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# On the Choice of Appropriate Development Strategy

## Insights from CGE Modelling of the Mozambican Economy

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**Abstract**

This paper makes use of a 1997 computable general equilibrium (CGE) model to analyse three potential strategies that Mozambique can pursue unilaterally with a view to initiating a sustainable development process. They include (i) an agriculture-first strategy, (ii) an agricultural-development led industrialization (ADLI) strategy, and (iii) a primary-sector export-oriented strategy. The ADLI strategy dominates the other development strategies since important synergy effects in aggregate welfare arise from including key agro-industry sectors into the agriculture-first development strategy. Moreover, the ADLI strategy can be designed so it has a relatively strong impact on the welfare of the poorest poverty-stricken households, and still maintain the politically sensitive factorial distribution of income.

Keywords: CGE modelling, development strategy, Mozambique

JEL classification: D58, O11



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## 1. Introduction

Mozambique has undergone substantial economic and political changes in the last decade. The civil war of the eighties came to a halt in the early nineties, with the peace accord between Frelimo and Renamo in 1992 and the first democratic elections in 1994. Following the end to hostilities Mozambique has been able to make a relatively quick economic recovery, posting high economic growth rates for most of the late nineties. In spite of the relatively strong recent path of economic growth, Mozambique remains one of the poorest countries in the world, and poverty remains widespread. Moreover, the economy has used up the potential for growth due to recovery. Attention has now turned towards the design of a development strategy for Mozambique that pays attention to both growth and poverty alleviation.

Due to the legacies of the past, there is only a limited number of ways in which Mozambique can pursue economic development in the short- to medium-term. While industrial companies are heavily concentrated in the southern province of Maputo, the vast majority of poverty-stricken households are located in rural areas, in the central and northern parts of the country. Moreover, the vast majority of poor rural households are subsistence-farming households, with limited access to markets. The marketing infrastructure is strongly underdeveloped, especially along the north-south axis of the country. It follows that agricultural development must form an integral part of any sustainable development strategy in Mozambique. Based on this insight, the current paper uses a computable general equilibrium (CGE) model and a recently developed 1997 social accounting matrix (SAM) to analyse the most appropriate strategy for Mozambique to promote economic development. The analyses will focus on measuring the distributional consequences of different development strategies that Mozambique can pursue unilaterally. Moreover, the analyses will show whether there are additional welfare benefits to be obtained, from embedding agricultural development within a more broadly defined development strategy, given the current structure of the Mozambican economy.

The features of the model mimic those of the CGE model in Arndt, Jensen and Tarp (2000). In particular, the model accounts for marketing margins associated with imports, exports and domestic marketing of domestically produced goods. Moreover, the model includes 12 different households and accounts for home consumption of own production. Households are disaggregated on a regional basis into northern, central, and southern households according to their location in rural and urban areas, and according to whether their main occupation is agricultural or non-agricultural. The model is well suited for distributional analyses since it takes important regional differences in income and expenditure patterns into account.

Three sets of experiments are carried out and analysed in this paper, reflecting three different possible approaches to initiating a sustainable development process in Mozambique. The basic strategy is an agriculture-first strategy, focussed on improving primary production technologies and improving marketing systems. The second strategy is an agricultural-development led industrialization strategy, which adds improved small-scale agro-industrial production technologies on top of the basic agriculture-first strategy. Finally, the third strategy, called primary sector export-oriented development, is based on a general focus on export markets, including increased agricultural productivity combined with increased production quality of export crops. It follows that each strategy has agricultural development at its core. Nevertheless, each strategy includes individual elements that allow for enhanced effectiveness of the core agricultural development strategy. The construction of the 1997 SAM and the features of the CGE model are set out in Section 2, while the three sets of experiments are analysed in Section 3. Section 4 concludes.

## 2. Construction of a 1997 SAM and calibration of a CGE model

In modern economy-wide studies, social accounting matrices (SAMs) and computable general equilibrium (CGE) models that take account of supply and demand behaviour and the importance of relative prices have become important analytical workhorses. The SAM is a comprehensive, disaggregated, consistent and complete data system that captures the many interdependencies that exist within a socio-economic system. Moreover, the SAM/CGE approach can be used as a conceptual framework to explore the impact of different development strategies (including changing export possibilities, certain categories of government expenditures, and investment) on the whole interdependent socio-economic system, including the structure of production, and factorial and income distributions. As such, the building of SAMs and the calibration of a variety of applied general equilibrium models have risen in importance in the development literature. It is this line of work that is pursued in the present paper in the context of Mozambique.

The dataset underlying the analyses in this paper is a Mozambican social accounting matrix (SAM) for 1997 (Jensen and Tarp, 2000). They applied a maximum entropy balancing procedure to create a consistent 1997 SAM dataset for Mozambique. Their procedure paid specific attention to the major data problems in the activities columns, i.e. in the input-output table. Accordingly, they employed a procedure, introduced in Arndt et al. (1998) to break the SAM balancing down into two parts: (i) the initial balancing of the activities columns, and (ii) the subsequent balancing of the whole SAM. In this way, the uncertainties surrounding the input-output part of the SAM were contained instead of being spread around to other parts of the SAM.

The most recent data available on the input-output structure of the Mozambican economy stem from the 1995 Mozambican SAM, established in Arndt et al. (1998). Accordingly, the input-output matrix from the 1995 SAM was used as prior for creating the 1997 SAM. Nevertheless, due to the possible inconsistencies between the 1995 input-output matrix and the 1997 national accounts totals on inputs and outputs, it was decided to use the two-step balancing procedure described above. Accordingly, the 1997 SAM was balanced through the initial balancing of the activities columns followed by the balancing of the full SAM table.

The dimensions of the 1997 SAM are set out in Table 2.1. The SAM includes separate production activities and retail commodities accounts. This has two particular advantages. First, it makes it possible to account separately for goods at the farm-gate and market levels, and to account separately for marketing margin wedges between producer/border prices and domestic market prices. Second, it allows for the proper inclusion of home consumption of own production in the production activities row. This is an appropriate way of accounting for this consumption item since home-consumed goods do not pass through the retail marketing chain.

