EXPLORING GROWTH LINKAGES AND MARKET OPPORTUNITIES FOR AGRICULTURE IN SOUTHERN AFRICA

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Abstract

Unexploited agricultural potential and regional trade opportunities together with the presence of South Africa and other middle-income countries, offer Southern Africa the unique opportunity to foster agricultural growth through regional linkages. In this study a global general equilibrium model that focuses on Southern Africa is used to analyze the implications that these specific characteristics of the regional economy have on growth choices of low-income countries. Three groups of growth scenarios are define to analyze the role of South Africa as a possible engine of growth, the role of own growth engines in low-income countries, and growth linkages between middle- and low-income countries. Results of the simulation scenarios show that larger benefits to low-income countries can be expected from grain and livestock productivity growth as a result of high multiplier effects and the large share of these activities in GDP. Productivity growth in grain and livestock results in higher GDP growth, higher agricultural output and food consumption, and lower agricultural imports than with productivity growth in non-traditional export crops. Unlike other regions where growth in grain production is likely constrained by domestic demand, growing middle-income economies in Southern Africa can provide additional demand to grains and livestock, slowing down the decline in grain prices in the region.

Introduction

Strengthening linkages and generating mutual benefits across countries is an important part of a strategy to generate economic growth. In the case of Africa, regionalism has received special attention as a result of growing fears of African marginalization and several regional initiatives were developed along the continent and in particular in Southern Africa. The need to promote the creation of institutional frameworks and programs for improving food security on the sub-region has been central to cooperation efforts by regional schemes such as the Common Market for Eastern and Southern Africa (COMESA); the Southern Africa development community (SADC); and the Southern Africa Custom Union (SACU).

Despite progress being made, the region is still a long way from taking full advantage of the opportunities that further integration and cooperation offer for development. Food deficits are still an issue in low-income countries, with productivity of cereal production still below the African average, and increased investments are needed if countries are to reap greater benefits from FTAs as well as for furthering the integration process.

In this context, there are at least four areas in which Southern African countries can benefit from regional integration and cooperation: (a) the economic diversity of the region; (b) regional food security; (c) regional infrastructure; and (d) trade and investment. Differences in income level often represent the differences in development stages. Thus, Southern Africa's economic diversity is generally viewed as a key reason for promoting greater regional integration for stimulating growth and poverty reduction. Per capita incomes in the region vary widely, and benefits from greater regional

integration are expected to come from the natural role South Africa can play in serving as a growth pole for the entire region, both in terms of providing a dynamic market for regional exports and a source of investment and technology diffusion.

Although Southern Africa is dominated by countries with small agricultural sectors, either due to more advanced and diversified economies or to a high dependency on mineral resources, agriculture remains the primary source of employment and income, especially among the region's low-income countries – Malawi, Mozambique, Zambia and Zimbabwe. In these countries, poverty and hunger is still pre-dominantly a rural phenomenon. In spite of this present situation, it is estimated that most low-income countries still enjoy an unexploited agricultural potential. Combining this potential with the pro-poor feature of agricultural-led growth indicates that the sector can play a central role in reducing poverty.

One of the strategic choices in an agricultural-led growth strategy in Southern Africa is: staple crops vs. non-traditional, high value agricultural products. Production of staple food and in particular of cereals and maize is one of the areas that could be affected by regional integration with obvious implications in terms of rural poverty and food security. The combined effect of low productivity, poor access to input and output markets, and poor infrastructure (roads and irrigation), prevents poor countries and in particular their smallholder sector from effectively competing with larger scale commercial farmers in the region. In the absence of these underlying constraints, poor countries have the potential to dramatically increase their share of maize traded in domestic and regional markets over time.

On the other hand, evidence of the potential importance for the region of non-traditional products like processed food, fruits and vegetables, and oilseeds, as well as livestock products, can be derived from the expansion of trade of these products in the region and from growing regional investment in their value chain of production. South Africa's foreign direct investment to the region – mostly in food retail (e.g. supermarkets and fast food chains), services and mineral industries – has been growing at a fast pace. Although these investments are in turn helping to increase exports from South Africa, this is expected to change in the future as the retail and agribusiness firms in each country increasingly invest in local distribution networks and become dependent on local suppliers. Moreover, by incorporating local suppliers into regional value chains, domestic agricultural sectors could become more diversified, and even specialized, as regional trade flow increases.

The purpose of this study is to evaluate how economic linkages in the region affect strategic options and priorities for agricultural development in Southern Africa. In addressing these issues the next section presents the general characteristics and particular features of Southern African economies, followed by the analysis of the potential of different sub-sectors to contribute to economic growth using a CGE model. The final section presents conclusions and recommendations to be considered in a development strategy for the region, based on the results of this study.

Regional agricultural growth opportunities

There are some unique characteristics of the region that offer Southern Africa the opportunity to foster development and agricultural growth through regional linkages. We

highlight here three of these characteristics: a) complementarities between low- and middle-income economies and hence strong trade and investment linkages across the countries; b) unexploited agricultural potential; and c) unexploited agricultural trade opportunities.

Southern Africa is the only region in the continent where there are a number of middle-and low-income countries in close proximity to each other (table 1). Six countries in the region belong to the middle income group of which, according to the World Bank definition, GDP per capita is higher than $735 in 2002. While there are currently five countries in the low income group, three of them actually moved down from being middle income countries in the early 1980s (Lesotho, Zambia and Zimbabwe). South Africa is already the region's engine of growth, with per capita income of $2,300, 38 percent of region’s total population and more than 70 percent of its GDP. Furthermore, the other two high-middle income countries, Botswana and Mauritius, though relatively small, are seen as the most successful examples of development in Africa.

