Agriculture-led growth:
foodgrains versus export crops in Madagascar

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ABSTRACT

This article compares the growth-generating power of alternative agricultural development strategies in Madagascar. Projections from a semi-input–output model and a recently developed social accounting matrix suggest that both paddy and export crops stimulate strong linkages with other sectors of the Malagasy economy. But since paddy output can be increased at lower cost, investment in rehabilitating small irrigated rice perimeters generates 40% to 100% more GDP than a comparable investment in coffee production. Paddy also generates greater employment and a more equitable income distribution.

1. MOTIVATION

Madagascar, like many developing countries, is seriously debating where to assign priorities within agriculture, on food or export crops. Along with most other African countries, Madagascar has signed the Lagos Plan of Action, committing to the goal of food self-sufficiency. Yet the World Bank and other donors press for greater priority on export crops (World Bank, 1981, 1986).

Those advocating priority for export crops have sparked a lively debate, as the 'food first' counter proponents hotly contest the wisdom of an export crop orientation (Lappé and Collins, 1977). Debate centers around the

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issues of food security and nutrition (von Braun and Kennedy, 1986), economic dependence, income distribution, and growth – growth of employment, income and investment (Maxwell and Fernando, 1989).

This article contributes to these discussions by comparing the growth generating power of alternative agricultural investments in Madagascar. Making use of a recently developed Social Accounting Matrix (SAM), the paper offers a detailed set of projections for Madagascar to supplement ongoing discussion that are marked by a "great dearth of country case studies" (Maxwell and Fernando, 1989). It likewise contributes to the literature on agricultural growth linkages (Mellor, 1976; Bell, Hazell and Slade, 1982). Although many linkage studies have measured the power of agricultural growth multipliers – for different crops in different countries and for farms of different size – few have compared alternative crops priorities within the same country.

Prepared as an input into current policy debates in Madagascar, the paper begins with a brief recap of recent evolution in Malagasy agriculture. It then describes the model and data used to project the growth consequences of alternative agricultural investment strategies. After reporting the results for Madagascar, the paper discusses general implications for other developing countries.

2. RECENT EVOLUTION OF MALAGASY AGRICULTURE

Agriculture provides the primary source of income for three-quarters of Madagascar's population. As a contributor to national income, it ranks a close second to services (Table 1). The formal industrial sector, dominated by food processing and textiles, remains small, accounting for only 8.6% of GDP and 3% of employment. By value, farm output is concentrated in rice (paddy), export crops (coffee, vanilla and cloves), root crops and livestock. Paddy, the major staple, is grown throughout Madagascar, and irrigated small holdings form the base of the rural economy in the central highlands (Hauts-Plateaux). Coffee, vanilla and cloves are grown on the east and north coasts.

Unfortunately, Madagascar's agriculture has stagnated over the past 15 years. Rice output per capita declined by 20% between 1975 and 1989, and imports averaged 8.2% of total rice availability over the second half of the eighties. Production of traditional export crops – coffee, vanilla and cloves – declined in value terms since the late seventies.

World markets and a decade and a half of heavy state control account for the malaise. For 10 years, from the mid-1970's to the mid-1980's, the government exercised a formal monopoly on rice and export crop marketing. Real producer prices fell under the weight of heavy export crop

TABLE 1

Listing of SAM accounts

SAM row accounts	1984 Gross output (million FMG)	Percentage of value added
Activities		
1. Paddy, irrigated low-input	59973	2.4
2. Paddy, irrigated high-input	87315	2.7
3. Paddy, rainfed	20918	1.1
4. Coffee, low-input	21534	1.3
5. Coffee, high-input	7201	0.4
6. Vanilla and cloves	14589	0.9
7. Non-traditional export crops	–	–
8. Industrial crops (cotton, groundnuts, sugarcane)	14176	0.5
9. Other agriculture (livestock, tubers perishables)	487485	26.1
10. Mining, energy, and water	85298	2.0
11. Rice milling	169988	0.2
12. Formal manufacturing	84885	2.3
13. Informal industries	403829	6.8
14. Private services (commerce, construction, services)	1001088	45.0
15. Public services	203799	8.2