Table 2.1

Labels of the macroeconomic social accounting matrix for Mozambique (MACSAM)

| Receipts | Expenditures<br>1.Activities | 2.Commodities | 3.Factors | 4.Enterprises | 5.Households | 6.Recurrent Govt. | 7.Indirect Taxes | 8.Govt. Invest. | 9.NGO | 10.Capital | 11.Rest of World | 12.Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Activities | | Marketed Production | | | Home Consumption | | | | | | | Total Sales |
| 2. Commodities | Intermediate Consumption | | | | Private Consump. of Marketed Commodities | Govt. Consumption | Export Subsidies | Govt. Invest.* | NGO Consump. | Non-Govt. Invest. | Exports(FOB) | Total Marketed Commodities |
| 3. Factors | Value Added at Factor Cost | | | | | | | | | | | Value Added at Factor Cost |
| 4. Enterprises | | | Gross Profits | | | Subsidies | | | | | | Enterprise Income |
| 5. Households | | | Wages incl. Mixed Income | Distributed Profits | | Social Security | | | | | Net Transfers by Workers | Household Income |
| 6. Recurrent Govt. | | Consump. Taxes | Factor Taxes | Enterprise Taxes | Income Taxes | | Indirect Tax Revenue to Govt. | | | | | Govt. Recurrent Receipts |
| 7. Indirect Taxes | Output Taxes | Import Tariffs | | | | | | | | | | Tariffs plus Output Taxes |
| 8. Govt. Invest. | | | | | | | | | | | Aid in Govt. Budget | Govt. Aid Receipts |
| 9. NGO | | | | | | | | | | | Aid in NGO budget | NGO Aid Receipts |
| 10. Capital | | | | Retained Earnings | Household Savings | Govt. Savings 1 | | Govt. Savings 2 | | | Net Capital Inflow** | Total Savings |
| 11. Rest of World | | Imports(CIF) | | | | | | | | | | Imports |
| 12. Total | Total Payments | Total Commodity Supply | Value Added at Factor Cost | Enterprise Expenditure | Household Income Allocated | Tax Financed Govt. Expenditure | Indirect Tax Receipts less Export Subsidies | Govt. Invest.* | NGO Consump. | Non-Govt. Invest. | Foreign Exchange Available | |

Source: see text.

Notes: *Includes extraordinary items (>*programas especiais=*) sometimes registered as recurrent expenditure. **Amounting, in principle, to the sum of the balance of payments entries not appearing elsewhere in row or column 9.

Table 2.2
Balanced 1997 macroeconomic SAM for Mozambique (figures in 100 bio. Mt.)

| | *ACT* | *COM* | *FAC* | *ENT* | *HOU* | *GRE* | *ITX* | *GIN* | *NGO* | *CAP* | *ROW* | *TOT* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *ACT* | | 546.5 | | | 85.8 | | | | | | | 632.3 |
| *COM* | 258.1 | | | | 275.8 | 37.7 | | 43.6 | 3.6 | 29.8 | 44.1 | 692.8 |
| *FAC* | 374.6 | | | | | | | | | | | 374.6 |
| *ENT* | | | 93.3 | | | | | | | | | 93.3 |
| *HOU* | | | 278.6 | 87.2 | | 3.7 | | | | | 4.6 | 374.1 |
| *GRE* | | 23.9 | 2.7 | 4.6 | 5.0 | | 8.1 | | | | | 44.2 |
| *ITX* | -0.4 | 8.5 | | | | | | | | | | 8.1 |
| *GIN* | | | | | | | | | | | 23.7 | 23.7 |
| *NGO* | | | | | | | | | | | 3.6 | 3.6 |
| *CAP* | | | | 1.5 | 7.5 | 2.8 | | -19.9 | | | 37.9 | 29.8 |
| *ROW* | | 113.9 | | | | | | | | | | 113.9 |
| *TOT* | 632.3 | 692.8 | 374.6 | 93.3 | 374.1 | 44.2 | 8.1 | 23.7 | 3.6 | 29.8 | 113.9 | |

Source: see text.

In addition to the activities and commodities accounts, the private income flow through the economy is described by the Factor, Enterprises and Households accounts. The factor account transfers income from the production activities to enterprises and households. In addition, enterprises distribute profits to the households, which own them, except for some minor retained earnings. Household earnings are mainly allocated towards consumption of own production, consumption of marketed retail commodities and savings for investment purposes. The institutional accounts also include accounts for the recurrent government budget and indirect taxes, the government investment budget, the NGO sector, and a private capital account that ensures balance between private savings and investment. The rest of the world account closes the SAM by ensuring consistency between the trade balance and foreign capital flows.

The SAM data-set was mainly developed from 1997 national accounts data, (INE,1999a), 1997 balance of payments data (BM, 1999), and official 1997 government budget data, (INE, 1999b). Moreover, summary tables from a 1996 Mozambican household survey, (INE, 1999c), were relied on to disaggregate the household sector. The disaggregation of factors in the SAM is based on a distinction between agricultural and non-agricultural labour, and capital. Moreover, non-agricultural labour income was disaggregated into skilled and unskilled labour income categories, based on household survey data on income shares for educational groupings. Furthermore, 1997 national accounts data on rural and urban households were disaggregated into 12 households based on the information from the household survey. The household disaggregation distinguishes between urban and rural households, between agriculturally and non-agriculturally dependent households, and between households located in the northern, central and southern parts of Mozambique.

The distinction between regional households is particularly important, since large differences in economic structure exist between the regions of Mozambique. While most industrial production is located around the capital, Maputo, in the southern region, agricultural production is mainly located in the more fertile central and northern regions. Due to poor marketing infrastructure and differences in household income levels, these differences are reflected in household consumption patterns. Income and expenditure patterns differ greatly between households located in different regions of the country. Accordingly, important distributional aspects of the Mozambican economic structure are captured in the current 1997 SAM.

A CGE model was subsequently established and calibrated to the SAM data set. The model has the same structural features as the CGE model presented in Arndt, Jensen and Tarp (2000). The model is based on the standard 1-2-3 model, including one country, two factors and three goods. Specifically, the standard model includes CES/CET functional relationships for aggregation and transformation of goods, Cobb-Douglass production functions for value added, and a Linear Expenditure System (LES) for household demand. Moreover, the model accounts for marketing margins associated with imports, exports and domestic marketing of domestically produced goods, and for home consumption of own production, for each of the 12 households. As such, the current model takes account of important interactions between marketing margins and home consumption of own production. Finally, the supply of production factors, including agricultural as well as skilled and unskilled non-agricultural labour, is fixed as part of the model closure. Analyses in this paper are short- to medium-term in nature.

While the structure of the model applied here is similar to the model in Arndt, Jensen and Tarp (2000), the dimensions are different. First, the agricultural production sectors are disaggregated into three regions, including a southern, central and northern region. In addition, the household sector is disaggregated into twelve sectors, accounting for (i) rural and urban location, (ii) agricultural and non-agricultural primary occupation, and (iii) location in the northern, central and southern regions of Mozambique. The household disaggregation is the sine qua non for carrying out the (distributional) analyses of the development strategies presented in this paper.

## 3. Experiments

### 3.1 Agricultural technology and marketing margins

The experiments carried out here, and which may be characterized as an agriculture-first strategy of development, extend the simulations presented in Arndt et al. (2000). Those simulations were made with a CGE model based on a 1995 Mozambican SAM. The 1995 SAM was characterized by a high level of aggregation on the household side. This meant that distributional issues were analysed at a very aggregate level, i.e. between rural and urban households. In contrast, the 1997 SAM utilised the 1996 household survey to disaggregate the household sector into 12 households. The current model is therefore better equipped for analysing the distributional issues, which are in focus in what follows.

Table 3.1
Simulations

| Simulations | Description |
|---|---|
| Base Run | Base 1997 data |
| Exp. 1 | 30% increase in agricultural productivity |
| Exp. 2 | 15% reduction in marketing margins |
| Exp. 3 | Experiments 1 + 2 |

Source: see text.