Development amongst the lower-income Southern African countries and the fostering of agricultural growth depends critically on how these countries can best take advantage of these unique opportunities and benefit from the regional dynamics afforded by their more advanced neighboring countries. South Africa could influence growth in other countries through different channels: international trade, spillover effects, investment and financial linkages. It can also affect business and consumer confidence in other African countries given the size of its economy and its leadership role in regional economic and political initiatives. Arora and Vamvakides (2005) econometrically estimated this potential effect using data for the period 1960-1999. Their results indicate

that a 1 percentage point increase in South African economic growth is correlated with a 0.5-0.75 percentage point increase in growth in the rest of Africa.

As middle-income countries account for more than 40 percent of regional total population, Southern Africa as a whole has average income of $1,510 (2002) per capita, much higher than that of other Sub-Saharan African countries (many of which per capita income is below $300). Because of this, agriculture is less important for the region's middle-income countries as a group, for which the agricultural sector accounts for only three percent of total GDP. While the agricultural sector is relatively more important in the low-income Southern African countries, agriculture accounts for only 20 percent of all countries' total GDP. There is only one country – Malawi in which the agricultural GDP share of 34 percent is above the agricultural share averaging for all the low-income Sub-Saharan African countries not including Southern Africa (31 percent).

Despite a relatively small agricultural sector, rural population is consistently high in most Southern African countries accounting for 48 and 68 percent of middle and low income countries' population respectively. Moreover, for most countries the poverty rate is as high as in the other Sub-Saharan African countries, even including some middle-income Southern African countries such as Swaziland, Botswana and Namibia. A vast majority of the poor live in rural areas and are dependent on agricultural incomes. Therefore, while agriculture may not be a dominant sector in the region, it could still play an important role in a development strategy for the region. Because of this, regional growth opportunities also come from the region's agricultural potential.

The poor performance of the agricultural sector in the past, mainly a result of bad policies or politically unstable environment, constrained the region to exploit its

agricultural potential. For example, an urban biased policy with emphasizing on mineral sector has significantly hurt Zambia's agricultural growth (Thurlow and Wobts, 2004). In Zimbabwe, recent political instability has resulted in declined agricultural production. One of the central issues resulting from this unexploited potential is the transformation of Southern Africa in a food deficit region. Still with high proportion of its population living in rural areas and depending on agriculture for income and sustenance, a growing food deficit has been a recurrent phenomenon in Southern Africa, given the low levels of agricultural productivity. While the five-year average yield for maize production in Zambia and Zimbabwe were only 30 percent below South Africa's level during the late 1970s, the yield gap raised to 50-60 percent in recent years (1998-02) as shown in figure 1. A recovery of maize productivity to its historical highest values can significantly improve low-income countries' competitiveness and result in import substitution of maize, livestock and other commodities, providing these countries with more growth opportunities in agriculture.

On the other hand, evidence of the potential importance for the region of products like fruits and vegetables, oilseeds, and cotton as a non-traditional crop in the case of Zambia can be derived from the expansion of trade of these products in the region and from growing regional investment in their value chain of production. While total agricultural exports from the region expanded at a rate of 7.5 percent a year, intra-Southern African exports grew at 13 percent annually between 1990 and 1999, resulting in increased regional trade shares for agricultural commodities exported from Southern African countries (from 7 percent in 1990 to 12 percent in 1999).

In the context of recent growth of regional markets, low-income countries showed disadvantages to compete in these markets. The expansion of regional trade in recent years is associated with South Africa's increasing involvement in the region. More than 70 percent of regional export expansion is explained by increased exports from South Africa[1], while Mozambique, Zimbabwe and Zambia together explained the remaining 30 percent. On the import side, only 8 percent of import growth is explained by South Africa, while Mozambique, Zimbabwe, Zambia and Angola explain almost 80 percent of the increased on imports. As a result of these trends, while South Africa significantly expanded net exports to the region, other exporting countries like Zimbabwe, Mozambique and Zambia experienced a reduction in net exports to the region. In 1990, South Africa was a net importer in the region (with net imports of US$62 million). By the end of the decade, South Africa has transformed in a net exporter to the region with US$288 millions of net exports, while all other countries have seen large increases in their imports from South Africa.

According to Davis (2004), the major barriers to intra-regional trade are not tariffs and non-tariff regulatory regimes, but underdeveloped production structures, low productivity and inadequate infrastructure. More opportunities could result from increasing productivity and competitiveness of different crops. While the region exports 2.3 million tons of fruit and vegetables for a value of almost one billion US dollars (2002), 90 percent of the exports are from South Africa. At current technical level, most low-income countries in the region can hardly compete with South Africa for such export market. For example, the average yield of fruit and vegetable production in the low-

[1] No disaggregated data of trade of SACU countries was available, but SACU trade in the region is mainly explained by South Africa

income countries is only half of South Africa's level, and a much larger gap exists in the quality of many commodities.

In sum, opportunities exist in Southern Africa to expand production of cereals and high value crops. This expansion could be promoted by the unique opportunities that the region offers through economic linkages between high and low income countries. Despite these opportunities, the unbalanced expansion of regional trade in the past ten years mainly explained by South Africa's export growth shows the difficulties that low-income countries face to compete in regional and international markets, where regional integration could exacerbate the tendency towards polarization already evident. In the following sections we use a CGE model to analyze how regional economic linkages and agricultural productivity growth opportunities could affect growth in low-income countries and determine the strategic development choices in the region.

A general equilibrium regional model for Southern Africa

The potential to increase farm real incomes and economic growth in low-income Southern African countries by improving agricultural productivity depends on the linkages of the agricultural sector with rest of the economy and the economic interdependencies among the countries, especially between middle-income and low-income countries in the region. Thus, it is necessary to employ a regional wide general equilibrium method to fully assess agricultural growth potential in Southern Africa.

The model and data description

The CGE model, as its name suggests, consists of an economy wide, multisectoral model that solves simultaneously and endogenously for both quantities and prices. As the

core of the model consists of the reconciliation of potential demand and supply imbalances in commodity and factor markets after introducing any shock (e.g., trade policy or productivity shocks), the CGE model is a useful tool to better capture both consumption and production linkages between agriculture and the rest of the economy. In addition to these features that are common to all CGE models, in the regional CGE model used for our study, equilibrium between commodity demand and supply in the world market is also obtained, allowing the model to capture the bilateral trading relationship among all countries included. Because of this, the world commodity prices are solved simultaneously at the country level with other endogenous variables.

