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# Competitiveness and revealed comparative advantage in the SADC maize industry

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**Abstract**

This paper evaluates the production and trade trends for maize and maize products in southern Africa, individual countries' revealed comparative advantages in producing these products, and the expected implications of freer trade in this sector. The analysis employs mainly annual bilateral trade data for the period 1996-2004, evaluated using comprehensive descriptive measures and the Revealed Comparative Advantage index. Results indicate that at least half of the countries in the SADC region are deficit producers of maize and maize products, and that only South Africa is a net exporter of all products considered. Substantial cross-hauling is observed, and the bulk of locally produced products are traded regionally, with over 90% regional bias for half of all positive trade, although specific opportunities for increased regional trade also exist. Tariff protection generally lies below rates observed elsewhere in the world for this sector; however, for half of the region, consistent non-tariff measures also are maintained. Regional competitiveness in production is restricted to a few countries that possess the capacity to produce and export significant quantities; and with the exception of those countries, the region as a whole lacks net comparative advantage in maize and maize flour production by global standards. These results suggest a need for concurrent policy interventions to improve production, regional and international trade. Food security strategies focusing solely on improving regional trade, while beneficial to specific regional producers, are unlikely to produce major food security benefits.

Keywords: Comparative Advantage, Competitiveness, Maize, SADC,

## Introduction

This paper evaluates inter-country competitiveness in maize production for the Southern Africa Development Community (SADC) region. The study seeks to establish, in light of the current move towards regionalism, the nature of expected benefits/losses from greater openness in maize trade. This analysis also serves to provide a comprehensive characterization of production and trade competitiveness for maize in the region, within the framework of existing trade policies. Using bilateral trade data for a sample of 12 SADC countries, evaluated through the Revealed Comparative Advantage (RCA) Index and comprehensive descriptive measures, the study assesses first the nature of current trade relations within the region, and between the region and the world; and second, the comparative advantages revealed by current production and trade flows in maize for each country. The main hypothesis tested is that SADC countries have different production expertise revealed through different trade capacities; therefore regional output can be improved through specialization and trade.

## Methods and Data

The analysis employs descriptive measures including self sufficiency ratios, the proportion of net-trade to total trade, the Grube-Lloyd intra-industry trade index, an analysis of the magnitude of tariff and non-tariff protection measures, and an assessment of regional bias in trade. Comparative advantage revealed by historic and current trade flows is established using import, export and net-trade RCAs for each SADC country, as defined in Table 1.

The RCA index employs observable trade balances to infer relative industrial competitiveness. Industries are said to exhibit international competitiveness if they are proficient at producing goods for the export market, whereas industries that are net importers are assumed to lack competitiveness.

Using conditions (4), (5) and (6), comparative advantage is revealed when: (i) $x_{i,j} > 1$ and $m_{i,j} < 1$, or (ii) $\omega_{i,j} > 1$. Note that unlike the first condition, where some ambiguity in interpretation might occur when the indices $x_{i,j}$ and $m_{i,j}$ move in the same direction, the second condition requires only that $x_{i,j}$ exceed $m_{i,j}$ for comparative advantage to hold. A look at all three types of the index gives a holistic understanding of the main driver of comparative advantage. The RCA index is a good choice for achieving the outlined objectives

in that it allows us to assess, based on current and historic trade data, the commodity types for which individual countries have shown competence in production and exports. Revealed trade pattern reflects differences in relative costs as well as non-price factors, both important in assessing relative competitiveness. The method has the added advantage of simplicity in application and limited data requirements, and compared to neoclassical measures of comparative advantage such as the Heckscher-Ohlin theory, the RCA is preferred because it is not based upon restrictive assumptions that may in practice not hold. Some limitations of the RCA are worth noting. First, RCA indices are not measures of efficiency, i.e. they only can describe trade patterns that have taken place, but cannot tell whether those patterns are optimal. Second, RCAs do not reveal the source of comparative advantage thus, cannot be interpreted on the basis of inherent differences between nations, for example differences in protective measures, transport costs, taste structures, or traditional ties (Donges 1982). Additional analyses would have to be done to deduce the source of advantage. Third, studies have suggested that RCA-based results are sensitive to the form of the index used in the analysis. Ballance (1987) shows that different indices are more consistent when viewed as binary measures of comparative advantage, than as cardinal ones.

