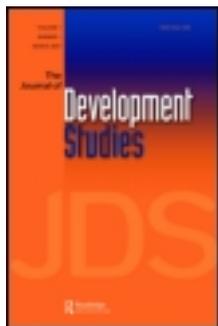


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The Journal of Development Studies

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/fjds20>

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Published online: 29 Mar 2010.

To cite this article: C. Arndt , H.T. Jensen , S. Robinson & F. Tarp (2000) Marketing Margins and Agricultural Technology in Mozambique, The Journal of Development Studies, 37:1, 121-137, DOI: [10.1080/713600061](https://doi.org/10.1080/713600061)

To link to this article: <http://dx.doi.org/10.1080/713600061>

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Marketing Margins and Agricultural Technology in Mozambique

CHANNING ARNDT, HENNING TARP JENSEN,
SHERMAN ROBINSON and FINN TARP

Improvements in agricultural productivity and reductions in marketing costs in Mozambique are analysed using a computable general equilibrium (CGE) model. The model incorporates detailed marketing margins and separates household demand for marketed and home-produced goods. Individual simulations of improved agricultural technology and lower marketing margins yield welfare gains across the economy. In addition, a combined scenario reveals significant synergy effects, as gains exceed the sum of gains from the individual scenarios. Relative welfare improvements are higher for poor rural households, while factor returns increase in roughly equal proportions, an attractive feature when assessing the political feasibility of policy initiatives.

I. INTRODUCTION

Widespread poverty is characteristic of rural areas in Mozambique where the vast majority of the population lives and where much of the economy's economic activity takes place. Mozambique has only recently recovered from the devastating effects inflicted by the war of the 1980s and early 1990s, and the economic infrastructure is extremely underdeveloped. In this environment, improving the marketing infrastructure and agricultural production technologies are critical challenges in promoting increased commercialisation, growth and poverty alleviation. Furthermore, agricultural technology and marketing improvements are likely to interact.

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The Journal of Development Studies, Vol.37, No.1, October 2000, pp.121-137
PUBLISHED BY FRANK CASS, LONDON

The limited market access of poor, small-scale farmers makes it difficult for them to purchase intermediate inputs like improved seed and simple investment goods like tools for cultivation, which could increase the productivity of their farming methods.

This article presents a quantitative assessment of the potential benefits from increases in the productivity of the agricultural sector and improvements to marketing networks. The analysis is based on a computable general equilibrium (CGE) model designed to capture important structural features of Mozambique. The model explicitly incorporates separate marketing costs for imports, exports, and domestic sales. Agriculture is disaggregated into eight sub-sectors. Household demand is split between marketed goods and home-consumption of own production, valued at production cost rather than market prices.

The model is based on a recent Social Accounting Matrix (SAM) for Mozambique, an aggregate version of which is presented in the Appendix [Arndt, Cruz, Jensen, Robinson and Tarp, 1998]. All CGE model equations are available in Arndt, Jensen, Robinson and Tarp [1999]. Some of the CGE model elasticity parameters were estimated using a new maximum entropy estimation approach that uses scarce information efficiently in a data-poor environment [Arndt, Robinson and Tarp, 1999].

The SAM data show that marketing margins for some sectors in Mozambique are as high as three times the producer price in 1995, and they are especially large for primary agricultural production. These marketing costs represent wedges between producer and purchaser prices, and partly explain why more than half of agricultural production remains non-marketed. Since the vast majority of the Mozambican population relies on agricultural production for their livelihood, there is potential for very large income gains through improved market integration in rural areas. One would expect synergy between a poverty-reducing strategy of increasing agricultural productivity combined with parallel improvements in the marketing infrastructure.

The country background of Mozambique is set out in section II. The SAM data base and the CGE model are described in section III, followed by a presentation of the simulation results in section IV. Section V concludes.

II. COUNTRY BACKGROUND¹

Mozambique has recently started recovering from war, regional conflict, and dramatic changes in the dominating political ideology. Emerging out of colonialism in 1974, the newly independent country initially opted for a command-type economic system. It was soon recognised that this approach would not be successful. However, attempts at economic reform could not

withstand the vicious war and destruction fuelled by South Africa from the early 1980s, and economic collapse became inevitable in 1986. Much of the economic and social infrastructure was destroyed by war, and large parts of the rural agricultural areas were effectively cut off from the rest of the economy. In addition, many rural people were driven away from their homes to seek refuge in safer urban areas and neighbouring countries. Following the peace agreement in 1992 and the first free general elections in 1994, there was a massive return of displaced people to rural agricultural areas. This has played an important role in the recovery of aggregate agricultural production during recent years.