The technological and behavioral functions for both producers and consumers are non-linear and substitution possibilities among factors in production and among commodities in final demand are incorporated in the model. Production technology is represented by fixed input-output coefficients for intermediate goods and CES function for primary inputs: two types of labor (skilled and unskilled), land, other natural resources, and capital. While supply of other factor is assumed to be fixed within each country, the model assumes the existence of unemployment in unskilled labor among low-income Southern African countries. Production technology varies across sectors and countries, and is calibrated to the countries' data. While production demand linkages are mainly captured by the input-output relationship included in the model, in most low-income Southern African countries, such linkages are relationship weak between agriculture and nonagriculture, given that the level of intermediate input use is quite low in most agricultural activities. As value-added is the major component of production revenue evaluated at producer prices, consumption linkages are significantly affected by

the factor intensity that varies across sectors and countries. A capital intensive sector may generate less consumption linkages among poor consumers whose income comes mainly from wage earning. This is one of major reasons why growth in smallholder agriculture has relatively strong cross sector linkages in developing countries. The empirical analysis of this study will evaluate this.

Consumption demand linkages are highly affected by income level, consumption patterns and marginal propensity to consume, which varies across countries. In a general equilibrium model, the price response (price elasticities of demand) is also important, as all prices in domestic markets are endogenously solved in the model. The incomes of consumers are determined in the factor markets after subtracting taxes. The demand for commodities by sector is determined from these incomes (given the household savings propensities) and from the government consumption functions. In our regional CGE model, consumer demand is solved from maximizing a Stone-Geary utility function, which implies a linear expenditure system (LES) for an individual commodity. The income elasticities used to derive the marginal budget shares for consumption are from Reimer and Hertel (2004), in which, for example, income elasticity of demand for grain is 0.4 – 0.5 for the low-income African countries. The subsistent parameters in the demand function are calculated by assuming a Frisch parameter (together with income elasticities) for each individual country. Once we know the income elasticity and subsistent parameter, price elasticities (including own and cross price ones) can be derived by imposing homogeneity condition on the LES function. Calculated price elasticity of demand for grain, for example, is 0.15 – 0.34.

There exists price-sensitive substitution (imperfect substitution) among foreign goods and domestic production and among goods produced by different trading partners. Because such setup, imports cannot be fully substituted by domestic goods even if productivity is improved in the domestic production sector. Increasing difficulties to substitute imports implies that productivity improvement in agricultural sector is not enough and additional trading facility or improving marketing condition is necessary to overcome such difficulty.

The GTAP database version 6.1, is employed for the study and GTAP data v6.1 (Dimaranan and McDougall, 2005) represents the world in 2001.The model explicitly focuses on Southern Africa and includes six individual Southern African countries: Botswana, Malawi, Mozambique, South Africa, Zambia, and Zimbabwe, and two aggregate sub-regions: the rest of Southern African Custom Union (SACU) and the rest of southern Africa.[2] Focus of the study is low-income countries in Southern Africa, and there are four such countries (Malawi, Mozambique, Zambia and Zimbabwe) that are explicitly defined in the GTAP database.

The model focuses on agriculture and includes 21 agricultural and agriculture-related sectors and 11 nonagricultural sectors, many of which, such as transportation and

[2] The model also includes three countries in East Africa: Madagascar, Tanzania, and Uganda, a rest of Sub-Saharan Africa region, two North African countries, Morocco and Tunisia, and a rest of North African region. Outside Africa, the model includes two big Asian countries, China and India, and a rest of Asia region, as well as African two major trading partners, the U.S. and the EU, and the other European countries as a group. The rest of the world is included as a region aggregating all other countries not included above. Focus of the study is low-income countries in Southern Africa, and there are four such countries[2] that are explicitly defined in the GTAP database used in the study. They are Malawi, Mozambique, Zambia, and Zimbabwe, while Lesotho was aggregated into a region – Rest of Southern African Custom Union (SACU) in the original database.

textile, directly link with the agricultural sectors. The inclusion of more disaggregated agricultural sub-sectors is constrained by the GTAP database. Many regional important agricultural commodities (such as tobacco for exports or cassava and other root and tuber crops for mainly meeting for domestic demand) were in an aggregate sector called "the other crop" in the GTAP database and cannot be distinguished as individual commodities. For the purpose of the study we have adjusted this sector according to the market orientation. Specifically, we split "the other crop" sector included in the GTAP database into two: "export other crops" and "domestically consumed other crops." We use export other crops to represent traditional export tree crops and tobacco, while the domestically consumed other crop sector represents roots and tubers as staples. Similar adjustment has been done for the aggregated "vegetable and fruits" sector in the database. We split this sector into two: the nontraditional exportable sector and the fruits vegetables for domestic markets.

There are two transport sectors in the GTAP database (water and other transport), and we focus on transportation other than water transportation, modeling transportation services as an intermediate input consumed by other sectors in the production process and determining price margins for international trade.[3] International transportation margins are calculated for African countries using bilateral data on C.I.F. and F.O.B. prices based on information from Limao and Venables (2002). While the market value of such price gaps is treated as exports of transportation services from the good exporting countries to the good importing countries,[4] the margins will be endogenously affected by the changes in the producer price for the domestic transportation sector. Improving transportation

[3] Due to data constraint, we did not consider price margins in domestic markets.
[4] In reality, international transportation services can be provided by exporting or importing countries, but are often provided by the third party.

sector's productivity lowers the unit cost of services provided by the sector, which causes exports to become more profitable and imports to become cheaper at the given prices, as the gap between C.I.F. and F.O.B. prices is smaller.