The agriculture-first simulation exercises include a base run and three different experiments as set out in Table 3.1. The base run solves the calibrated model for quantities and prices, which can be derived directly from the SAM. While experiment 1 is meant to measure the effects of a uniform 30 percent increase in agricultural productivity, experiment 2 measures the effect of a uniform 15 percent reduction in marketing margins. Experiment 1 captures the effects of exogenous improvements in agricultural production technology, e.g. through the introduction of higher yielding or more drought tolerant crops, while experiment 2 captures the effects of improvements to the worn down Mozambican marketing infrastructure, e.g. through improvements in transportation, marketing, distribution and storage. Subsequently, experiment 3 measures the effects of combining experiments 1 and 2. Thus, experiment 3 is used to measure whether there are synergy effects to be obtained from improving agricultural technology and marketing infrastructure simultaneously. As shown in Arndt et al. (2000), this is likely to be the case since agricultural marketing margins are particularly high.[1]

Table 3.2 presents the impact on macroeconomic aggregates. Not surprisingly, all experiments lead to significant economic expansion. Clearly, non-linearity is characteristic of the impact on all macro-aggregates, implying that there are synergy effects involved in improving agricultural technology and marketing infrastructure simultaneously. While the synergy effect amounts to 0.7 percent for real value added, it amounts to 1.3 percent for nominal absorption. Recalling that a consumer price index is used as numeraire for the simulations, the strong non-linearity in nominal absorption shows that the simultaneous improvement of agricultural technology and the marketing system has significant positive welfare implications.

Table 3.2
Macroeconomic indicators (percent)

| | Base Run(100 bn Mt) | Exp. 1 | Exp. 2 | Exp. 3 |
|---|---|---|---|---|
| Real GDP | 408.0 | 8.4 | 4.4 | 13.5 |
| Nominal GDP | 408.0 | 6.1 | 5.6 | 13.2 |
| Nominal Absorption | 477.0 | 5.3 | 5.6 | 12.2 |

Source: see text.

The breakdown of real value added into expenditure items in Table 3.3 shows that agricultural technology improvements lead to strong growth in consumption, while other demand components decline. Home consumption increases particularly strongly, since this consumption component avoids the large and increasing marketing costs. In contrast, improvements to the marketing system lead to a strong balanced expansion of all expenditure components, except for home consumption, which grows less. The combined experiment indicates strong expansion of consumption components and moderate expansion of the international trade components. Overall, the combined scenario shows that there are important synergy effects, which are only captured through simultaneous improvements to agricultural technology and the marketing system. This is especially so for consumption of marketed goods, where synergy effects account for 1.2 percent of base run consumption.

Table 3.4 presents selected price indices and the combined experiment shows that prices at the value added and producer level, as well as domestic prices on foreign trade increase relative to the consumer price index numeraire. The main reason is that marketing margin wedges between farm gate and border prices, on the one hand, and domestic market prices, on the other, decline strongly. The very strong increase in domestic and foreign trade, due to increased agricultural production, leads to a strong increase in the price of commercial services. In the combined experiment, the effect on marketing costs of this price increase is almost exactly offset by the 15 percent reduction in marketing margin rates. In other words, improved marketing infrastructure can be used to counteract increasing marketing costs, when agricultural supply expands. The implication is that improvements to agricultural production technologies have to go hand in hand with improvements to the

[1] All experiments in this paper are based on a closure where total factor supplies and foreign capital inflows are fixed, and investment is saving-driven. An average consumer price index defines the numeraire.

marketing infrastructure. Otherwise, the cost of marketing will increase to such an extent that marketing of the additional agricultural production will not be profitable for the farmers or desirable for the consumers.

Table 3.3
Real GDP components (percent)

| | Base Run(100 bn Mt) | Exp. 1 | Exp. 2 | Exp. 3 |
|---|---|---|---|---|
| Exports | 45.0 | -4.1 | 11.9 | 7.1 |
| Imports | 114.0 | -1.6 | 4.7 | 2.8 |
| Home Consump. | 87.1 | 19.7 | 1.2 | 20.3 |
| Marketed Consump. | 275.9 | 7.7 | 4.6 | 13.5 |
| Recurrent Government | 36.5 | -3.4 | 4.4 | 1.6 |
| NGO | 3.6 | -7.3 | 3.3 | -4.5 |
| Investment | 73.9 | -3.4 | 3.6 | -0.4 |
| Real GDP | 408.0 | 8.4 | 4.4 | 13.5 |

Source: see text.

Table 3.4
Price indices (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 |
|---|---|---|---|---|
| GDP deflator | 100 | -2.2 | 1.1 | -0.2 |
| Producer prices | 100 | -1.7 | 4.1 | 2.8 |
| Demand prices | 100 | 2.8 | 0.8 | 3.8 |
| Value added prices | 100 | -0.6 | 5.6 | 5.6 |
| Export prices | 100 | -1.6 | 9.0 | 7.6 |
| Import prices | 100 | 3.3 | 1.1 | 4.1 |

Source: see text.

Table 3.5
Agricultural terms of trade (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 |
|---|---|---|---|---|
| Producer prices | 100 | -31.5 | 9.2 | -22.5 |
| Demand prices | 100 | -20.7 | 3.4 | -17.4 |
| Value added prices | 100 | -36.8 | 9.0 | -28.1 |
| Export prices | 100 | -5.1 | 7.5 | 3.4 |
| Import prices | 100 | -0.8 | 1.4 | 0.6 |

Source: see text.

Table 3.5 presents summary measures for the agricultural terms of trade evaluated at different points in the price chain. It appears that relative agricultural value added prices decline strongly when agricultural production technologies improve. In fact, value added prices declines to such an extent that agricultural labour wages decline (see Table 3.6). This means that the benefits from agricultural technology improvements mainly work through lower prices on home and marketed consumption of agricultural goods. In this way, a large part of the welfare improvement is switched from households with agriculture as primary occupation, to households with high agricultural consumption shares (see Table 3.7). Improvements to the marketing infrastructure improve relative agricultural producer and value added prices, but synergy effects are small.

Table 3.6 presents factor prices, and it follows that non-agricultural labour wages and capital returns develop very similarly.[2] As noted above, agricultural labour wages decline strongly following agricultural technology improvements. This somewhat counterintuitive result follows from strong declines in agricultural producer and value added prices. High marketing costs simply mean that marketing of the increasing agricultural supply is too costly. In contrast, non-agricultural labour wages and capital returns increase strongly. Lower agricultural prices and higher supply of agricultural goods, lead to a switch in demand towards non-agricultural goods and services. In particular, services benefit since they avoid marketing costs by definition. This leads naturally to strongly increasing factor income for non-agricultural labour and capital owners. Improvements to the marketing infrastructure benefits agricultural labour wages, since agricultural marketing margins are particularly large. Moreover, there are large synergy effects for agricultural labour income in the order of four percent, associated with simultaneous improvements to agricultural productivity and the marketing infrastructure. This indicates that simultaneous improvements to marketing networks are necessary for agriculturally dependent households to share in the welfare gains following from increased agricultural productivity.