Commodities
16. Paddy
17. Coffee
18. Vanilla and cloves
19. Nontraditional export crops
20. Industrial crops
21. Other agriculture (livestock, tubers, perishables)
22. Mining, energy and water
23. Rice
24. Formal manufacturing
25. Informal industries
26. Private services (commerce, construction, services)
27. Public services

Households
28. Large urban areas
29. Secondary urban centers
30. Large farms
31. Small farms
32. Rural nonfarm, poor

TABLE 1 (continued)

SAM row accounts	1984 Gross output (million FMG)	Percentage of value added
33. Rural nonfarm, rich		
34. Institutions (corporations, financial, nonprofits		
35. Government		
36. Rest of world		
37. Capital		

FMG, Malagasy franc (1 US$ = 576.6 FMG in 1984).

taxation and declining world prices (Dorosh, Bernier and Sarris, 1990). Deteriorating production and marketing infrastructure could not be maintained by a government without access to western capital markets. Under strong pressure from the donor community, the government began to liberalize agricultural marketing in 1983, as part of wider economic policy reforms.

As the Malagasy economy opens up, a decade of neglect exposes serious deficiencies in agricultural infrastructure. Coffee plantations, 60% of which are 25 or more years old, are reaching the end of their productive life (FAO, 1989). Vanilla and especially cloves are poorly maintained. To increase rice production, 60 000 small-scale irrigation perimeters require rehabilitation in the central highlands (AIRD, 1991). And several lackluster large-scale public schemes (Lac Aloatra, etc.) have achieved only low economic rates of return (Barghouti and LeMoigne, 1990).

Donors and government are presently reviewing priorities for strategic investments in agriculture. Current discussions center on rice and export crops. To boost rice production, most experts believe rehabilitation of small irrigated rice perimeters will yield quickest results. To increase export crop revenues, most focus on small-farmer based export crops – coffee, vanilla or non-traditional export crops. As an input into those discussions, this paper compares the growth generating power of each of these two broad strategic alternatives.

3. A MODEL FOR ESTIMATING THE IMPACT OF AGRICULTURAL GROWTH

3.1. Incorporating linkages

Agricultural growth stimulates demand for production inputs and for the consumer goods required by farm households. Where excess capacity exists,

that increased demand translates into higher output and non-farm incomes. Thus the total income gain generated by agricultural growth includes the direct farm income plus the indirect earnings generated in other sectors.

To measure these indirect effects requires a model that relates sectoral output, household income, consumer demand, and inter-industry input linkages. Since supply responsiveness across sectors determines how effectively growing demand will translate into increased domestic output and income, any model must make clear assumptions about supply elasticities in all sectors of the economy.

One option, the input–output model, embodies the classic approach to this question. It sets total supply in each sector (Z) equal to the two sources of demand, inter-industry input demand (AZ) and final consumption demand (F). Final demand includes consumption by households (βY) and exogenous sources of demand such as exports (E). The value added share (v) in gross commodity output (Z) determines income (Y).

$$Z = AZ + F$$
$$= AZ + \beta Y + E$$
$$= AZ + \beta v Z + E \tag{1}$$

Assuming supply to be perfectly elastic in all sectors, total output and incomes are determined by the level of exogenous demand (E). Equation (2) describes this relationship, with (I) representing the identify matrix and (M) equal to ($A + \beta v$):

$$Z = (I - M)^{-1} E \tag{2}$$

Yet in reality, some sectors face supply constraints. This is especially true in agriculture, where land, labor, rainfall and technology frequently lead to steep, upward-sloping supply curves. Because input–output (IO) models assume perfectly elastic supply in all sectors, they over-estimate second-round output responses following from any exogenous shock. Empirical estimates of agricultural growth multipliers suggest that IO multipliers overstate actual second-round growth by a factor of two to ten (Haggblade, Hammer and Hazell, 1991).