Nevertheless, production technologies employed by most farmers remain rudimentary and the quality of inputs is poor. Little was done during colonial times to develop peasant agriculture, and lack of support to the smallholder sector has been a distinct shortcoming until recently. Intermediate inputs account for less than 13 per cent of total costs in agriculture, while value added accounts for more than 87 per cent. In addition, almost 90 per cent of total value added in agriculture is generated by labour inputs (not tabulated). There are significant possibilities for shifting to better production technologies through improved seed varieties and other inputs, and through improved farming practices [Bay, 1998].

While the many structural impediments facing Mozambican peasants and the low productivity of the agricultural sector remain to be addressed, market liberalisation efforts have been effectively pursued in the past decade. Following the introduction of an Economic and Social Reconstruction Programme in 1987, substantial economic decentralisation has occurred. In particular, all domestic and external prices have been freed up and the centralised marketing system for agricultural crops has been effectively dismantled. This strategy of market deregulation has not, however, significantly transformed agricultural production. Agricultural commercialisation remains at very low levels, and recent high agricultural growth rates may be mainly attributable to good rains and war recovery.

A key problem limiting the impact of market reforms and the potential benefits of better agricultural technology is that many farmers do not have market access. Missing markets are widespread, and transactions costs are very high. This reflects the thinly populated and very spread out nature of the country in combination with the poorly developed state of the domestic marketing infrastructure. There are only around 20 people per sq. km in the country which extends for more than 1,500 km from South Africa in the South to Tanzania in the North. Moreover, at Independence in 1974 the colonial marketing system broke down completely, and the rural population found themselves without access to even rudimentary networks for the distribution of goods and marketing of output. Only limited progress has been made since then.

The east-west, international-trade-oriented, transport corridors which played a critical role during the colonial period have been reestablished and investment programmes for the further development of port facilities as well as roads running alongside the rail lines have been outlined. In contrast, the major task of reestablishing the road networks connecting the different regions of Mozambique on a north-south axis has been coming along slowly. Some progress has been made regarding the extension of primary and secondary road networks and this has been accompanied by some integration of trading activities between different parts of the country. Despite these efforts, bringing the different regions into one integrated domestic economy, linking rural production areas with urban consumption centres through the establishment of country-wide transport, storage, and communication facilities, remains to be achieved. Similarly, while marketing is now mainly in private hands the number of traders is low, particularly in the Northern provinces. The extension service is poorly developed, and access to credit and other services for poor farmers hardly exists.

The limited degree of integration of rural areas into the rest of the economy can be seen from the high level of home consumption of agricultural production. Home consumption accounts for 65 per cent of total agricultural production valued at producer prices (that is, excluding marketing margins and consumption taxes) and represents about 23 per cent of total household consumption of commodities. It is clear that a large part of home-consumed production is grown out of safety-first considerations. Moreover, Mozambique is normally hit by at least one major natural disaster in the form of flooding or massive drought every seven years [*Rojas and Amade, 1997*]. The food-security motive is likely to be particularly important for the production of the drought-resistant staple crop cassava, which has, as shown in Table 1, the largest production value among all agricultural activities. Nevertheless, for a number of other crops, such as maize, vegetables, and raw cashew, the poor marketing system is, in combination with the generally high transactions costs, a key determinant for the high shares of home-consumed production.

Since the cessation of hostilities, government priorities have shifted towards extending domestic road networks and other infrastructure. The initiatives include development of market information systems, improved telecommunications systems, improved functioning of ports, and extension of domestic road networks. Investments in marketing infrastructure have been and continue to be undertaken with the goal of significantly reducing marketing costs, and thereby lowering barriers to marketing participation for rural inhabitants. It is clear however that much more can be done on for example the secondary and tertiary road networks. While the particular history of Mozambique influences the size of marketing margins, the

country is nevertheless illustrative for much of rural Africa where transactions costs are much higher than in any other regions of the World and arguably the major constraint to future growth and development.