Table 3.6
Factor prices (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 |
|---|---|---|---|---|
| Agricultural Labour | 1 | -9.0 | 12.8 | 7.7 |
| Unskilled Non-agricultural Labour | 1 | 13.2 | 2.3 | 16.1 |
| Skilled Non-agricultural Labour | 1 | 13.3 | 2.2 | 16.1 |
| Capital | 1 | 12.1 | 2.4 | 15.3 |

Source: see text.

Table 3.7 presents equivalent variation measures for the individual households, and they show, as indicated above, that a large part of welfare improvements are switched to households with large agricultural consumption shares. This means in particular that agricultural technology improvements will have a relatively small impact on urban households with agriculture as primary occupation. First, their agricultural labour wages decline strongly, and second their cost of living increases since they have relatively low agricultural consumption shares. Interestingly, marketing infrastructure improvements will benefit this group of households the most. This stems in particular from the expansion of agricultural wages. Moreover, the relative declines in market prices mean that improvements to the marketing system benefit urban agricultural households more than other agricultural households. Nevertheless, urban agricultural households will only

[2] No behaviour is imposed on the CGE model to discriminate between skilled and unskilled non-agricultural labour. Due to the agricultural/non-agricultural design of the experiments in the current paper, it follows that non-agricultural wages will vary in tandem. Moreover, since agriculture is very labour-intensive, returns to capital will be closely correlated with non-agricultural wages.

experience modest overall welfare improvements between 5-8 percent from the combined scenario, in spite of large synergy effect in the order of 2-3 percent.

Table 3.7
Equivalent variation (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 |
|---|---|---|---|---|
| Urban Agricultural, south | 0 | -3.6 | 7.3 | 5.4 |
| Urban Agricultural, centre | 0 | -3.5 | 9.1 | 8.1 |
| Urban Agricultural, north | 0 | -4.0 | 9.0 | 7.9 |
| Urban Non-agricultural, south | 0 | 10.9 | 2.3 | 13.7 |
| Urban Non-agricultural, centre | 0 | 10.2 | 2.1 | 12.4 |
| Urban Non-agricultural, north | 0 | 12.4 | 1.8 | 14.6 |
| Rural Agricultural, south | 0 | 15.4 | 3.4 | 19.1 |
| Rural Agricultural, centre | 0 | 6.2 | 6.2 | 14.8 |
| Rural Agricultural, north | 0 | 7.7 | 6.1 | 16.8 |
| Rural Non-agricultural, south | 0 | 22.1 | -0.9 | 20.1 |
| Rural Non-agricultural, centre | 0 | 14.2 | 1.4 | 15.6 |
| Rural Non-agricultural, north | 0 | 17.7 | 0.6 | 18.2 |
| Total | 0 | 10.0 | 3.7 | 14.7 |

Source: see text.

The rural non-agricultural households represent the other extreme in relation to welfare improvements. They benefit strongly from agricultural technology improvements even though they receive most of their income from non-agricultural income sources. The reason is again that non-agricultural wages and capital returns benefit from the increased demand for non-agricultural goods and services. Moreover, rural non-agricultural households have relatively high agricultural consumption shares, so they benefit strongly both from higher income and lower agricultural market prices. Improvements to the marketing networks do not benefit this group much since they receive their income from non-agricultural sources. Nevertheless, simultaneous improvements to agricultural technology and the marketing infrastructure benefit this group of households the most. Altogether, rural non-agricultural households experience a welfare improvement between 16-20 percent, in spite of the fact that synergy effects are non-existent.

In between the two extreme groups of households are the rural agricultural and urban non-agricultural households. They benefit between 12-19 percent from the combined experiment. Rural households benefit more than urban households since improvements of the marketing system are very favourable to rural households. Again, agricultural technology improvements by themselves benefit non-agricultural households the most, while marketing system improvements benefit agricultural households the most. The exception is the rural agricultural households in the southern capital region, which benefits strongly from agricultural technology improvements and less from marketing infrastructure improvements. Again strong synergy effects characterize the (rural) agricultural households, while synergy effects are small for the (urban) non-agricultural households.

Altogether, the analysis shows that the distributional impact of improvements to agricultural technology and marketing infrastructure has a tendency to benefit (rural) households with high agricultural consumption shares. Moreover, non-agricultural rural households benefit the most since non-agricultural income expands relatively strongly. Another important conclusion is, however, that synergy effects are particularly strong for households with agriculture as primary occupation. Accordingly, synergy effects are very important elements of the (small) welfare improvements which the group of urban agricultural households experiences. It follows that simultaneous improvements to agricultural technology and the marketing system are important since they ensure that all groups of households benefit from the agriculture-first development strategy. Nevertheless, the most important conclusion is that rural agricultural households, which account for the main part of (poor) households in Mozambique, benefit strongly. The large synergy effects, which accrue to these households show that the strategy of simultaneous improvements to agricultural technology and the marketing system is also likely to have a strong poverty alleviating impact.

However, the current experiments also show that the functional distribution of income, as measured by the factor prices, changes in favour of non-agricultural labour and capital. This is obviously an artefact of the particular choice of shocks to the model, i.e. a 15 percent reduction in marketing margins and a 30 percent increase in agricultural productivity. Nevertheless, such an outcome may imply that this strategy becomes less attractive from a political point of view. One possibility is to vary the size of the shocks, in order to find a combination, which ensures a more balanced development in the functional distribution of income. Another possibility is to focus on some important agriculturally related industrial sectors, and see whether the development of these sectors can be used to arrive at a more balanced expansion of factorial income and welfare. The next set of experiments shows that this can actually be achieved.

### 3.2 Agriculture and agro-industrial technology and marketing margins

The experiments in this section are meant to capture a process of agricultural-development led industrialization. As such they extend the results in Section 3.1 by looking at the effects of accompanying technological improvements in food processing and textile sectors. The focus is therefore on the potential for technological improvements in a key set of agro-industry sectors to interact with improved agricultural technology and marketing infrastructure. The simulation exercise includes five experiments as set out in Table 3.8. The first experiment reproduces the results of a 30 percent increase in agricultural productivity, while the second experiment shows the results of a 30 percent productivity increase in food processing sectors, i.e. grain milling and other food processing, and textiles. The combined experiment of experiments 1 and 2 is included as experiment 3. The fourth experiment reproduces the results of a 15 percent decrease in marketing margins, and finally experiments 3 and 4 are combined in experiment 5.

