80	0.80	0.80	0.80
Textile-For	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Textile-Inf	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Other Manuf-For	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Other Manuf-Inf	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Ex Proc Zone	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Construction-For	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Construction-Inf	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Transport-For	0.90	1.41	0.92	0.92	1.31	1.34	1.05	1.27	0.90	1.36	1.35	1.40	1.11	1.16
Transport-Inf	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Commerce-For	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Commerce-Inf	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Tourism-For	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Tourism-Inf	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Other services-For	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Other services-Inf	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Public Admin	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00
Importcompl	1.10	1.40	1.00	1.00	1.30	1.20	0.90	1.40	1.10	1.30	1.30	1.20	1.10	1.00

Source: CGE model, calibrated according to Ravelosoa et al. (1999).

Table B.2 -- Price elasticities of demand

	Household groups in the SAM													
	urban households, by qualification				rural farm households								rural non-agricultural	
	high	medium	low	low	High Plateau		East Coast		South		West		poor	rich
			male	female	small	large	small	large	small	large	small	large		
Paddy	-0.20	-0.20	-0.28	-0.28	-0.42	-0.32	-0.42	-0.32	-0.44	-0.64	-0.42	-0.32	-0.38	-0.32
Vanilla	-0.80	-0.80	-0.33	-0.33	-0.72	-0.72	-0.72	-0.72	-0.44	-0.64	-0.72	-0.72	-0.65	-0.72
Coffee	-0.80	-0.80	-0.33	-0.33	-0.72	-0.72	-0.72	-0.72	-0.44	-0.64	-0.72	-0.72	-0.65	-0.72
Other export crops	-0.80	-0.80	-0.33	-0.33	-0.72	-0.72	-0.72	-0.72	-0.44	-0.64	-0.72	-0.72	-0.65	-0.72
Industrial crops	-0.70	-0.70	-0.56	-0.56	-0.22	-0.16	-0.22	-0.16	-0.44	-0.64	-0.22	-0.16	-0.20	-0.16
Cassava	-0.05	-0.05	-0.03	-0.03	-0.18	-0.41	-0.18	-0.42	-0.48	-0.67	-0.18	-0.40	-0.16	-0.40
Other crops	-0.50	-0.50	-0.62	-0.62	-0.34	-0.41	-0.34	-0.41	-0.29	-0.41	-0.34	-0.41	-0.31	-0.40
Livestock	-1.33	-1.33	-0.87	-0.87	-0.96	-1.27	-0.96	-1.25	-1.00	-1.39	-0.95	-1.29	-0.88	-1.29
Fishing	-1.66	-1.66	-0.63	-0.63	-0.73	-1.26	-0.73	-1.27	-0.29	-0.41	-0.74	-1.24	-0.66	-1.27
Sylviculture	-0.62	-0.62	-0.37	-0.38	-0.34	-0.48	-0.33	-0.48	-0.35	-0.48	-0.34	-0.49	-0.34	-0.50
Mining	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Energy/Water	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Petroleum	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Rice-For	-0.21	-0.21	-0.32	-0.32	-0.49	-0.37	-0.50	-0.38	-0.48	-0.66	-0.50	-0.37	-0.43	-0.34
Food processing-For	-0.33	-0.33	-0.73	-0.74	-0.51	-0.68	-0.57	-0.76	-0.58	-0.86	-0.51	-0.68	-0.45	-0.69
Food processing-Inf	-0.31	-0.31	-0.70	-0.70	-0.52	-0.68	-0.58	-0.76	-0.55	-0.77	-0.52	-0.68	-0.45	-0.65
Textile-For	-1.38	-1.38	-0.57	-0.57	-0.74	-0.96	-0.52	-1.11	-0.64	-1.04	-0.74	-0.96	-0.56	-0.81
Textile-Inf	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Other Manuf-For	-1.39	-1.39	-0.56	-0.56	-0.73	-0.96	-0.50	-1.12	-0.61	-1.04	-0.73	-0.96	-0.56	-0.80
Other Manuf-Inf	-1.39	-1.39	-0.56	-0.56	-0.73	-0.96	-0.51	-1.12	-0.62	-1.04	-0.73	-0.96	-0.56	-0.80
Ex Proc Zone	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Construction-For	-1.37	-1.37	-0.57	-0.56	-0.73	-0.96	-0.50	-1.12	-0.61	-1.04	-0.73	-0.96	-0.56	-0.81
Construction-Inf	-1.37	-1.37	-0.58	-0.56	-0.73	-0.96	-0.50	-1.12	-0.61	-1.04	-0.73	-0.96	-0.56	-0.81
Transport-For	-1.36	-1.36	-0.55	-0.55	-0.75	-1.06	-0.61	-1.02	-0.51	-1.09	-0.77	-1.11	-0.64	-0.94
Transport-Inf	-1.39	-1.39	-0.56	-0.56	-0.73	-0.96	-0.50	-1.12	-0.61	-1.04	-0.73	-0.96	-0.57	-0.80
Commerce-For	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Commerce-Inf	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Tourism-For	-1.39	-1.39	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Tourism-Inf	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Other services-For	-1.32	-1.32	-0.60	-0.59	-0.74	-0.96	-0.51	-1.12	-0.62	-1.04	-0.73	-0.96	-0.59	-0.82
Other services-Inf	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Public Admin	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80
Importcompl	-1.40	-1.40	-0.56	-0.56	-0.72	-0.96	-0.50	-1.12	-0.61	-1.04	-0.72	-0.96	-0.55	-0.80

Source: CGE model, calibrated according to Ravelosoa et al. (1999).

Table B.3 -- Production and trade parameters

	Target price elasticity of	Armington elasticity	CET elasticity
Paddy	0.3		
Vanilla	0.3		2
Coffee	0.3		2
Other export crops	0.3		2
Industrial crops	0.3		2
Cassava	0.5		
Other crops	0.5		0.4
Livestock	0.3		0.4
Fishing	0.7		0.9
Sylviculture	0.3		0.9
Mining	0.3	0.4	2
Energy/Water	0.3		
Petroleum	0.3	2	2
Rice-For	0.7	2	2
Food processing-For	0.7	0.9	0.9
Food processing-Inf	1		
Textile-For	0.3	0.9	
Textile-Inf	1		
Other Manuf-For	0.3	0.4	0.9
Other Manuf-Inf	1		
Ex Proc Zone	0.3		
Construction-For	0.7		
Construction-Inf	1		
Transport-For	0.7	0.4	0.4
Transport-Inf	1		
Commerce-For	0.7	0.4	
Commerce-Inf	1		
Tourism-For	0.5	2	0.9
Tourism-Inf	1		0.9
Other services-For	0.7	0.4	0.4
Other services-Inf	1		
Public Admin	0.3		
Importcompl			

Source: Madagascar CGE 1999.