III. DATA AND MODELLING FRAMEWORK

The SAM employed for this analysis was constructed on the basis of a new set of national accounts compiled by the National Institute of Statistics (NIS) in accordance with the United Nations standards for national accounting.² The NIS national account figures diverge from the official data compiled by the National Department of Planning (NDP). The collection of data by the NDP is based on questionable estimation and cross-checking procedures [Johnson, 1995]. More specifically, the NDP accounts rely heavily on data from technical ministries and public enterprises and do not, for example, capture activities in the services sector very well. In contrast, the NIS data are based on a variety of surveys and adjustments are made for items which go unnoticed in the NDP approach.

The SAM was developed with the specific purpose of establishing a comprehensive data base with a detailed picture of the agricultural sector. The data set includes 40 production activities, among which there are 12 primary agricultural sectors and two agricultural processing sectors.³ A special activity is included to take account of the costs of commercial services related to the marketing of imports, exports, and domestically marketed production. Since commercial services are used to market output, the cost of these services represents a wedge between producer and purchaser prices. These margins, together with consumption taxes, represent the differences in the value of non-marketed goods at the activity level and marketed goods at the commodity level.

Factors of production include agricultural labour, non-agricultural labour, and capital. Land is considered abundant in most circumstances, and, since no data on returns to land are available, returns to land is implicitly accounted for as returns to capital. Except for some minor factor and enterprise tax payments, the main shares of factor incomes are passed on to households. There are two household sub-categories, urban and rural. Agricultural labour income is allocated between rural and urban households, with approximately 82 per cent to the former and 18 per cent to the latter, while non-agricultural labour income is allocated with 44 per cent to the former and 56 per cent to the latter. Poverty-alleviation initiatives directed at poor rural households can have a major effect if they increase labour income in general and target agricultural labour income in particular. In contrast, around 80 per cent of capital income goes to urban households, while only 20 per cent goes to rural households.

As the macroeconomic SAM in Table A2 shows, the expenditure patterns of the two household types are different, especially regarding home consumption, which makes up 44 per cent of rural household consumption but only five per cent of urban household consumption.⁴ The individual savings rates of the two household categories differ greatly; the urban rate is slightly more than 12 per cent while the rural savings rate is less than four per cent. Aggregate household savings are small, and, combined with a comparably low level of enterprise savings, the SAM indicates very small overall domestic savings. Government and private investment rely to a large extent on funding from foreign capital inflows with the sum of these two amounting to about one third of GDP.⁵

Marketing margins are based on the distinction between factory/farm gate prices on the one hand and purchaser prices on the other, reflecting storage, and marketing costs.⁶ The marketing margins were introduced into the CGE model through commercial service coefficients. This treatment amounts to assuming that each production good from a given production sector requires a fixed amount of marketing services in order to reach the market. In essence, they are input-output coefficients relating to the demand for commerce services required to move goods from producer to market. A single production activity provides the marketing services associated with imported, exported, and domestically marketed commodities.

The model formulation incorporates home consumption and marketed consumption through a linear expenditure system (LES). In this formulation, the marginal budget shares of marketed and non-marketed goods are fixed and each commodity has an associated minimum consumption level below which physical consumption cannot fall. Home consumed goods are, as already noted, valued at producer prices while marketed goods are valued at purchaser prices, including consumption taxes and marketing margins.

Labour supplies are fixed in the agricultural and non-agricultural sectors.⁷ As a result, wage rates are allowed to diverge between agricultural and non-agricultural labour. The model assumes full employment of available resources in the sense that overall factor supplies are kept fixed, while average factor returns vary to clear the separate factor markets. In the macro closure, government recurrent and investment expenditure are constant shares of aggregate absorption. Foreign capital inflows and savings rates of the different agents and institutions are kept fixed, so private investment is set by available savings. A freely varying real exchange rate equilibrates the external account. The value of imports exceeded the value of exports by a factor of 2.6 in 1995 (see Table A2). The excess of imports over exports was financed by foreign capital inflows, including large aid

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transfers. Finally, the consumer price index, including both marketed and home consumption, defines the numeraire in the model.