Simulation scenarios

The study includes three groups of growth scenarios (table 2). The first group (Scenario 1) focuses on the role of South Africa as a possible engine of growth for the low-income Southern African countries. The second group of scenarios focuses on the low-income Southern African countries' own growth engines. Two types of agriculture are analyzed: growth in maize and livestock (Scenario 2) is used to discuss the role of domestic and regional food markets, while growth in fruits and vegetables, oilseeds and cotton is used in Scenario 3 to evaluate the role of nontraditional exports in regional growth. The third group of scenarios (Scenarios 4 – 5) focuses on the growth linkages between middle- and low-income Southern African countries by combing shocks of the first two groups of scenarios. In Scenario 4, growth in non-agricultural sectors in middle-income countries is combined with growth in maize and livestock in low-income countries, while Scenario 5 focuses on the nontraditional export sector combining productivity shocks to fruits and vegetables, oilseeds and cotton with non-agricultural growth in middle income countries.

Alternative growth scenarios for Southern Africa's agriculture

Agriculture in low-income countries benefits from growth in South Africa

Scenario 1 models the impact of economic growth in South Africa on the low-income Southern African countries. In this simulation, South Africa's GDP is assumed to

grow at 4.5 percent annually and such growth is primarily driven by productivity growth (as an exogenous shock) in the nonagricultural sectors, including both manufacturing and services, which reflects the trend of the economy in the past 25 years. This growth rate is consistent with the target set by South Africa's government for the next five years in the Accelerated and Shared Growth Initiative for South Africa (see South African Government Information, 2006). Assumed growth is highly possible given that South African economy did grow at 5 percent in 2005 (Statistics South Africa, 2006). There is no additional exogenous productivity shock in the agricultural sector in South Africa, nor in any other country in the region or outside the region. Thus, observed growth in South Africa's agriculture or in the other Southern African countries is solely induced by the non-agricultural sector's growth in South Africa.

Growth in South Africa does show strong impact on its neighbor's economies in the region. We use growth elasticity to measure such impact. Relatively large growth elasticity is observed in the region's other SACU countries (as a group), in which a one percent of growth in South Africa stimulates 0.33 percent of total GDP growth, indicating strong growth linkages between South Africa and other SACU countries. Calculated growth elasticity for the four low-income Southern African countries is relatively small, but it is still significant, ranking from 0.10 for Zimbabwe to 0.20 for Zambia. That is to say, a one percent of GDP growth in South Africa results in 0.10 – 0.20 percent of GDP growth in the four countries (table 3). It is important to keep in mind that our analysis may significantly underestimate the potential growth linkages in the region because the static nature of the model, which does not allow us to capture capital investment and

spillovers from technology embodied in both investment and imports of capital goods, which, as discussed in the previous sections, are more important and dynamic.

The captured growth linkages between South Africa and its neighbor countries in the model mainly come from changes in relative prices or terms of trade effects. In brief, increased productivity growth in South Africa's non-agricultural sectors increases income and expand growth of agricultural. If growth in South Africa's agriculture cannot meet with increased domestic demand, regional agricultural prices would rise, creating opportunities for its neighbor countries to increase agricultural production and exports. We further discuss these results below.

Growth in South Africa is driven by productivity increases in the country's non-agricultural sector in the simulation, while growth in its agricultural sector is either modest or declines, provided that capital and labor are competed away by a more efficient non-agricultural sector. On the other hand, income generated from non-agricultural growth increases expenditure on both agricultural and nonagricultural commodities, even though demand for many agricultural goods is income inelastic in a middle income country such as South Africa. For example, the consumer demand for wheat and maize products increases by 2.2 and 2.1 percent, respectively, while the production of these two commodities only grows at 1.6 percent. For some high-value agricultural goods with high income elasticity, such as vegetables and fruits, the growth rate on the demand side is much higher than that on the production side. As growth in production is outpaced by demand growth, South Africa's agricultural imports increase and exports fall. For example, South Africa's maize and oilseed net exports decline by 3.5 and 15.9 percent, respectively, due to increased domestic demand and slow growth in

production. As a net importer of cotton, South Africa's cotton imports increase by 16 percent due to raising demand from growth in the country's textile industry.

Change in South Africa's agricultural exports and imports creates market opportunities for its neighbor countries in which there is a comparative advantage in exporting the commodities of which South Africa either increases imports or reduces exports. Taking oilseed trade as an example, three of the four low-income Southern African countries (except for Zambia) are oilseed net exporters in the base year (2001). 16 percent of declines in South African oilseed exports result in 5 – 14 percent increases in these three countries' oilseed net exports. Similar situation occurs in cotton trade, a commodity that South Africa increases imports by 16 percent. As cotton net exporting countries, three of the four low-income Southern African countries (except for Malawi) benefit from it, though the gains are relatively modest, given that countries outside the region are strong competitors in South African cotton market.

Given South Africa's share in the regional economy, growth of its agricultural imports positively affect agricultural prices in the region and increased border prices further induces price increases in the domestic markets of other Southern African countries. Facing higher domestic prices, production is further stimulated even in those non-exportable agricultural sectors. Table 4 summarizes the growth in four aggregate agricultural sub-sectors and their contributions to the overall economic growth in the three low-income countries (except for Zimbabwe). As the table shows, growth in staple crops that are mainly for domestic markets contributes the most to the overall economic growth due to the size of these sectors and much faster growth rate in these sectors. For example, grain and other staple crops account for more than 10 percent of GDP in the

three countries, and growth in these sectors contribute to 23 – 31 percent of overall growth in GDP in the three countries.

Increased agricultural production, together with higher agricultural prices, benefits farmers more. Real agricultural income increases by 0.82 – 1.52 percent annually in the four low-income countries, when South Africa's GDP grows at 4.5 percent a year. While raising food prices may hurt the urban poor, total food consumption still increases in the four countries, ranking from 0.9 percent of increase in Mozambique to 1.3 percent in Zambia (table 3.2).