3.2. Modeling options

More realistic depictions of supply responsiveness fall into two general categories: (a) semi-input–output (SIO) models; and (b) price endogenous models, both available in many flavors. The two classes of models are alike in all respects but one. Both incorporate intermediate and consumption

demand as in the IO model. Both diverge from the IO model by admitting to upward sloping supply curves in tradable sectors. And by invoking the small country assumption, both treat the price of internationally traded goods as fixed. The fixed world prices lead to fixed domestic output in tradables in both classes of models. Output in tradable sectors can increase through technical change or increased investment, but not through short-run injections of domestic demand. Any increase in demand for tradables leaves price, and hence domestic production, unchanged; the demand increase merely decreases net exports.

The two models differ only in their assumption about output supply elasticity in nontradables. The SIO model assumes perfectly elastic non-tradable supply, while the price endogenous models do not. Given this assumption, the SIO model becomes a fixed-price model. World prices fix the price of tradables, even though supply is often highly inelastic. And nontradable prices are fixed by virtue of a perfectly elastic output supply.

The price endogenous models, in contrast, incorporate upward-sloping supply in nontradable sectors. Because of this, an exogenous shock which increases incomes and demand will lead to price inflation in nontradables. Output response in nontradables be lower than in the SIO, and income multipliers will be lower as well. The formal relationship among the IO, SIO and price endogenous models has been spelled out elsewhere (Haggblade, Hammer and Hazell, 1991).

Which model is most appropriate? The answer hinges on the supply elasticity of nontradables. Where labor supplies are highly elastic and excess capacity exists in nontradable sectors, the SIO is appropriate. In contrast, where non-tradable output can be increased only at increasing cost, a price endogenous model is required.

In the case of Madagascar, we have opted for the SIO. A decade and a half of stagnation have led to excess capacity, underemployment, and consequently a highly elastic supply of nontradables. Because this proves true in many other settings, the SIO has proven increasingly popular in modeling responses to supply shocks in many developing countries. See, for example, Bell and Hazell (1980), Bell, Hazell and Slade (1982), Rogers (1986), Haggblade and Hazell (1989), Subramanian and Sadoulet (1990), and Lewis and Thorbecke (1992).

3.3. SIO model

The following two equations, contrasted with (1) and (2) above, capture the SIO model's essential distinction. The SIO classifies all economic sectors as either tradable (Z_1) or non-tradable (Z_2). The SIO model permits output responses only in the nontradable sectors, those with elastic

supply (Z_2). In contrast, output in tradable sectors (Z_1) is fixed, given upward-sloping supply curves and fixed world prices. In these fixed-supply tradable sectors (Z_1), increases in domestic demand merely reduce net exports (E_1), which then become endogenous to the system:

$$Z_1 = A_1 Z + \beta_1 v_1 Z + E_1$$

$$Z_2 = A_2 Z + \beta_2 v_2 Z + E_2 \tag{3}$$

$$\begin{bmatrix} E_1 \\ Z_2 \end{bmatrix} = (\mathrm{I} - M^*)^{-1} \begin{bmatrix} Z_1 \\ E_2 \end{bmatrix} \tag{4}$$

Investments in agriculture, or weather-induced supply shocks, trigger exogenous shifts in the output of tradables (Z_1) such as paddy. That exogenous increase in output directly raises farm incomes by the amount of value added in the additional paddy production. As in the IO model, multiplier effects derive from increased demand for intermediate goods used in paddy production and increased final demand by paddy farmers enjoying higher incomes. In both models, supply response in nontradables (Z_2) is perfectly elastic. So increased demand for nontradables leads to higher output and higher domestic incomes in these sectors, setting off successive rounds of demand-induced growth in non-tradables output. In the SIO model, this increase in demand does not stimulate further domestic production of tradables. Given fixed world prices, their output is fixed. So increased demand for tradables does not increase domestic supply, it merely decreases net exports of tradables.

3.4. Madagascar model

The semi-input-output (SIO) model used here is built around a condensed SAM (Social Accounting Matrix) that includes twelve commodity accounts, fifteen activities, six household groups, one other nongovernment institution, government, rest of world and one capital account (Table 1). The SAM is built from detailed 1984 national accounts for Madagascar and the results of a number of household budget surveys (see Dorosh, Bernier et al., 1991).