The model employs behavioural parameters available in Arndt, Robinson and Tarp [1999]. They produced estimates of minimum consumption levels for the LES specification of home and marketed consumption, and provided import substitution (CES) and export transformation (CET) elasticities for some aggregate commodity categories. For the purposes of the current simulations, the parameter estimates for the aggregate sectors were allocated among the more disaggregate sectors according to the particular aggregation chosen for the estimation exercise.

Table 1 provides additional information on the structure of the economy with emphasis on the production side. Grains have a high import share at 42.4 per cent. Other export crops have a high export share but a low share

TABLE 1
PRODUCTION STRUCTURE OF THE ECONOMY (per cent)

	Value Added	Exports	Imports	E/X	M/Q	Domestic Margin
Grain	5.7	0.2	4.0	0.8	42.4	27.4
Cassava	6.1	0.0	0.0	0.0	0.0	302.5
Raw Cashew	0.7	0.2	0.0	5.7	0.0	44.2
Raw Cotton	0.3	0.0	0.0	0.0	0.0	0.0
Other Export Crops	0.6	2.4	0.1	54.8	8.2	52.3
Basic Food Crops	6.8	0.3	1.6	0.9	10.9	111.2
Livestock	2.4	0.1	0.2	0.4	7.4	13.6
Forestry	3.3	1.7	0.0	9.3	0.2	14.9
Fishery	4.3	21.3	0.0	71.5	0.0	44.3
Mining	0.5	2.6	0.3	77.6	41.1	8.9
Food Processing	2.8	8.6	18.8	13.7	26.9	58.7
Textiles and Leather	1.0	6.8	2.8	67.8	39.5	36.2
Wood	0.5	1.2	0.6	21.7	19.9	26.0
Paper and Packaging	0.1	0.0	1.4	1.2	40.7	37.4
Fuels and Chemicals	0.5	1.1	18.5	15.4	54.2	46.7
Non-Metals	0.3	0.0	3.1	0.7	39.9	31.6
Metals	0.2	0.7	1.4	41.3	56.2	23.4
Machinery and Equipment	0.2	0.6	28.7	17.5	76.2	14.0
Electricity and Water	0.6	0.0	1.4	0.0	21.0	0.0
Construction	12.6	0.0	0.0	0.0	0.0	0.0
Transport and Communication	6.8	23.9	4.8	21.7	12.3	0.0
Banking and Insurance	7.2	0.9	0.2	2.2	1.2	0.0
Dwellings	1.1	0.0	0.0	0.0	0.0	0.0
Public Administration	3.7	0.0	0.0	0.0	0.0	0.0
Education	1.7	0.0	0.0	0.0	0.0	0.0
Health	0.6	0.0	0.0	0.0	0.0	0.0
Other Services	7.5	27.3	12.0	39.5	40.0	0.0
Commerce	21.9	0.0	0.0	0.0	NA	NA
Total/Average	100.0	100.0	100.0	12.5	26.9	11.9

of value added. Overall, trade shares in primary agriculture are low with a bias towards imports. Agricultural value added amounts to 25.9 per cent of total value added. Domestic margins tend to be higher in primary agriculture but are also quite high in food processing and textiles and leather. Finally, the commerce sector, which provides commercial services, represents 21.9 per cent of value added.

IV. SIMULATION RESULTS

In the model, implementation of agricultural technology improvements, through Hicks neutral productivity increases, is straightforward and in line with our focus on the productivity enhancing importance of introducing better quality inputs such as improved seed in combination with better farming practices. Reductions in marketing margins are modelled through scaling down the commercial service coefficients discussed in detail in section III.⁸ In the analysis, investment expenditures associated with improved technology and marketing infrastructure are ignored. This treatment amounts to assuming that these investments are undertaken prior to the current simulations, and the analysis makes no attempt to quantify the costs of realising the policy initiatives studied here – the focus is on benefits.

TABLE 2
SCENARIOS

Scenario	Description
Base run	Base SAM data set for 1995
Scen. 1	Increase in productivity by 30 per cent for all agricultural products
Scen. 2	Reduction of marketing margins for all goods by 15 per cent
Scen. 3	Scen. 1 & Scen. 2 combined

The simulations include a uniform 30 per cent improvement in productivity across agricultural sectors and a 15 per cent reduction in the commercial service coefficients for imported, exported, and domestically produced and marketed commodities. The simulations are summarised in Table 2. Achieving agricultural productivity growth of the order of 30 per cent in Mozambique is probably feasible over a reasonably short time span due to the rudimentary nature of current agricultural production practices. Reductions in marketing margins of the order of 15 per cent are also feasible, given the scope for improving the marketing system after the devastation caused by the war. While a 15 per cent gain may come relatively cheaply, large investments in marketing infrastructure will likely be needed to achieve significant further declines in marketing costs.