Agriculture has strong growth linkages with non-agriculture

In the second group of scenarios, we turn our focus to the low-income Southern African countries' own growth engines. Scenario 2 focuses on maize and livestock sectors while Scenario 3 analyzes the impact of growth in the nontraditional export sector. In these scenarios we exogenously increase productivity growth by 4.5 percent in the respective sectors of the three low-income countries,[5] while there is no additional growth in the other sectors in these countries and no additional growth in the middle-income Southern African countries. The cumulative effect is equivalent to doubling the countries' productivity of maize and livestock production in 15 years. The same productivity growth is also assumed for the three export subsectors in Scenario 3. By applying the same TFP growth rate for the three countries we are able to capture differences in response across countries, indicating differences in the linkage effects of those sectors in each country's economy.

Numerous earlier studies have concluded that agriculture, especially food crops, have strong growth linkages and multiplier effects; that is, increased agricultural (or food

[5] We did not consider Zimbabwe in this section given the country's uncertainty in its political situation.

crop) production would generate a disproportionately large increase in the country's total GDP, through increased demand for inputs, and more importantly, through increased consumption demand as a result of higher agricultural incomes.[6] In these two scenarios, we focus on such linkage effect by calculating GDP growth multipliers, deriving from TFP shocks in corresponding agricultural sub-sectors. Here, multipliers are defined as the total increase in real GDP or agricultural GDP divided by the increase in the shocked sector's total value-added, both measured at the initial (base-year) level of prices. The resulting multipliers derived using CGE models are in general relatively smaller than the standard fixed-price multipliers.[7] As shown in Table 5 the two groups of agricultural sub-sectors selected in this study have strong multiplier effects on either total GDP or agricultural GDP. A one unit (not one percent) increase in maize and livestock production generates ***additional*** 1.23 – 1.36 units of total GDP, and 0.99 – 1.05 units of agricultural GDP in the three low-income South African countries.

Multiplier analysis cannot reveal the scale effect, as a larger sector can have stronger impact on the overall growth, even though the multiplier may not be big. For this reason we also present the aggregate growth effect on GDP, agricultural GDP, agricultural exports and imports, and other macro economic indicators in table 6 under the two scenarios. As discussed in table 3.3, maize and livestock combined account for 32 – 55 percent of agricultural GDP in the three countries, while non-traditional exports account for a much smaller share (3 – 9 percent of agricultural GDP). Growth in maize and livestock together results in 0.2 – 0.5 percent and 1.7 – 2.4 percent annual growth in

[6] See Bell and Hazell (1980) for an early methodological discussion of alternative multiplier models used in growth linkage analysis, and the discussion of Haggblade, Hammer, and Hazell (1991) on the improvement in the multiplier models with limited price endogeneity.
[7] See Dorosh and Haggblade (2003) for a comparison of CGE and fixed-price multipliers for several Sub-Saharan African countries.

total GDP and agricultural GDP, respectively, in the three countries. On the other hand, a productivity shock of the same magnitude applied to livestock and maize generates a much smaller effect on both total GDP and agricultural GDP when the shock is applied to the non-traditional export crops.

As expected, maize and livestock growth has a larger impact on domestic production and import substitution, with maize imports falling by 12.2 – 38.7 percent and livestock imports falling by 8.6 – 10.8 percent in the three countries, resulting in a decline of total agricultural imports by 0.8 – 2.7 percent. On the other hand, the major impact of increased productivity in non-traditional export crops is on the exports, which increases by 2.3 – 2.7 percent per year in Mozambique and Zambia.

The expansion of grain and livestock output results in a reduction of domestic food prices at an annual per capita rate of -0.76 percent in Mozambique and -1.33 and -0.91 percent in Malawi and Zambia respectively, which explains the significant increases in food consumption but also shows the existence of demand constraints to the expansion of grain production. With no simultaneous growth in income generated outside the grain sector and significant substitution for imports through improving import channels, productivity in the grain sector can cause a shift in domestic terms of trade against agriculture, negating the income benefit of productivity improvement (Adelman, 1984). Simultaneous growth in maize and livestock, as simulated in Scenario 2, can help improve the terms of trade in the grain sector, such that with increased grain production domestic prices fall while agricultural income still increases in all the three countries.

Growth in middle-income countries can help low-income countries overcome their domestic demand constraints for grains

In the third group of scenarios, agricultural productivity growth in low-income Southern African is combined with growth in South Africa and other middle-income countries in the region. For the other middle-income Southern African countries, we include Botswana, rest of SACU and the rest of Southern African region to represent Mauritius and Angola. This group of scenarios can help us further understand the strong linkages and interdependency between these two groups of countries in the region.

Two scenarios are defined combining growth in middle-income countries with growth in maize and livestock (Scenario 4), and growth in non-traditional export crops (Scenario 5). South Africa's GDP is assumed to grow at the same rate as in Scenario 1 (4.5 percent annually), while growth in Botswana and the rest of SACU is assumed to be 7 and 6 percent, respectively, close to the average historical growth rates of these countries. The rest of SADC region, grows at 7 percent too, assuming economic recovery in Angola. In all these countries, growth is driven by productivity increases in the non-agricultural sectors, while for the three low-income countries, growth is driven by productivity increases in maize and livestock (in Scenario 4) and in non-traditional export crops (in Scenario 5). Similar as in Scenarios 2 and 3, a 4.5 percent of annual productivity growth rate is assumed for selected agricultural subsectors.