The model classifies six of the twelve commodities as having elastic supplies (Z_2): rice milling [1], informal industries, private services, public services, vanilla and cloves, and other agriculture. Of these, vanilla and

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[1] Given current excess capacity in rice milling, the model assumes that the service provided by milling paddy into rice can be provided at constant cost. Supply of paddy, itself, is however inelastic.

cloves are traded internationally while the other five commodities are not. For the five nontraded goods, the assumption of perfectly elastic supply appears to be a reasonable approximation of reality given the considerable unemployment and excess capacity present in Madagascar, especially in the 1984 base year for which the SAM was constructed. Vanilla and cloves, too, even though they are tradable commodities, are highly elastic in supply. Little labor, apart from harvesting labor, is used in the production of these essentially wild gathered commodities, and farm households rarely apply material inputs. Madagascar's exports of vanilla and cloves is largely constrained by world demand.

The six remaining SAM commodities – paddy, coffee, non-traditional export crops, oilseeds and other industrial crops, mining, and formal manufacturing – are designated as tradables whose output, given world prices, is fixed (Z_1).

As in most applications, the SIO model adopted here is a fixed-price model. In this instance, that standard simplification corresponds closely to economic reality. For tradable goods such as rice and coffee, world prices can be taken as exogenous in a small country like Madagascar. For non-traded goods such as services, informal manufactured goods and many perishable agricultural commodities, fixed prices depend on firms' ability to increase output at constant cost. Formally, this requires a perfectly elastic output supply, a reasonable assumption, as discussed above. Similarly, the remaining export crops, vanilla and cloves, are highly elastic in supply. So even though Madagascar is a major world supplier of vanilla and cloves, its ability to supply output at constant cost makes fixed domestic prices a tenable assumption, at least in the short run as long as rural wage rates do not rise appreciably.

As a point of departure, the base run models what observers consider the most likely sources of agricultural growth in Madagascar, those focused on improved small farmer technology for paddy, coffee, vanilla and cloves production. High-input technology, and in the case of paddy, small-scale irrigation rather than rainfed cultivation, seem the most viable avenues for future public investment.

In addition, the base run assumes that consumers spend additional income in the same way they have in the past, that is that average budget shares equal marginals, and that savings is not translated into investment expenditure in the short run. That is, as in most linkage studies, it considers investment to be exogenous. [2]

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[2] See Bell, Hazell and Slade (1982), for example.

4. CONSEQUENCES OF ALTERNATIVE AGRICULTURAL GROWTH STRATEGIES

4.1. Income and employment multipliers

Given the base run assumption of high-input, small-farm technology, a 1 FMG increase in paddy output will generate a GDP increase of 1.802 FMG, while a similar boost in coffee output will produce 1.974 FMG in national income (Table 2). Vanilla and cloves – demand-constrained unlike the others – will generate 2.041 FMG in GDP following an exogenous 1 FMG increase in export demand. Employment will increase by 2.9, 2.6 and 2.6 jobs, respectively, for each million FMG increase in output.

Although export crops achieve 10–15% greater income growth than does paddy, the downstream – or multiplier – effects are essentially the same. The initial 1 FMG increase in output of export crops simply represents a greater initial injection of value added than a corresponding 1 FMG increase in output of paddy. For that reason, the value added multipliers (GDP/value added) rank the three crops in reverse order from the above GDP/output multipliers.

Compared to values of 1.3 and 1.5 found in other African countries, (Haggblade, Hazell and Brown, 1989; Haggblade and Hazell, 1990; Lewis and Thorbecke, 1992), the value added multipliers computed for Madagascar are high, 2.0 to 2.7. This may be because other studies have considered only rural regions rather than the full national economy. While expenditures outside the rural region represent leakages in a regional model, they represent income gains for the nation at large.