TABLE 3
MACROECONOMIC INDICATORS AND PRICES

	Base Run	Per cent deviation from base values		
		Scen. 1	Scen. 2	Scen. 3
Real GDP (10 ¹¹ Meticais)	172.1	6.8	5.0	12.2
Absorption (10 ¹¹ Meticais)	223.3	6.8	4.9	12.9
Value added price index	100	1.4	5.3	7.3
Export producer price index	100	4.8	5.3	10.3
Import purchaser price index	100	6.2	0.2	6.4
Cost of living index for rurals	100	-5.9	2.8	-3.1
Cost of living index for urbans	100	3.7	-0.8	3.0
Real exchange rate index	100	3.3	-0.1	2.8
Ag. terms of trade: Producer	100	-24.9	7.4	-17.8
Ag. terms of trade: Value added	100	-29.4	7.1	-22.4
Ag. terms of trade: Export	100	-1.8	6.7	5.1
Ag. terms of trade: Import	100	0.2	-0.6	-0.5
Price of commerce	1	9.8	2.2	12.7

Macroeconomic indicators and price measures for the different scenarios are given in Table 3. The productivity increase of 30 per cent for all agricultural products (scenario 1) yields an aggregate welfare improvement of 6.8 per cent (the change in absorption deflated by the aggregate consumer price index). The productivity increase raises output and lowers relative prices significantly in the agricultural sector. The price decline moderates the increase in aggregate rural income and transmits much of the gain to the urban sector. Since agriculture has very high trade margins (Table 1), the greater output generates a significant increase in demand for commerce services, driving up their price. The result is that the gap between supplier and market prices for exports and imports rises. Exports decrease more than imports in real terms, and a mild depreciation of the real exchange rate (3.3 per cent) restores equilibrium in the trade balance.⁹

The 15 per cent reduction in marketing margins (scenario 2) leads to a 4.9 per cent increase in welfare. The decrease in marketing margins narrows the spread between producer and purchaser prices, raising the former and lowering the latter. Both producers and consumers gain and the gains are spread evenly across the economy, as further discussed below. The impact on trade is the converse of scenario 1: exports gain slightly more than imports and there is a slight appreciation of the real exchange rate (0.1 per cent) to restore equilibrium.

Combining the first two scenarios (scenario 3), there is evidence supporting the hypothesis that prior improvements in marketing infrastructure allow the economy to reap greater benefits from improvements in agricultural productivity. The increase in welfare in scenario 3 is about ten per cent greater than the sum of the effects of

scenarios 1 and 2 run separately. The reduction in marketing margins diminishes the decrease in agricultural producer prices that would otherwise follow from the significant expansion of supply as agricultural productivity rises. Improvements to the marketing network ensure that increased production following agricultural productivity improvements benefits both farmers and consumers more, as the gap between producer and purchaser prices is narrowed.

The relative changes in the cost of living indices for rural and urban households differ across the scenarios.¹⁰ Gains in agricultural productivity (scenario 1) lower agricultural prices significantly, and since rural households allocate a larger share of their budget to agricultural goods (Table A2), their cost of living index falls relative to that of urban households. In contrast, lower marketing margins (scenario 2) increase producer prices in agriculture and increase the relative cost of living for rural households with significant home consumption. The cost of living effects of the combined scenario are very close to the sum of the two separate scenarios.

Table 3 also shows that increased agricultural productivity, which increases output, worsens the agricultural terms of trade. Decreased marketing costs improve the agricultural terms of trade by increasing the producer price of agriculture more than that of non-agriculture. In the combined scenario (scenario 3), however, the agricultural productivity effect is stronger and the terms of trade move significantly against agriculture. From a policy perspective, the combined scenario is attractive because the adverse terms of trade effect of increasing agricultural productivity is significantly ameliorated.