Stimulated by the growth in the middle-income countries, similar TFP shocks employed in Scenario 2, result in much higher growth rates in maize and livestock in this scenario. Compared with Scenario 2 in which maize grows at 1.9 – 2.6 percent in Zambia, Mozambique, and Malawi and livestock at 9.7 – 11.2 percent in Zambia, Malawi and Mozambique, growth rate of maize rises to 2.8 – 3.1 percent and growth rate of livestock increases to 10.6 – 12.0 percent in the corresponding countries in Scenario 4,

indicating much less demand side constraints to production. Because of this, and together with other general equilibrium linkage effects, Scenario 4 results in much higher annual growth in per capita GDP (1.1 – 1.2 percent in the three countries) than that (below 0.5 percent) in Scenario 2, in which growth is generated from the countries' own agricultural productivity increase alone. Increased economic growth in middle income countries also enhances impacts of productivity growth on total agricultural production. Real AgGDP per capita grows at 2.5 percent in Mozambique, 3.0 percent and 3.4 percent in Zambia and Malawi, respectively, all substantial increases compared to those in Scenario 2 (table 7).

Economic growth in the middle income countries also boosts the impact of productivity growth in non-traditional exports in the low-income countries (Scenario 5). GDP growth in Malawi, Mozambique and Zambia is more than 7 to 10 times larger in this scenario than that in scenario 3 in which the agricultural export growth is stimulated by improving productivity in these countries alone (table 3.6).

Given the strong linkage effects between low- and middle-income countries in the region, growth in grain and livestock shows larger benefits than the growth in the agricultural exports. With a similar increase in agricultural income, productivity growth in grain and livestock results in higher GDP, agricultural output, and food consumption, and more reduction in agricultural imports than that resulting from productivity growth in non-traditional export crops.

Contribution of different agricultural sub-sectors' growth to the overall economic growth varies across the three low-income countries in the simulations, even though the productivity shock is the same in these countries (table 8). For example, at agricultural

sub-sector level, maize and livestock are equally important to the GDP growth in Malawi, while in Mozambique and Zambia, contribution of livestock to GDP growth more than doubles the contribution of maize. The size of the sector and resulted real growth in the shocked sector both matter in explaining such difference across countries. In terms of sectoral size, maize accounts for more than one-third of agricultural GDP, while it is a much smaller subsector in Mozambique and Zambia (table 3.7). With 4.5 percent of TFP growth, maize production grows at 3.1 percent in Malawi, which is lower than the productivity growth because of certain negative terms of trade effect and that resources are released from maize production to other economic activities. The same productivity shock results in a relatively low (2.8 percent) growth in Mozambique's and Zambia's maize production.

On the other hand, growth in non-traditional export crops has a larger impact on agricultural exports than growth in the staple sector. This is the case for Mozambique where exports of agricultural products under Scenario 5 (increased productivity of non-traditional exports and growth of middle-income economies) increase at an annual per capita rate of 2 percent, compared to only 0.5 percent in Scenario 4 with productivity growth in maize and livestock. Zambia's growth of agricultural exports is also higher with productivity growth of non-traditional export crops, while impact on Malawi's agricultural export growth is below 0.5 percent in both scenarios 4 and 5 (table 7). Fruits and vegetables show the highest export growth rate in Mozambique while oilseed exports increase the fastest in Zambia. However, the major contribution to agricultural export growth in both countries does not come from growth in fruits and vegetables or oilseeds given their small share in total exports, but from cotton (table 9). This crop could offer

export opportunities to Zambia where it could still be considered a non-traditional export crop with a share in agricultural exports of 10 percent, compared to more than 20 percent in Mozambique. These results confirm the potential these countries have to expand non-traditional crops to diversify exports, but also show the limitations of these crops to become growth engines in the agricultural sector, due to their small share in agriculture.

Conclusions

This study has identified several characteristics that offer Southern Africa the opportunity for agricultural growth through regional linkages. The first characteristic is the complementarity between the low- and middle-income Southern African economies. Southern Africa is the only region in the continent where there are a number of middle- and low-income countries in close proximity to each other. Second, potential strong trade and investment linkages in the region can contribute to agricultural growth in the low-income countries. Regional trade has seen a significant expansion during the 1990s associated to South Africa's increasing involvement in the region, and could expand further in the coming years if South Africa is able to sustain its economic growth as occurred in recent years. This will offer new opportunities to low-income countries to expand and diversify exports, especially among the non-traditional export crops. Third, regional growth opportunities also come from the region's agricultural potential. A recovery of maize productivity to its historical high, for example, can significantly improve low-income countries' competitiveness and result in import substitution of maize, livestock and other commodities, providing these countries with more growth opportunities in agriculture. Also, increased productivity and competitiveness of non-

traditional export crops such as vegetables, oilseeds, and cotton could result in the expansion of trade of these products in the region.

In this study we have analyzed the implications that these specific characteristics have on growth choices for low-income Southern African countries engaged in an agricultural-led growth strategy. A comparison between the impacts of growth in different sub-sectors shows larger benefits to low-income countries from grain and livestock productivity growth as a result of the larger share of these activities in GDP. Productivity growth in grain and livestock results in higher GDP growth, agricultural output, food consumption, agricultural exports and lower agricultural imports than with higher productivity growth in fruits and vegetables.

A significant productivity gap exists in maize and livestock between low- and middle-income countries in the region. Productivity improvement in cereal and livestock production can contribute to boost domestic agricultural production and import substitution, and reduce the growing food deficit in low-income countries, while increasing farmers' income. Unlike other regions, where growth in grain production is likely constrained by domestic demand, growing middle-income economies in Southern Africa can provide additional demand to grains and livestock, slowing down the expected decline in grain prices in the region. Low-income Southern African countries could take advantage of growth in the middle-income countries in the region to promote sustainable growth in maize and livestock.

Potential to increase productivity and production of non-traditional export crops is also high, with export crops showing relatively high multiplier effects to the overall economic growth. However, because of their small share in the economy, nontraditional

exports are unlikely to have a big impact on overall economic growth, especially in the near future. Moreover, trade complementarity is still not significant at present in the region. The regional markets for many agricultural products seem not as important as external markets, and exports to the middle income countries, such as South Africa, represents a small share of total exports from low-income countries. Because of this, even with favorable growth conditions in the region (as assumed in Scenario 5), the expansion of agricultural exports from the low-income countries is still modest (with growth rate below 3 percent per year).