Often, however, the objective is neither to predict theoretic, optimal comparative advantages, nor to establish the particular explanatory factors that gave rise to those advantages. In practice, economies are subject to numerous macroeconomic instabilities that produce disequilibria, making it difficult to accurately predict the relative prices and trade volumes in an undistorted macro environment, as predicted by Ricardian comparative advantage. Moreover, innovation has given rise to dynamism in comparative advantage, so that in most industries comparative advantage is no longer a static condition based on international division of resources, but a result of deliberate policy interventions to develop and sustain advantages in specific sectors. The RCA index enables us to measure those types of advantage.

**Table 1**. Methods

| Competitiveness Measure | Definition |
|---|---|
| Self sufficiency ratio | $d_{i,j} = (Q_{i,j} / D_{i,j}) \times 100$ (1) |
| Proportion of Net trade to Total Trade | $\frac{X_{i,j} - M_{i,j}}{X_{i,j} + M_{i,j}}$ (2) |
| Grube-Lloyd intra-industry trade index | $GLI_{i,j} = 1 - \left\| \frac{X_{i,j} - M_{i,j}}{X_{i,j} + M_{i,j}} \right\|$ (3) |
| Export RCA (Balassa 1965) | $x_{i,j} = \frac{X_{i,j} / X_{tot,j}}{X_{i,w} / X_{tot,w}}$ (4) |
| Import RCA (Donges 1982) | $m_{i,j} = \frac{M_{i,j} / M_{tot,j}}{M_{i,w} / M_{tot,w}}$ (5) |
| Net trade RCA (Murrell 1990) | $\omega_{i,j} = x_{i,j} / m_{i,j}$ (6) |

where $Q_{i,j}$ is the quantity of commodity $i$ produced in country $j$, $D_{i,j}$ is country $j$'s demand of the commodity $i$, $X_{i,j}$ ($M_{i,j}$) is exports (imports) from country $j$ of product $i$, $X_{tot,j}$ is the total exports from country $j$, $X_{i,w}$ is world exports of commodity $i$, and $X_{tot,w}$ is total world exports.

The data requirements for this analysis include (1) annual country-level bilateral trade data, (2) current tariff and non-tariff measures, and (3) annual production and consumption data, for the period 1996 to 2004. Bilateral trade data were obtained from the World Integrated Trade Solution (WITS) database, for 12 of the 14 SADC countries (excluding Angola and Democratic Republic of Congo), complemented by statistics from the UN's FAOSTAT, TRAINS and COMTRADE databases, and the WTO's IDB database. Informal trade updates were made for Mozambique, Zambia, Zimbabwe, Malawi and Tanzania, using informal trade statistics reported at country-level by the National Institute for Statistics (2006) for Mozambique, the USAID unrecorded cross-border trade studies (1995), FEWS NET informal cross-border trade records (2006), and the Michigan State University Food Security Group (2004-2006). The tariff rates and NTMs were obtained from WITS and TRAINS respectively, at the HS 6-digit level, and production and consumption data were obtained mainly from FAOSTAT, complemented by statistics from national statistics offices where available. Statistics are converted to US dollar equivalents for ease of comparison across countries. Results are presented in Table 2.

## Results and Discussion

In this analysis, computations generally use averages for the nine-year study period data, unless otherwise stated. Note that the NTM percentage values presented in Table 2 tell us simply how many tariff lines under the HS subheading are covered by the existing non-tariff measures, without any information on the nature of the NTMs, or the extent to which these are trade distorting. Three different forms of the RCA index are computed according to equations (4), (5) and (6) in Table 1, using first the SADC region as the 'world market', to reveal differences in comparative advantage for SADC countries relative to each other; and second using global trade statistics to assess global advantage in production and export. Only the net-trade RCA values from these analyses are presented in Table 2.

### *Production and Utilization*

Results indicate that at least half of the countries in the SADC region are deficit producers of maize and maize flour. Exceptions include South Africa-Tanzania, Madagascar and Malawi, the occasional self-sufficient or surplus producers of maize. Of these, Madagascar, South Africa and Tanzania are net exporters of maize grain, and only Namibia and South Africa are net exporters of maize flour. The largest regional demand, in trade volumes, is from Zambia and Zimbabwe, although in terms of proportions, Mauritius, Botswana and Namibia are more depended on imports.

Trade occurs mainly at the regional level, and is guided by sub-regional trading agreements such as the tariff-free SACU agreement for South Africa, Botswana, Lesotho, Namibia, and Swaziland; COMESA for Zimbabwe, Zambia and Malawi; and EAC for Tanzania, Kenya and Uganda. We observe an over 90% regional bias for at least half of all positive trade, though occasional significant trade with the world market is also observed, suggesting some untapped potential for improved regional trade. Such trade, however, is only important for food security if large enough to contribute significantly to the region's demand. Results indicate that although Mauritius and Madagascar have the lowest levels of trade with the SADC region, their limited supply, demand and trade volumes make their lack of involvement trivial to the region's broader food security agenda. On the other hand, Tanzania and South Africa's extra-regional exports of maize grain, Tanzania and Zambia's exports in maize flour, as well as Zimbabwe and Mozambique's grain imports are of some significance to the region. We note however that in a tally of supply to needs, the region still falls short of its requirements (a quantity-based net trade ratio of -0.38 is observed for the region).