Table 4 presents the welfare impact of the scenarios in terms of changes in household consumption, measured by equivalent variation from the base.¹¹ Given that average household savings rates are assumed fixed in the model, these measures provide a good indicator of the distributional impact of the scenarios between rural and urban households. Rural households are the main gainers from increased agricultural productivity. The significant increases in agricultural production are accompanied by substantial decreases in producer prices, so rural household income increases only

TABLE 4
EQUIVALENT VARIATION ON CONSUMPTION

	Base Run	Per cent of base consumption		
		Scen. 1	Scen. 2	Scen. 3
Urban	0	5.2	4.7	10.5
Rural	0	12.3	4.6	18.2
Total	0	8.5	4.6	14.1

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slightly. Yet, rural households benefit significantly on the consumption side since they allocate a relatively large share of their budgets to agricultural goods.

Urban and rural households gain roughly the same per cent increase from lowering trade margins (scenario 2). As noted above, narrowing the gap between producer and purchaser prices spreads the gains across the economy. Again, the results for scenario 3 indicate a synergy between the two effects – the gain in welfare for both urban and rural households from scenario 3 is greater than the sum of the gains from the two separate scenarios.

TABLE 5
COMPONENTS OF REAL GDP (10¹¹ Meticais)

	Base Run	Per cent deviation from base values		
		Scen. 1	Scen. 2	Scen. 3
Exports	32.7	-2.2	9.4	8.0
Imports	83.9	-0.8	3.7	3.1
Home Consumption	32.6	24.3	-0.8	22.5
Marketed Consumption	106.8	4.4	6.4	11.8
Recurrent Govt.	16.8	-0.7	2.7	2.4
Non-Govt. Organizations	5.5	-2.5	1.5	-1.5
Investment	61.5	-1.1	2.4	1.2
Real GDP	172.1	6.8	5.0	12.2

Table 5 presents data on the effect of the scenarios on components of real GDP. There are significant interactions between agricultural productivity increases and marketing margin reductions for most of the final demand components of real GDP – the results from scenario 3 generally do not equal the sum of the other two scenarios. For example, increased agricultural productivity (scenario 1) leads to significant import substitution in grains, which has a high import share (Table 1),¹² and hence aggregate exports decline because less export earnings are required to achieve the fixed trade balance. Lowering trade margins, on the other hand, narrows the gap between border prices and domestic market prices for both imports and exports, and leads to increases in both. The trade-creating effect which dominates in the combined scenario, indicates a significant interaction between increasing the supply of traded goods and lowering the costs of moving these goods to and from international markets.¹³

Agricultural productivity increases have a major effect on the level of home-consumed production. Increased agricultural production decreases producer prices, which makes home consumption of agricultural goods more attractive. Moreover, the increase in the price of marketing services amplifies the gap between producer and purchaser prices, which further

TABLE 6
FACTOR PRICES

	Base Run	Per cent deviation from base values		
		Scen. 1	Scen. 2	Scen. 3
Labour	1	0.1	11.4	15.0
Non-Agricultural Labour	1	8.9	4.9	14.4
Capital	1	10.6	2.0	13.4

favours home consumption. Lowering marketing margins ameliorates the effect of the widening price gap – scenario 2 lowers home consumption – and provides incentives for a further switch towards marketed consumption in the combined scenario. However, the agricultural production effect on the consumption patterns still dominates in this case.

Table 6 shows the effects of the scenarios on returns to labour and capital. The increase in agricultural productivity leads to almost no change in the agricultural wage (it rises by 0.1 per cent). The decline in producer prices almost exactly offsets the effect of increased productivity as far as agricultural labour is concerned. In this scenario, some of the gains are transmitted through lower prices to the non-agricultural sectors. The wage of non-agricultural labour and the capital rental rate both rise significantly, but the significant increase in demand for capital intensive commercial services increases capital returns relative to wages.

Lower trade margins (scenario 2) increase all factor returns, but favour agricultural labour since the agricultural sectors have the highest trade margins (Tables A2 and 1). The combined scenario is notable in that it spreads the gains more evenly across the three factors, with all factors gaining more than the sum of the effects of the two separate scenarios. The synergy between increasing agricultural productivity and lowering trade margins in parallel yields returns to all factors that exceed the sum of the separate scenarios, with little change to the overall functional distribution of income. From a policy perspective, the results of these interactions are very desirable, since much political conflict is rooted in changes in the distribution of income among factors of production.