The effects on macroeconomic variables are presented in Table 3.9. There are large economic gains from each of the individual experiments, and synergy effects are clearly important. Due to size differences, the effects of technological improvements in the agro-industry sectors are moderate, compared to agricultural technology and marketing system improvements. Nevertheless, synergy effects associated with improving technologies in agro-industry alongside improvements to agriculture technologies and marketing infrastructure prove important. Taking experiment 3 in Table 3.2 into account, it can be seen that the improved agro-industry productivity creates synergy effects in the order of 0.4 percent for real value added (15.6 vs. 13.5+1.7), and 0.6 percent for nominal absorption (14.5 vs. 12.2+1.7).[3] Thus, there are important synergy effects to be considered on a macroeconomic level, implying that improvement to agro-industry technologies is an important element of the ADLI development strategy.[4]

Table 3.8
Simulations

| Simulations | Description |
|---|---|
| Base Run | Base 1997 data |
| Exp. 1 | 30% Increase in agricultural productivity |
| Exp. 2 | 30% Increase in productivity of agro-industry sectors |
| Exp. 3 | Experiments 1 + 2 |
| Exp. 4 | 15% reduction in marketing margins |
| Exp. 5 | Experiments 3 + 4 |

Source: see text.

Table 3.9
Macroeconomic indicators (percent)

| | Base Run (100 bn Mt) | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Real GDP | 408.0 | 8.4 | 1.7 | 10.3 | 4.4 | 15.6 |
| Nominal GDP | 408.0 | 6.1 | 1.7 | 8.3 | 5.6 | 15.7 |
| Nominal Absorption | 477.0 | 5.3 | 1.7 | 7.4 | 5.6 | 14.5 |

Source: see text.

The breakdown of real value added into expenditure items in Table 3.10 shows that productivity increases in agriculture and agro-industry sectors mainly lead to increases in consumption. Moreover, there are some synergy effects from combining technological improvements in agriculture and agro-industry, amounting to around 0.3 percent for both marketed consumption and aggregate investment. However, in contrast to agricultural productivity expansion, productivity growth in agro-industry sectors shows a relatively well-balanced expansion of all demand components. Furthermore, improvements to marketing infrastructure clearly benefit foreign trade and other marketed components of final demand. Altogether, this implies a more balanced expansion of demand in the combined experiment 5. Similar to the agriculture-first strategy, synergy effects are

3 The additional synergy gain from including the agro-industrial technology improvements is calculated by comparing the impact of experiment 3 in Table 3.2 plus the impact of experiment 2 in Table 3.9 with the total impact of experiment 5 in Table 3.9.

4 The total synergy effects including agro-industry sectors in the strategy can be broken down into synergy effects related to (i) the intra-action between agricultural and agro-industry productivity improvements, and (ii) the inter-action between technology improvements in agriculture and agro-industry, and marketing infrastructure improvements. It follows from Table 3.9 that synergy effects for real GDP are equally divided between these two sources of synergy, while synergy effects for nominal absorption stem mainly from the first source. From a welfare perspective, this implies that development of agro-industry sectors is a very important element of the ADLI strategy.

particularly important in marketed demand, accounting for 1.4 percent of marketed consumption.

Table 3.10
Real GDP components (percent)

| | Base Run (100 bn Mt) | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Exports | 45.0 | -4.1 | 5.0 | 0.4 | 11.9 | 12.6 |
| Imports | 114.0 | -1.6 | 2.0 | 0.2 | 4.7 | 5.0 |
| Home Consump. | 87.1 | 19.7 | 1.6 | 21.3 | 1.2 | 22.2 |
| Marketed Consump. | 275.9 | 7.7 | 1.6 | 9.6 | 4.6 | 15.6 |
| Recurrent Govt. | 36.5 | -3.4 | 1.3 | -2.1 | 4.4 | 3.1 |
| NGO | 3.6 | -7.3 | 0.9 | -6.6 | 3.3 | -3.7 |
| Investment | 73.9 | -3.4 | 0.9 | -2.8 | 3.6 | 0.3 |
| Real GDP | 408.0 | 8.4 | 1.7 | 10.3 | 4.4 | 15.6 |

Source: see text.

Table 3.11 presents price indices, evaluated at different points in the price chain. They show that agricultural productivity gains lead to decreasing producer and value added prices and increasing market prices relative to the numeraire consumer price index. Increasing agro-industry productivity does not change this conclusion. As was the case for the agriculture-first strategy, marketing system improvements are particularly important in supporting prices. Accordingly, lower marketing margins lead to strongly increasing producer and value added prices, more than making up for the declines following from the productivity increases. The combined experiment 5 therefore leads to balanced increases in producer and market prices relative to the numeraire consumer price index. The differential price developments in the combined experiment are also consistent with the switch towards marketed demand, which was observed above.

Table 3.11
Price indices (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| GDP prices | 100 | -2.2 | 0.1 | -1.8 | 1.1 | 0.1 |
| Producer prices | 100 | -1.7 | 0.4 | -1.3 | 4.1 | 3.3 |
| Demand prices | 100 | 2.8 | 0.4 | 3.4 | 0.8 | 4.3 |
| Value added prices | 100 | -0.6 | 0.1 | -0.5 | 5.6 | 5.7 |
| Export prices | 100 | -1.6 | 1.9 | 0.2 | 9.0 | 9.5 |
| Import prices | 100 | 3.3 | 1.4 | 4.7 | 1.1 | 5.5 |

Source: see text.

The agricultural terms of trade presented in Table 3.12 show that agricultural productivity increases lead to substantially modified domestic agricultural terms of trade. Relative demand prices decline less than relative producer and value added prices due to increasing marketing costs for cost-heavy marketed agricultural goods. Agro-industry productivity increases lead to increasing agricultural terms of trade. However, synergy effects between agricultural and agro-industry technology improvements work against relative agricultural producer and value added prices. This implies that some of the gains are being shifted towards non-agricultural production activities and households. Overall, the combined experiment 5 leads to strongly declining relative agricultural prices. Nevertheless, combining improvements to agricultural technology and marketing infrastructure with improvements to agro-industry technology moderates the falling agricultural terms of trade considerably. Again, this indicates that development of agro-industry sectors is an essential element of the ADLI strategy.

Table 3.12
Agricultural terms of trade (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Producer prices | 100 | -31.5 | 4.8 | -27.5 | 9.2 | -17.9 |
| Demand prices | 100 | -20.7 | 2.9 | -17.9 | 3.4 | -14.4 |
| Value added prices | 100 | -36.8 | 7.3 | -31.4 | 9.0 | -22.0 |
| Export prices | 100 | -5.1 | 0.5 | -4.6 | 7.5 | 3.8 |
| Import prices | 100 | -0.8 | 0.1 | -0.8 | 1.4 | 0.7 |

Source: see text.

The factor prices, presented in Table 3.13, show that agro-industry technology improvements are very important in securing that agricultural productivity growth is reflected properly in agricultural labour earnings. Agro-industry productivity growth leads to increasing agricultural labour earnings, both on its own and by creating synergy effects amounting to 0.9 percent of agricultural labour earnings. Combined with improvements to the marketing infrastructure that benefit agricultural labour earnings strongly as well, increased agricultural and agro-industry productivity leads to an almost unchanged factorial distribution of income. The ADLI development strategy, where focus is on industrial aspects as well as agriculture, will therefore be more attractive than the agriculture-first strategy, in the sense that all household groups gain equally in terms of income, regardless of their individual factor endowments. Nevertheless, different households will experience different welfare gains due to differences in the composition of household demand.