TABLE 2

Multiplier decomposition under improved small farmer technology

	Effect of a 1 FMG increase		
	Paddy supply	Coffee supply	Vanilla/Cloves export demand
Change in national income			
Initial direct increase	0.492	0.632	0.682
Multiplier effects	1.310	1.343	1.359
Total income increase	1.802	1.974	2.041
Value added multiplier	2.66	2.13	1.99
Change in employment (jobs per million FMG)	2.929	2.639	2.617

Source: Model simulations.
High-input paddy and coffee production, investment exogenous, average budget shares, 1984 world prices.

TABLE 3

Income distribution effects of small farmer led agriculture growth

	Effect of a 1 FMG increase in each of the following		
	Paddy supply	Coffee supply	Vanilla/Cloves export demand
Household income			
Large cities	0.177	0.272	0.286
Secondary towns	0.036	0.051	0.053
Large farms	0.345	0.311	0.397
Small farms	0.904	0.611	0.562
Rural nonfarm, poor	0.068	0.052	0.036
Rural nonfarm, rich	0.063	0.078	0.080
Total households	1.593	1.374	1.413
Institutions' income	0.142	0.164	0.122
Government share of national income	0.067	0.436	0.504
Total national income	1.802	1.974	2.041

Source: Model simulations.
The government's share of national income is the value added it receives from taxes on commodities and production activities. It does not include the revenue they receive from corporate and household income taxes.

The greater employment generated by paddy is most pronounced among unskilled, rural workers. This translates into a more equitable distribution of income as well (Table 3). While urban households and government earn more from export crops, rural farm households gain most from paddy production. This difference in income distribution arises largely because 40% of export crop value (f.o.b.) accrues to the government and to traders as commodity taxes and commercial margins.

The sectoral impact of growth in alternative agricultural commodities is strikingly similar (Table 4). Private services attract by far the largest component of agricultural demand linkages. Industries other than formal manufacturing also grow rapidly in the wake of agricultural expansion. So does other agriculture, which consists mainly of perishable foods. Increases in milk and horticultural crop production in the Hauts-Plateaux since the recent liberalization underscore the importance of demand linkages in stimulating production of these nonfoodgrains. It suggests that agricultural investment strategies focused on paddy or export crops will contribute, through demand linkages, to broader agricultural growth.

Only public service growth differs across the three crops. Because of the large share of tax revenue in export crop earnings, and because we assume

TABLE 4

Sectoral composition of small farmer led agricultural growth

Output change in each sector	Effect of a 1 FMG increase		
	Paddy supply	Coffee supply	Vanilla/Cloves export demand
Paddy, low-input	0.000	0.000	0.000
Paddy, high-input	0.979	0.000	0.000
Paddy, rainfed	0.000	0.000	0.000
Coffee, low-input	0.000	0.000	0.000
Coffee, high-input	0.000	0.300	0.000
Vanilla, Cloves	0.000	0.000	0.249
New Export Crops	0.000	0.000	0.000
Industrial Crops	0.000	0.000	0.000
Other Agriculture	0.497	0.382	0.388
Mining, Energy, Water	0.005	0.005	0.005
Rice Milling	0.202	0.165	0.164
Formal Manufacturing	0.003	0.003	0.003
Other Industries	0.381	0.322	0.330
Private Services	0.895	0.947	0.930
Public Services	0.088	0.296	0.328

Source: Model simulations.

that government spends new income as it has spent past revenue, this results in large increases in the civil service payroll as export crops grow.

The striking similarity in sectoral growth stemming from different agricultural strategies arises because of the predominance of consumption linkages. Of the two sources of demand linkages – demand for intermediates and final consumer goods – consumption linkages dominate, accounting for 80% of total multiplier effects induced by agricultural growth (Dorosh, Haggblade et al., 1991). Demand for intermediates account for the remaining 20% of the income growth induced in other sectors. Because of the overwhelming importance of consumption linkages, any intervention that raises farmer income by a given amount induces broadly similar subsequent consumption expenditure.