V. CONCLUSION

Mozambique is a large spread-out country with a big agricultural sector and significant potential for agricultural development, especially in the northern provinces. Yet, agricultural technology is rudimentary and the integration of rural areas with the rest of the economy has been limited. This is reflected in the high share of home consumption out of rural household own

production. In this environment of low productivity and high transactions costs there are enormous potential gains from improving agricultural productivity and lowering the costs of moving goods from producers to purchasers.

The results presented in this paper indicate that increasing agricultural productivity is an important priority for Mozambique, with large potential gains. However, increasing agricultural output in an environment of very high marketing costs leads to a significant fall in prices. These price declines transmit most of the gains in factor income to the non-agricultural sectors and factors of production. Rural households do, however, gain from greater availability of food and lower producer prices which lower the cost of home-consumed goods.

Lowering marketing costs decreases the gap between producer and purchaser prices in all markets. The gains are spread across the economy, but agriculture gains relatively more because its marketing margins are higher. The scenario is trade creating, both aggregate exports and imports grow, because the lower marketing margins increase the returns to producers supplying to export markets and lower the domestic market price to purchasers of imports. The consumption of marketed goods rises significantly, while home-consumption declines slightly.

The combined scenario reveals significant synergy between increasing agricultural productivity and lowering marketing costs in parallel. The welfare gains from the combined scenario are larger than the sum of the gains from the two separate scenarios. Lowering marketing costs somewhat ameliorates the worsening in the agricultural terms of trade caused by the increase in supply due to the increase in agricultural productivity. Both rural and urban households gain significantly as returns to all factors increase - agricultural and non-agricultural wages, and capital rentals. Compared to the separate scenarios, the combined scenario yields little change in the distribution of income across factors of production - the functional distribution. This result makes the combined scenario appealing from a policy perspective. It should cause a relatively low level of political strain, while providing relatively large increases to the welfare of poor rural households.

Due to the multiplicity of preconditions for a broadly based development process and the limited availability of government resources in Mozambique there is a clear need for prioritising among different policy initiatives. So far, government priorities have been directed towards increasing the efficiency of governance, and improving incentive structures and the quality of price signals in the economy. Following the introduction of democratic rule and the recent recovery of the economy to more normal levels, priorities seem to have shifted in favour of improvements in the

educational and health systems as well as extensions to the primary road network. This study shows that there are good reasons for redirecting resources towards improved agricultural productivity especially in small-scale farming, and continued initiatives to reduce marketing costs through improved infrastructure, including in particular investment in the secondary and tertiary road network. There are significant synergy effects between improved agricultural productivity and reduced marketing costs, and the synergy between the two raise the welfare of poor rural households while preserving the politically sensitive functional distribution of income.

final version received February 2000

NOTES

1. For further background see Arndt, Jensen and Tarp [2000a]. Data referred to in the text can, unless indicated otherwise, be derived from the SAM in the Appendix.
2. A thorough description of the features of the SAM can be found in Arndt, Jensen and Tarp [2000b] from which several of the data in what follows have been taken.
3. The 40 SAM activities were aggregated into 27 CGE activities, including eight primary agricultural and two agricultural processing sectors. The complete GAMS code for estimating SAM coefficients and the modelling exercise is available from the authors.
4. Since home consumption is valued at farm gate prices while marketed consumption is valued at consumer prices, it follows that the home consumption share of physical rural consumption is even higher than the 44 per cent in value terms.
5. The investment share derived from the SAM in Table A2 is slightly higher due to the inclusion of non-governmental organisation (NGO) expenditures in the capital rows and columns.
6. The price gap may reflect some degree of imperfect competition. In the SAM and the model, they are assumed to reflect real costs.
7. Simulations with a Constant Elasticity of Transformation specification between agricultural and non-agricultural labour supplies lead to the same conclusions.
8. The current experiments analyse the effects of reductions in the demand for marketing services following from investment in marketing infrastructure. The experiments do not take account of potential efficiency gains in the production of commercial services associated with improvements to the marketing infrastructure. The demand effect is assumed to dominate, at least initially, in the Mozambican context. Better infrastructure will make it possible to transport, for example, one ton of maize faster and with less input of man-hours and fuel, but the trucks carrying the cargo remain the same. In any case, efficiency gains in the provision of marketing services would yield similar qualitative results, reinforcing the conclusions derived from our analysis.
9. The real exchange rate is defined as the ratio between (i) an index composed of domestic exports and imports prices, and (ii) an index composed of domestically marketed and non-marketed goods prices.
10. The numeraire in this article is the cost of living index including urban and rural household consumption. Changes in the individual rural and urban indices are therefore relative to an average. Thus, when the cost of living of urban households drops, rural people must experience an opposite effect.
11. Equivalent variation measures the lump sum transfer that would make the household indifferent between the scenario and the base case plus the transfer.
12. This effect is likely to diminish as Mozambique becomes more self sufficient in food following economic recovery.