Table 3.13
Factor prices (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Agricultural Labour | 1 | -9.0 | 4.6 | -3.5 | 12.8 | 14.1 |
| Unskilled Non-agricultural Labour | 1 | 13.2 | 0.5 | 14.1 | 2.3 | 16.9 |
| Skilled Non-agricultural Labour | 1 | 13.3 | 0.5 | 14.2 | 2.2 | 16.9 |
| Capital | 1 | 12.1 | 0.1 | 12.4 | 2.4 | 15.6 |

Source: see text.

The welfare gains for individual households, measured by the equivalent variation measure, are presented in Table 3.14. It appears that improvements to production technologies and marketing infrastructure by themselves have very different effects on welfare distribution. While agricultural technology improvements benefit consumers of agricultural goods and disfavours suppliers of agricultural labour, agro-industrial technology improvements benefit mainly agricultural households who supply labour to agricultural production activities. Combining technology improvements in agriculture and agro-industry sectors therefore imply that no household groups experience significant losses of welfare. In fact, all but one household group gain.

Table 3.14
Equivalent variation (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Urban Agricultural, south | 0 | -3.6 | 2.4 | -0.8 | 7.3 | 8.6 |
| Urban Agricultural, centre | 0 | -3.5 | 3.6 | 0.7 | 9.1 | 13.0 |
| Urban Agricultural, north | 0 | -4.0 | 3.7 | 0.4 | 9.0 | 12.9 |
| Urban Non-agricultural, south | 0 | 10.9 | 0.6 | 11.8 | 2.3 | 14.6 |
| Urban Non-agricultural, centre | 0 | 9.9 | 0.7 | 11.0 | 2.1 | 13.3 |
| Urban Non-agricultural, north | 0 | 12.4 | 0.6 | 13.3 | 1.8 | 15.4 |
| Rural Agricultural, south | 0 | 14.4 | 1.6 | 16.5 | 3.4 | 21.4 |
| Rural Agricultural, centre | 0 | 6.2 | 2.8 | 9.9 | 6.2 | 18.8 |
| Rural Agricultural, north | 0 | 7.7 | 3.1 | 11.9 | 6.1 | 21.3 |
| Rural Non-agricultural, south | 0 | 22.1 | -0.4 | 21.5 | -0.9 | 19.4 |
| Rural Non-agricultural, centre | 0 | 14.2 | 0.8 | 15.3 | 1.4 | 16.6 |
| Rural Non-agricultural, north | 0 | 17.7 | 1.1 | 19.2 | 0.6 | 19.6 |
| Total | 0 | 9.8 | 1.5 | 11.9 | 3.7 | 16.9 |

Source: see text.

However, gross differences in welfare gains remain. While rural non-agricultural households gain strongly from lower consumer prices and higher income, urban agricultural households only just break even. The huge differences in welfare impact are to a large extent evened out when improvements to the marketing system are included in the analysis. Similar to the agriculture-first strategy, marketing improvements are particularly beneficial for those agricultural households who loose out from the agricultural technology improvement. However, in contrast to the agriculture-first strategy, the combined scenario, where improvements to agricultural technology are accompanied by improved agro-industry technology and marketing infrastructure, shows a remarkably uniform improvement in welfare for all household groups. It is also apparent that the very poor group of households, collected under the heading of rural agricultural households, benefits more than other households. This is very important, since it suggests that the combined strategy can have a positive impact on welfare distribution and poverty in addition to the positive macroeconomic synergy effects on GDP and Absorption.

In relation to the combined scenario, it is important to note that strong synergy effects characterize the impact on welfare for several household groups. This is especially so for households with agriculture as primary occupation. In particular, synergy effects are very strong for urban agricultural households, which are the only ones to loose out from agricultural technology improvements by themselves. Accordingly, the impact of synergy effects on the welfare of urban agricultural households range between 0.4-0.7 percent for simultaneous agro-industry technology improvements and 2.1-3.5 percent for simultaneous marketing system improvements. Only rural agricultural households have synergy effects of the same order of magnitude. Altogether, the results suggest that simultaneous improvements to agro-industry technologies are necessary to reap the full benefits of an agriculture-first development strategy. Moreover, these synergy effects work to ensure a balanced impact on welfare among the different household groups.

In sum, the experiments of the current section show that the inclusion of improvements to agro-industry technologies are important to reap the full benefits from a strategy based on improvements to infrastructure and agricultural technologies. Compared to the results of the former section, synergy effects in the impacts on macroeconomic aggregates are important. Including agro-industries in the development strategy is also important since it strengthens agricultural value added prices. Accordingly, it serves to moderate the sharp fall in agricultural value added prices when agricultural technologies are improved. The inclusion of agro-industries in the development strategy also ensures that agricultural productivity growth is properly reflected in agricultural labour earnings. Accordingly, the overall strategy leads to an almost unchanged factorial distribution of income. This makes the ADLI strategy attractive in the sense that all household groups will gain in terms of income.

The inclusion of agro-industries in the development strategy also means that all households will experience strong welfare gains. Moreover, the inclusion of agro-industries means that welfare gains will be evenly distributed among households. It means, in particular, that poor households with agriculture as primary occupation benefit more strongly. Thus, the strategy, which combines improvements to infrastructure and agricultural technology (agriculture-first) with improvements to agro-industry technology (agriculture-development led industrialization), will benefit the poorest group of households, i.e. rural agricultural households, the most. This is very important since it suggests that this overall strategy can have a positive impact on poverty and the distribution of welfare, while retaining the politically sensitive factorial distribution of income.

### 3.3 Primary sector export-oriented development

The experiments in this section, which may be seen as component parts of a primary sector export-oriented development strategy, are summarised in Table 3.15. The first experiment establishes the effects of a 30 percent increase in the productivity of agricultural export sectors, including (i) grains, (ii) raw cashew nuts and (iii) other export crops. This is followed by the second experiment, which includes a uniform increase in the CET transformation elasticity for the three agricultural export sectors.[5] This is intended to reflect a general increase in the quality of domestic production of agricultural export crops, e.g. through the introduction of new varieties. The third experiment puts experiments 1 and 2 together in order to study possible synergy effects between improvements to agricultural technology and improved abilities of agricultural producers to transform production into exports. The fourth experiment simulates a 10 percent decrease in the CET share parameters for agricultural export crops. This change reflects a general shift in the focus of the producers of export crops towards export markets. The fifth experiment brings the third and fourth experiments together.

[5] The transformation elasticities for agricultural export crops are increased to a uniform value of 3.0.

Table 3.15
Simulations

| Simulations | Description |
|---|---|
| Base Run | Base 1997 data |
| Exp. 1 | 30% increase in agricultural productivity |
| Exp. 2 | Uniform increase in CET transformation elasticities to 3 for agricultural export goods |
| Exp. 3 | Experiments 1 + 2 |
| Exp. 4 | 10% decrease in CET share parameters for agricultural export goods |
| Exp. 5 | Experiments 3 + 4 |

Source: see text.