Under a range of alternative assumptions, the income and employment responses closely resemble those of the base run (Dorosh, Haggblade et al., 1991). In particular, low export prices [3] and a regime of export tax

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[3] Coffee and vanilla prices have fallen 40% since 1984, the base year for the SAM. To assess the effects of lower export prices on the multiplier results, a modified SAM was constructed with reduced export taxes and increased government foreign borrowing. As indicated, the influence on the multiplier results was minimal.

TABLE 5

Investment multipliers (GDP per FMG invested)

	Pessimistic scenario	Optimistic scenario
Paddy: Rehabilitation of small irrigated perimeters	(Traditional technology) 3.68	(High-Input technology) 4.65
Robusta coffee project: Mixed replanting and pruning, high-input technology	(Low world price) 1.69	(High world price) 3.22

Source: Model simulations.

reduction change the multipliers by only 3–10%. Concentrating growth in large rather than small farms alters multipliers only in the third decimal place. Large farmers do consume more imported manufactures and less rice than small farmers. But since both rice and manufactures are tradable commodities, both represent income leakages in the model. This leads to virtually identical income multipliers for small and large farmers. Endogenizing investment, by incorporating investment spending from current savings, increases the demand linkages and hence growth multipliers by 20% to 30% in the short run [4], but does not affect the ranking of the crops in terms of value-added or output multipliers [5].

4.2. Investment multipliers: coffee vs. paddy

Ultimately, the ranking of alternative agricultural investments by their income-generating power depends on how much investment is required to initiate output growth in the first place. Once output grows by 1 FMG, the consequences are broadly similar.

But the investment necessary to increase paddy output by 1 FMG differs substantially from investment requirements for boosting coffee output. Under optimistic projections of output response using high-input paddy technology, 1 FMG invested in paddy will generate 4.7 FMG in national income (GDP). Yet the same 1 FMG invested in coffee, even under the optimistic high world coffee price scenario, would only yield 3.2 FMG in

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[4] In the long run, investment also increases production capacity by shifting supply curves.
[5] Alternate assumptions on marginal budget shares, based in part on small household surveys, lowered multipliers by 15–20%. The average budget shares used in all of the other simulations better reflect actual consumer behavior in Madagascar, though, since expenditures on rice (modeled here as having an inelastic supply) are overstated relative to consumption of non-traded goods in the surveys. (Dorosh, Haggblade et al., 1991).
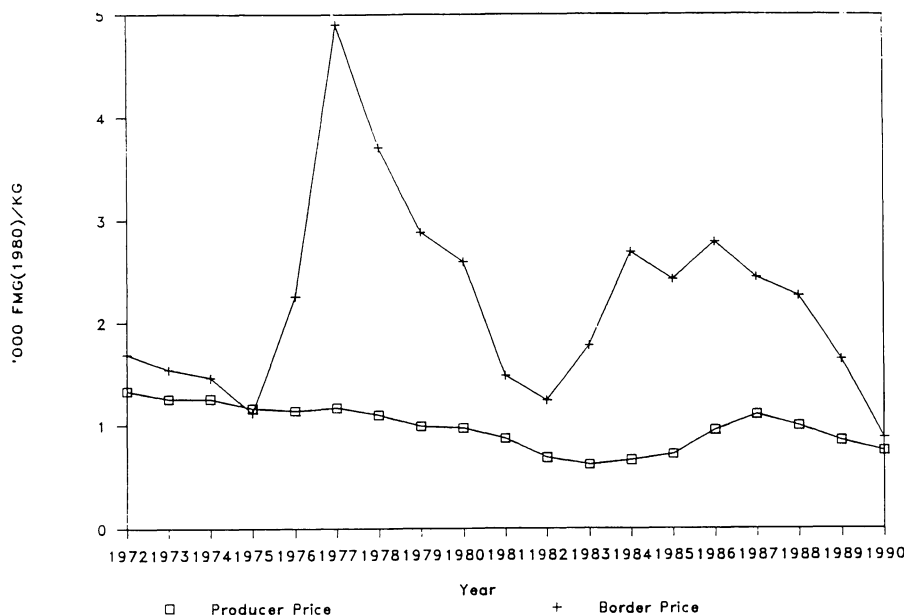
Fig. 1. Real coffee prices, 1972–1980. Source: Dorosh and Bernier (1991).

national income (Table 5). On efficiency grounds, it appears that investments in paddy yield higher returns than in coffee [6].