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13. Trade creation is of course very dependent on the ability of Mozambican exporters to penetrate export markets, highlighting that this is an important area for policy concern.

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APPENDIX

A MACROECONOMIC SOCIAL ACCOUNTING MATRIX FOR MOZAMBIQUE

A social accounting matrix (SAM) provides a snapshot of an economy at a point in time. A SAM can be very detailed, tracking information across an array of activities, commodities, factors, and institutions, or very aggregate with a simple depiction of the macroeconomic aggregates. Regardless of dimensions, it is important that a SAM be in balance; that is, that row sums equal column sums. A balanced SAM ensures that all of the basic macroeconomic identities are satisfied. Table A1 provides the labels and Table A2 provides the figures for a basic macroeconomic SAM for Mozambique for 1995 [Arndt, Cruz, Jensen, Robinson and Tarp, 1998]. From this basic macroeconomic SAM, one can read directly, or derive very simply, GDP, gross savings rates, the trade balance, the government deficit, net capital inflows, and the structure of demand. For example, to obtain GDP in market prices (172.1×10^{11} Meticaís), one simply sums the figures in the cells labelled 'value added', 'output taxes', and 'consumption taxes'. Row and column balance assures that GDP derived from the demand side will equal the sum of factor returns and indirect taxes.

The macroeconomic SAM presented in Table A2, and the microeconomic SAM upon which it is based, are in many ways quite standard. They generally follow the structure presented by Pyatt and Round [1985]. They differ from most existing SAMs in that home consumption is accounted for and marketing margins are carefully tracked. Also, relative to many SAMs for Africa, the microeconomic SAM contains substantial agricultural sector detail.

TABLE A1
LABELS OF THE MACROECONOMIC SOCIAL ACCOUNTING MATRIX

	1	2	3	4	5	6	7	8	9	10	11	12
1 Ag Activity							home consumption					
2 Non-Ag Activity												
3 Commerce												
4 Ag Commodity												
5 Non-Ag Commodity												
6 Value Added												
7 Urban Household												
8 Rural Household												
9 Recurrent Govt.												
10 Capital												
11 Rest of World												
12 Total												

marketed sales including exports

marketing margins

intermediate consumption

value added

output taxes

consumption taxes

imports

home consumption

marketed consumption

govt. commodity purchases

investment

exports

factor payments

factor taxes

retained earnings

income taxes

savings

govt. transfers

budget surplus

net remittances

net capital inflow (aid)

TABLE A2
MACROECONOMIC SOCIAL ACCOUNTING MATRIX (10¹¹ Metrics)

	1	2	3	4	5	6	7	8	9	10	11	12
1 Ag Activity				16.08			2.89	26.90				45.87
2 Non-Ag Activity					178.37		0.75	2.09				181.21
3 Commerce				11.54	37.89							49.43
4 Ag Commodity	1.50	12.07					11.55	6.92		0.09	1.60	33.74
5 Non-Ag Commodity	4.24	87.89	15.39				58.64	29.74	16.78	66.97	31.11	310.74
6 Value Added	40.32	81.35	34.08									155.75
7 Urban Household						83.70		1.06			1.83	86.60
8 Rural Household						66.89		0.27			1.63	68.78
9 Recurrent Govt.	-0.19	-0.10	-0.04	1.11	15.59	3.68	2.00	0.49				22.53
10 Capital						1.49	10.78	2.65	4.43		47.73	67.06
11 Rest of World				5.01	78.89							83.90
12 Total	45.87	181.21	49.43	33.74	310.74	155.75	86.60	68.78	22.53	67.06	83.90	