The impact on key macroeconomic indicators are summarised in Table 3.16.[6] It follows that improved agricultural technologies and increased transformation elasticities have significant positive macroeconomic effects. Nevertheless, the experiments also indicate that synergy effects in the impact on absorption are negative, implying that welfare is worsened by the simultaneous improvement of agricultural productivity and the quality of production of agricultural export sectors. Looking at the export promotion experiments, it follows that increased quality of domestically produced export crops, i.e. increasing transformation elasticities, leads to a strong increase in real GDP. However, this increase in value added is more than countered by the negative impact of increased orientation towards export markets, i.e. lowering of the CET share parameters, when synergy effects are taken into account. Overall, the agricultural export promotion strategy leads to increases in macroeconomic aggregates, due to the positive impacts of improved agricultural production technologies and increased quality of production in agricultural export sectors. However, the strong negative macroeconomic effects associated with increased export penetration of foreign markets, imply that the export-promotion part of the development strategy has a negative net impact on macroeconomic aggregates.

Table 3.16
Macroeconomic indicators (percent)

| | Base Run (100 bn Mt) | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Real GDP | 407.5 | 1.8 | 2.7 | 4.6 | -2.5 | 1.0 |
| Nominal GDP | 404.4 | 1.5 | 1.1 | 2.7 | -1.8 | 1.3 |
| Nominal Absorption | 476.1 | 1.1 | 1.4 | 2.2 | -1.7 | 0.7 |

Source: see text.

The impact on the demand components of real GDP is presented in Table 3.17, and it follows that the overall export strategy leads to increasing exports. However, the experiments also indicate that total exports decline strongly when the CET transformation elasticities for agricultural export crops are increased in experiment 2. This is important since it indicates that a higher level of transformability of agricultural export goods will

[6] The CES substitution elasticity for grain imports was reduced from six to two, in the current export-led development strategy section. The very high elasticity, which was estimated in Arndt, Robinson, and Tarp (1999), reflect the inflow of food aid in drought years. The adjustment was made since the high elasticity lead to unreasonable results. Due to the adjustment, base run values in the current section differ somewhat from the base run values of the two previous sections.

have positive macroeconomic effects at the expense of declining exports. The results show that agricultural producers transform their products into domestic goods, which are absorbed by household consumers. Basically, the increasing transformation elasticities amount to an increase in the quality of the large amounts of potential export crops, which are sold domestically. This leads to a strong expansion of domestic agricultural demand and crowding out of agricultural exports.

Nevertheless, the combined experiment 3 shows that there are significant positive synergy effects in agricultural exports. This is especially true for exports of raw cashew nuts, which almost triple from their base run level. Overall, agricultural exports increase from simultaneous improvements to agricultural productivity and the quality of agricultural export crops. However, exports of other (non-agricultural) goods generally decline, implying that total exports shrink from the base run level. Thus, the increases in macroeconomic aggregates observed above, do not follow from increasing exports, but rather from increasing domestic (consumption) demand.

Taking increasing export market orientation into account in experiment 4, leads to increasing exports and declining domestic demand. Thus, this part of the export-promotion package does not achieve export-led growth of demand either. The overall strategy, included as experiment 5, leads to both increasing exports and domestic (consumption) demand. However, compared to the agricultural productivity experiment 1, exports increase at the expense of an overall decline in demand. It follows that the export component of the overall strategy achieves increased exports at the expense of lower overall demand. Thus, the strategy of strengthening the agricultural export sector through improved quality of production and orientation towards export markets does not enhance the impact of improving agricultural productivity.

Table 3.17
Real GDP components (percent)

| | Base Run(100 bn Mt) | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Exports | 46.6 | 0.5 | -5.2 | -2.5 | 3.5 | 2.7 |
| Imports | 115.7 | 0.2 | -2.1 | -1.0 | 1.4 | 1.1 |
| Home Consump. | 87.3 | 4.0 | 7.1 | 11.8 | -5.3 | 1.9 |
| Marketed Consump. | 274.3 | 1.9 | 2.0 | 3.9 | -2.4 | 1.5 |
| Recurrent Govt. | 35.8 | -0.4 | -1.9 | -1.6 | 1.4 | 0.4 |
| NGO | 3.7 | -2.4 | -0.4 | -3.7 | 1.8 | -2.7 |
| Investment | 75.5 | -1.4 | 0.2 | -2.1 | 0.9 | -1.9 |
| Real GDP | 407.5 | 1.8 | 2.7 | 4.6 | -2.5 | 1.0 |

Source: see text.

The price indices, included in Table 3.18, show that each of the individual components of the strategy leads to declining producer and value added prices, and increasing prices for marketed goods, including imports and exports. Nevertheless, significant non-linearity can also be observed. In particular, the combination of improved agricultural technologies and increased quality of agricultural export goods leads to very moderate price changes as compared with the individual experiments 1 and 2. The same pattern can be observed when changes in the orientation towards export markets are analysed in experiments 4 and 5.

Overall, the significant non-linearity in prices ensures that the intermediate strategy, included in experiment 3, and the overall strategy, included in experiment 5, leads to moderate declines in producer and value added prices and moderate increases in market prices.

Table 3.18
Price indices (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| GDP prices | 100 | -1.1 | -2.4 | -2.6 | 0.0 | -0.5 |
| Producer prices | 100 | -1.4 | -0.5 | -1.2 | -0.9 | -1.4 |
| Demand prices | 100 | 0.9 | 1.9 | 1.3 | 0.6 | 0.5 |
| Value added prices | 100 | -1.3 | -0.2 | -0.1 | -2.9 | -1.5 |
| Export prices | 100 | 2.5 | 7.4 | 2.9 | 3.6 | 0.7 |
| Import prices | 100 | 2.9 | 6.8 | 4.3 | 1.6 | 1.3 |

Source: see text.

Agricultural terms of trade evaluated at different prices are presented in Table 3.19, and they show strong declines in all experiments. Relative agricultural value added prices decline in particular, exemplified by the 12 percent decline from the overall strategy in experiment 5. However, the agricultural terms of trade also show strong signs of synergy effects, whereby the strong negative effects on relative agricultural prices are significantly moderated. Increased export market orientation among producers of agricultural export goods, in experiments 4 and 5, are particularly important in moderating relative agricultural price declines.

Table 3.19
Agricultural terms of trade (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Producer prices | 100 | -13.4 | -14.5 | -16.8 | -4.3 | -10.5 |
| Demand prices | 100 | -8.6 | -14.0 | -14.9 | 3.8 | -5.2 |
| Value added prices | 100 | -15.9 | -17.3 | -20.8 | -2.4 | -12.3 |
| Export prices | 100 | -0.5 | 0.6 | -1.4 | 2.0 | -0.7 |
| Import prices | 100 | -0.1 | 0.1 | -0.2 | 0.4 | -0.1 |

Source: see text.