4.3. Savings and dynamic linkages

Different investment strategies also generate different levels of savings. Under high world prices, export crops generate enormous tax revenues given the resulting high level of taxation (see Fig. 1). If, as the model assumes, government saves most of the increased export crop tax revenues, the export crop strategy generates 25% more savings per unit of investment than does paddy. Under low world prices, prospects for taxing export crops diminish, and in this setting, investments in paddy rehabilitation generate savings per unit of investment twice as large as those earned in coffee.

So the ranking of dynamic growth paths is ambiguous. The long-run, investment-led growth emanating from export crop investments may be

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[6] To increase export sales of vanilla would require different sorts of investment. Instead of irrigation rehabilitation, new seedlings and extension support, it would require market development or other interventions aimed at boosting world demand for Malagasy natural vanilla. Since investment costs required to boost exports are unknown, no computations of investment multipliers for vanilla are made here.

TABLE 6

Rice-neutral, balanced investment strategy for Madagascar

	Rice	Coffee
1. Output		
a. Change in output (value)	0.212	1
b. Rice imports per unit change in output	−0.981	0.208
c. Total change in rice imports (value) [1a × 1b]	−208	208
2. Investment		
a. Capital-output ratio	0.387	0.641
		(1.282)
b. Investment Required [2a × 1a]	0.082	0.641
		(1.282)
3. Investment Shares [2b/0.641 × 100]	13	100

Source: Model simulations.
Figures in parentheses show values under low world price of coffee scenario.

higher or lower than that of paddy, depending on trends in world export crop prices.

4.4. Foreign exchange earnings

In food deficit countries like Madagascar, increased paddy output saves foreign exchange by substituting for cereal imports. In Madagascar, a one million FMG investment rehabilitating paddy irrigation facilities will earn 50% more foreign exchange than an equivalent investment in coffee.

4.5. Impact on rice demand and imports

Unlike promotion of export crops, investments in paddy boost domestic food production and reduce cereal import requirements. In contrast, promotion of export crops raises income, increases demand for food and thus boosts cereal imports (Table 6).

Yet in the future, if Madagascar becomes self-sufficient in rice production, additional investment in paddy may depress domestic prices. Although it might be possible to export the eventual surplus, given thin world rice markets Madagascar may wish, at that point, to limit growth in its rice production capacity. A balanced growth strategy might consider increasing investments in export crops but at the same time increasing domestic paddy production sufficiently to enable domestic farmers to supply the additional paddy demanded as a result of higher incomes in export crops. Table 6 describes this rice-neutral balanced growth path. Every 100 FMG invested in coffee production would require an additional 13 FMG in paddy

rehabilitation in order for domestic rice production to keep pace with the increased rice demand stimulated by the coffee investment.

5. CONCLUSIONS

Both paddy and export crops have strong linkages with other sectors of the Malagasy economy. A one FMG increase in the output of paddy, coffee, vanilla or cloves generates about two FMG in total GDP. But since paddy output can be increased at lower cost, investment in rehabilitating small irrigated rice perimeters generates 40–100% more GDP than a comparable investment in coffee production. Paddy also generates greater employment and a more equitable income distribution.

The source of that growth has important implications for other countries considering the merits of agriculture as an engine of economic growth. Consistent with other findings (Gibb, 1974; Haggblade and Hazell, 1989; Bell, Hazell and Slade, 1982), the Madagascar data indicate that consumption linkages account for 80% of the indirect growth propelled by agricultural investment. This suggests that future empirical research should focus on consumption patterns more carefully than on production budgets. Rather than focusing on farm management and input–output data, as many studies have in the past, empirical research in the future will need to concentrate on consumption data if we are to better understand the growth tradeoffs of alternative agricultural development strategies.

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