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Table 1. Production and poverty in Southern Africa

	GDP p.c. (2002 $US)	%Rural pop	Poverty head count[a]	Agriculture. to GDP
Sub-Saharan Africa (SSA)	**509**	**64**	**51**	**17**
SSA not including SAF	**297**	**66**	**55**	**31**
Southern Africa (SAF)	**1,510**	**57**	**34**	**5**
Middle Income	**2,520**	**48**	**24**	**3**
Mauritius	4,073	58	5	6
Botswana	3,372	50	31	2
South Africa	3,002	42	9	3
Namibia	1,805	68	35	9
Swaziland	1,350	73	66	9
Angola	803	64	72	6
Low Income	**310**	**68**	**46**	**20**
Lesotho	518	70	40	15
Zimbabwe	479	63	45	15
Zambia	342	60	69	18
Mozambique	243	66	38	24
Malawi	154	85	42	34

Table 2. Definition of simulation scenarios and shocks, annual per capita growth (percentage)

	South Africa	Botswana	SACU	Rest SAF	Malawi	Mozambique	Zambia	Zimbabwe
Scenario 1: South Africa as an engine of growth								
Non-agriculture	5.76	-	-	-	-	-	-	-
Scenario 2: Productivity growth in maiz & livestock								
Maize & cereals other than wheat and rice	-	-	-	-	4.5	4.5	4.5	-
Ruminants	-	-	-	-	4.5	4.5	4.5	-
Non-ruminants	-	-	-	-	4.5	4.5	4.5	-
Milk	-	-	-	-	4.5	4.5	4.5	-
Scenario 3: Productivity growth in non-traditional export crops								
Fruits & vegetables	-	-	-	-	4.5	4.5	4.5	-
Oilseeds	-	-	-	-	4.5	4.5	4.5	-
Fibers (Cotton)	-	-	-	-	4.5	4.5	4.5	-
Scenario 4: Productivity growth in non-agriculture in middle income countries and maize and livestock in low income countries								
Non-agriculture	5.76	7.34	6.25	8.25	-	-	-	-
Maize & cereals other than wheat and rice	-	-	-	-	4.5	4.5	4.5	
Ruminants	-	-	-	-	4.5	4.5	4.5	
Non-ruminants	-	-	-	-	4.5	4.5	4.5	
Milk	-	-	-	-	4.5	4.5	4.5	
Scenario 5: Productivity growth in non-agriculture in middle income countries and non-traditional export crops in low income countries								
Non-agriculture	5.76	7.34	6.25	8.25	-	-	-	-
Fruits & vegetables	-	-	-	-	4.5	4.5	4.5	-
Oilseeds	-	-	-	-	4.5	4.5	4.5	-
Fibers (Cotton)	-	-	-	-	4.5	4.5	4.5	-

Table 3. Impact of productivity growth in South Africa's non-agriculture sectors (annual per capita growth %)

	Botswana	Rest of SACU	Rest of SADC	Malawi	Mozambique	Zambia	Zimbabwe
GDP elasticity South Africa (%)	0.19	0.33	0.02	0.15	0.16	0.20	0.10
Real GDP-factor prices	0.84	1.49	0.11	0.67	0.71	0.90	0.47
Real agric.GDP base prices	0.58	1.38	0.17	0.96	0.72	1.27	0.91
Total agricultural exports	1.52	0.70	0.20	0.43	-0.47	1.24	1.06
Total agricultural imports	-0.14	1.91	-0.12	0.19	0.64	0.59	0.05
Agricultural exports to South Africa	10.18	5.92	5.94	12.71	4.61	9.21	11.25
Agricultural imports from South Africa	-0.45	1.60	-0.71	0.13	0.15	0.37	-1.00
Real agric.income	1.04	3.23	0.26	1.18	0.82	1.52	1.09
Food price index	0.68	1.09	0.09	0.27	0.38	0.24	0.09
Food consumption	1.32	1.85	0.10	1.07	0.90	1.25	0.81

Table 4. Contribution of different agricultural sub-sectors to GDP growth from growth in South Africa (percentage)

		Maize	Other domestic crops	Livestock	**Staple crops + Livestock**	Non-traditional export crops	Traditional export crops	**Total export crops**	Total agriculture
Malawi	Share in total agriculture value added	41.86	18.32	13.05	**73.22**	8.45	18.33	**26.78**	100.00
	Annual growth in value added	0.46	1.70	1.03	**0.87**	1.02	0.94	**0.97**	0.90
	Contribution to growth of ag. value added	21.37	34.75	15.02	**71.14**	9.64	19.22	**28.86**	100.00
Mozambique	Share in total agriculture value added	21.16	56.25	10.67	**88.09**	3.65	8.26	**11.91**	100.00
	Annual growth in value added	0.38	0.95	0.98	**0.82**	0.56	-0.10	**0.10**	0.73
	Contribution to growth of ag. value added	11.06	73.00	14.32	**98.38**	2.77	-1.14	**1.62**	100.00
Zambia	Share in total agriculture value added	19.95	42.20	13.88	**76.02**	8.87	15.10	**23.98**	100.00
	Annual growth in value added	0.79	1.67	1.02	**1.32**	1.37	1.06	**1.17**	1.29
	Contribution to growth of ag. value added	12.32	54.76	11.01	**78.10**	9.47	12.43	**21.90**	100.00

Table 5. Multiplier effects of agricultural sub-sectors in low income countries

		GDP	Agricultural GDP
Maize + Livestock	Malawi	1.36	1.05
	Mozambique	1.31	0.99
	Zambia	1.23	1.05
Non-traditional export crops	Malawi	1.26	0.99
	Mozambique	1.66	1.02
	Zambia	1.47	0.95

Table 6. Impact of productivity growth in grain and livestocka and non-traditional export crops (annual per capita growth %)