The impact on factor prices, presented in Table 3.20, shows that households with agriculture as primary occupation will have the highest income expansion from the overall strategy in experiment 5. This is, however, mainly due to the effect of increased export orientation on the part of producers of agricultural goods in experiment 4. Accordingly, the intermediate strategy of improved technology and increased quality of agricultural export goods in experiment 3, lead to declining agricultural and increasing non-agricultural incomes. Synergy effects are strongly positive for agricultural labour returns, and strongly negative for returns to other factors.

Table 3.20
Factor prices (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Agricultural Labour | 1 | -0.1 | -6.6 | -3.6 | 3.4 | 3.1 |
| Unskilled Non-agricultural Labour | 1 | 2.3 | 4.2 | 5.6 | -4.0 | 1.0 |
| Skilled Non-agricultural Labour | 1 | 2.4 | 4.3 | 5.7 | -4.0 | 1.0 |
| Capital | 1 | 2.1 | 3.3 | 4.7 | -3.4 | 1.0 |

Source: see text.

Finally, the impact on household welfare, measured by equivalent variation, is presented in Table 3.21. It follows that the welfare improvements from the overall strategy in experiment 5, is dominated by the intermediate strategy in experiment 3. Thus, the nominal income expansion for agricultural households, which follow from increased orientation towards overseas export markets, is dominated by large relative price-increases on food-items, which weigh heavily in the consumption-baskets of agricultural households. It is therefore clear that the intermediate strategy of simultaneous improvements to production technologies and the quality of agricultural export products, included in experiment 3, is the preferred strategy. This strategy leads to welfare gains for all households except for urban agricultural households. Urban agricultural households suffer in particular from the combination of (i) agricultural factor income declines and (ii) relative increases in non-agricultural market prices. In contrast, rural non-agricultural households benefit strongly from (i) non-agricultural factor income increases and (ii) relative declines in agricultural market prices. It is also important to notice that the majority of poor households, grouped under the headings of rural agricultural households in central and northern regions, benefit relatively little. Accordingly, while the preferred intermediate strategy leads to overall welfare gains, it is also likely to lead to increasing inequality.

Table 3.21
Equivalent variation (percent)

| | Base Run | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 4 | Exp. 5 |
|---|---|---|---|---|---|---|
| Urban Agricultural, south | 0 | -4.0 | -7.1 | -5.5 | -2.6 | -2.6 |
| Urban Agricultural, centre | 0 | -4.5 | -8.3 | -5.9 | -4.1 | -2.9 |
| Urban Agricultural, north | 0 | -4.7 | -8.6 | -5.7 | -5.0 | -3.1 |
| Urban Non-agricultural, south | 0 | 3.4 | 4.8 | 6.2 | -2.2 | 2.3 |
| Urban Non-agricultural, centre | 0 | 3.2 | 4.4 | 6.0 | -2.3 | 2.2 |
| Urban Non-agricultural, north | 0 | 3.9 | 5.6 | 7.2 | -2.4 | 2.6 |
| Rural Agricultural, south | 0 | 2.4 | 3.6 | 7.0 | -6.0 | 1.1 |
| Rural Agricultural, centre | 0 | -0.9 | -2.1 | 0.5 | -4.5 | -0.7 |
| Rural Agricultural, north | 0 | -0.4 | -1.4 | 2.3 | -6.6 | -0.5 |
| Rural Non-agricultural, south | 0 | 6.7 | 11.0 | 12.4 | -2.5 | 4.1 |
| Rural Non-agricultural, centre | 0 | 4.6 | 7.1 | 8.5 | -2.4 | 3.0 |
| Rural Non-agricultural, north | 0 | 5.8 | 9.1 | 10.6 | -2.8 | 3.8 |
| Total | 0 | 1.9 | 2.4 | 4.5 | -3.7 | 1.1 |

Source: see text.

In general, the experiments under the heading of primary-sector export-oriented development show that the intermediate strategy of improved production technologies and increased quality of production in agricultural export sectors can lead to reasonably strong economic expansion. On the other hand, the inclusion of increased export market orientation among producers of agricultural crops has negative growth effects. Thus, the interim strategy is clearly preferred. The experiments show that all households except the relatively small group of urban agricultural households will benefit from this approach. However, it will mainly benefit the rich non-agricultural households, whereas the large group of poor agricultural subsistence farming households benefit less. This interim strategy will therefore most likely lead to a further unbalancing of the distribution of welfare between households.

Furthermore, the economic expansion of the strategy does not primarily derive from an expansion of exports. Agricultural exports do increase, but total exports are driven down. The economic expansion rather stems from an expansion of domestic demand. The increasing (consumption) demand follows from increasing supply and lower prices on agricultural goods, and the upgrading of the quality of domestically marketed agricultural export crops. In conclusion, the initiation of a unilaterally implemented export-led development strategy in Mozambique will be difficult. The implementation of a strategy, along the lines of experiment 3, will actually lead to declining exports. Moreover, while such a strategy will lead to important economic expansion, the relative distributional impact is not favourable to the poorest agricultural households.

## 4. Conclusion

Mozambique has recently recovered from the war-torn economy, which emerged in the wake of the peace-agreement in 1992 and the first democratic elections in 1994. Accordingly, attention is turning away from stabilization towards development of the economy. This paper has used a SAM/CGE model framework to analyse three different strategies for initiating a sustainable development process in Mozambique. Each of the three proposed development strategies has agricultural development at its core, and they can all be implemented unilaterally by Mozambique.

The analyses show that the most successful development strategy for Mozambique is likely to be the ADLI strategy, where agricultural development is accompanied by increased integration of markets and development of key agro-industry sectors. This strategy clearly dominates the strategy, presented as a primary-sector export-oriented development strategy, where agricultural development is accompanied by increased export market penetration and improved production quality of agricultural export crops. The latter strategy does have a potential for economic expansion. However, it mainly benefits richer non-agricultural households, whereas poorer agricultural households benefit less. Thus, the strategy will most likely lead to an unbalancing of the distribution of welfare. Moreover, the key to economic expansion is not increased exports, but increased domestic demand due to increased quality of domestically consumed agricultural export goods.

The above conclusions do not relate to trade negotiations in a regional (e.g. SADC) or global (WTO) context. If trade negotiations lead to increased demand for Mozambican products this would represent a potential gain. Moreover, increased export orientation is potentially beneficial in the longer term. However, the experiments clearly indicate that the initiation of a successful export-led development strategy in Mozambique will be difficult if it has to be unilaterally implemented.

The analyses in this paper also indicate that an ADLI strategy will dominate a partial agriculture-first strategy, which only includes improvements to agricultural technology and marketing infrastructure. Accordingly, the latter strategy misses out on important synergy effects, which accompany the inclusion of agro-industrial technology improvements in the ADLI strategy. Moreover, the inclusion of agro-industries into the development strategy can be used to ensure a balanced development in the functional distribution of income, which is politically sensitive. Similarly, it can be used to ensure a reasonably balanced expansion of welfare. This nevertheless benefits the poorest rural agricultural households the most. Accordingly, the ADLI strategy represents a desirable development strategy for Mozambique, which can help ensure a relatively balanced income expansion, and still have a positive impact on the distribution of welfare and poverty.

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