	Scenario 2: Grain & livestock			Scenario 3: non-traditional export crops		
	Malawi	Mozambique	Zambia	Malawi	Mozambique	Zambia
Real GDP	0.48	0.34	0.24	0.19	0.17	0.18
Real agric.GDP base prices	2.44	1.80	1.68	0.78	0.54	0.68
Agricultural exports	-0.19	1.09	0.98	0.09	2.67	2.29
Agricultural imports	-2.71	-0.79	-1.90	-0.36	0.15	-0.67
Real agric.income	0.51	0.67	0.31	0.52	0.49	0.33
Food price index	-1.33	-0.76	-0.91	-0.09	0.02	-0.07
Food consumption	2.59	1.58	2.03	0.28	0.25	0.28

Table 7. Impact of productivity growth in grain and livestocka and non-traditional export crops and growth in non-agriculture in middle income countries (annual per capita growth %)

	Scenario 4: Grain & livestock			Scenario 5: Non-traditional export crops		
	Malawi	Mozambique	Zambia	Malawi	Mozambique	Zambia
Real GDP	1.16	1.06	1.20	0.88	0.89	1.14
Real agric.GDP base prices	3.42	2.51	2.96	1.78	1.26	1.93
Agricultural exports	0.21	0.51	1.90	0.48	2.10	3.24
Agricultural imports	-2.85	-0.23	-1.43	-0.54	0.70	-0.21
Real agric.income	1.82	1.51	1.91	1.86	1.34	1.94
Food price index	-0.99	-0.34	-0.62	0.26	0.45	0.23
Food consumption	3.63	2.46	3.32	1.31	1.12	1.56

Table 8. Contribution of different sectors to GDP growth as a result in growth in agriculture in low-income countries and non-agriculture in middle-income countries (percentage)

		Maize + Livestock	Maize	Livestock	**Non-traditional export crops**	Fruits and vegetables	Oilseeds	Cotton
Malawi	Share in total agriculture value added	**48.57**	37.03	11.54	**7.73**	2.33	3.95	1.46
	Annual growth in value added	**4.93**	3.11	10.74	**10.58**	1.17	3.76	2.65
	Contribution to growth of ag. value added	**54.68**	26.35	28.33	**50.67**	1.69	9.19	2.39
Mozambique	Share in total agriculture value added	**28.76**	19.12	9.64	**3.46**	1.42	0.32	1.71
	Annual growth in value added	**5.89**	2.81	11.99	**11.65**	10.62	13.02	12.24
	Contribution to growth of ag. value added	**48.31**	15.32	32.99	**32.72**	12.28	3.41	17.03
Zambia	Share in total agriculture value added	**29.70**	17.52	12.19	**7.98**	1.69	2.50	3.79
	Annual growth in value added	**6.00**	2.76	10.64	**8.55**	8.61	7.20	9.41
	Contribution to growth of ag. value added	**44.85**	12.18	32.67	**37.35**	7.95	9.85	19.55

Table 9. Contribution of non-traditional export crops to growth in agricultural exports of low-income countries (with productivity growth in non-traditional export crops in low-income countries and in non-agriculture in middle-income countries, percentage)

		Fruits & vegetables	Oilseeds	Cotton
Malawi	Share in total exports	1.95	0.41	1.16
	Export growth	22.34	35.11	24.46
	Contribution to ag. export growth[\a]	89.09	29.59	57.90
Mozambique	Share in total exports	10.15	5.70	22.23
	Export growth	20.68	12.73	14.87
	Contribution to ag. Export growth	39.49	13.66	62.19
Zambia	Share in total exports	9.33	0.73	10.60
	Export growth	16.78	38.00	21.61
	Contribution to ag. Export growth	43.57	7.73	63.74

Note: Contribution to growth of these crops is greater than 100 percent because of negative growth in exports of other commodities

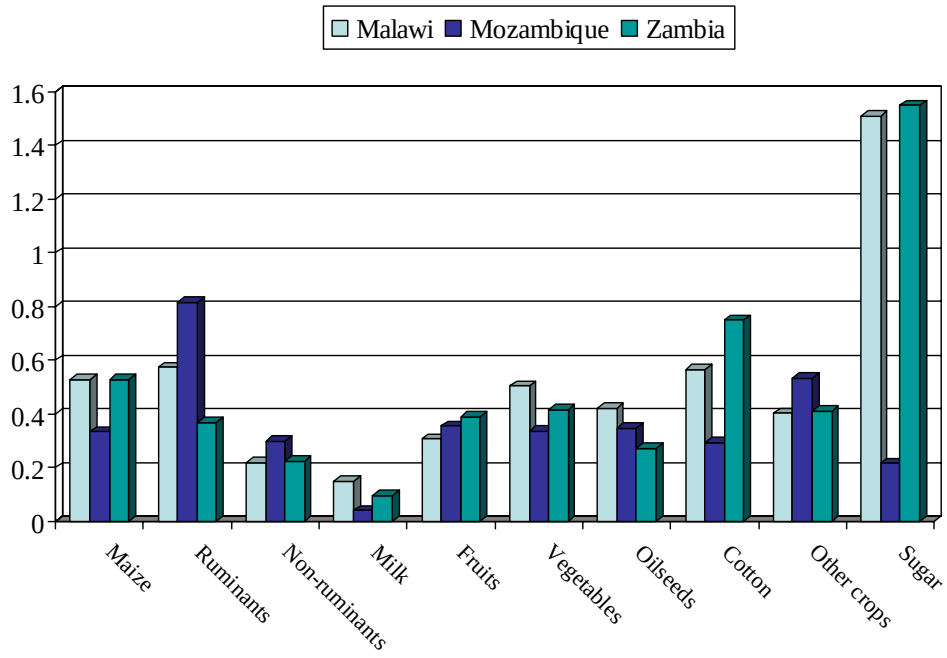

Figure 1. Average productivity of agricultural commodities relative to South Africa 1998-2003 (South Africa's productivity = 1)