Substantial cross-hauling is observed among SADC countries, indicating significant cross-border movement of maize and maize products. Cross-hauling also is an indication of seasonal exports that might need to be replaced later by comparable amounts of imports, or re-exports from a surplus trading partner. Notice, for example, that although South Africa appears capable of large maize exports to the region, a significant proportion of those exports need to be compensated for by imports to balance domestic requirements. Here, the source of advantage may be better access to surplus world markets, rather than greater efficiency in production per se. In terms of tariff protection, SADC's MFN rates for the maize sector generally lies below those observed in some of the world's largest producers of cereals, notably Argentina, China, India, Thailand and Japan. In comparison to other African regions, SADC tariffs are still among the lowest, relative to say Cameroon (5-

30%), Ghana (20%), Nigeria (up to 70%), Kenya (25-60%) and Morocco (35-40%). For half of the SADC region, however, consistent non-tariff measures (trade license requirements, trade taxes, monopolistic measures or export bans) are maintained. No clear relationship seems to exist between the level of tariff protection and the degree of self-sufficiency. South Africa, the largest producer, maintains some of the lowest tariff rates with no NTMs, comparable to other deficit SACU countries; whereas Tanzania, the second largest producer, maintains some of the highest tariff rates with NTMs, comparable to deficit markets such as Zambia and Zimbabwe.

***Revealed Comparative Advantage***

In interpreting the results a distinction is made between revealed inter-country 'competitiveness' in producing a given commodity, versus revealed 'comparative advantage' for a given country in producing specific products. Comparative advantage can be ascribed to enterprise-specific policies, whereas competitiveness is often subject to a country's broader macroeconomic environment (Lafay 1992). In evaluating revealed advantages through the RCA index, the focus is on establishing where competitiveness and comparative advantages lie, rather than the sources of these advantages. Additionally, bearing in mind the limitations of the RCA as a cardinal measure of comparative advantage, the discussion focuses instead on the ordinal trends of revealed advantage.

Results indicate that Botswana, Mauritius, Swaziland and Zimbabwe exhibit no regional or global *net* comparative advantages in the maize sector (recall that just the post-2000 data were used for RCA analyses for Zimbabwe). For Swaziland (Zimbabwe), only the export-specific advantage in maize flour (grain) is revealed, although due to a higher proportion of imports, this advantage is not sustained at net trade levels.

Malawi and Mozambique are both fairly large producers of maize by regional standards, with no clearly revealed net advantages in either grain or flour. Export-specific advantages, however, are revealed at both the global and regional levels for Malawi (global only for Mozambique), and considering disaggregated annual trade flows, we observe that in fact, the net trade RCAs for grain in Malawi exceed 1 for some of the seasons considered, although not frequently enough to establish an overall advantage. Although Tanzania and Zambia also export proportionately more maize and maize flour than an average SADC (global) country, revealed by > 1 export-specific RCAs, these exports are balanced out by equally large imports, so that no net comparative advantages are revealed. Lesotho reveals no net advantages at the regional trade level (some export-specific advantages in maize and maize flour resulting from fairly large exports to South Africa are observed), and at the global level, net comparative advantage is revealed in maize flour. A similar trend is observed for Namibia, where substantial amounts of maize flour are exported to Angola and South Africa, despite Namibia being a deficit producer of maize. Compared to other SADC countries, Namibia's net advantage in maize flour is second only to South Africa's, though still less than 1. The global advantage is more prominent. Madagascar is reveled to be a smaller maize importer than an average SADC country, probably explained by the lower dietary importance of maize. The country produces fairly large amounts of maize (a near self sufficient producer) but is not a significant exporter, both by global and regional standards. No net comparative advantages are revealed at the regional trade level, and the > 1 net-trade RCA for maize observed at the global level is mostly 'import advantage' driven.

Most of South Africa's cereals exports are absorbed by the SADC region, with limited exports to the rest of Africa, the EU and other world markets (maize exports are the most global in reach). Maize imports follow the reverse trend, with South Africa sourcing more maize from the world market compared to the SADC region. The largest regional supplier of maize has traditionally been Zimbabwe (imports have dropped dramatically in the past few years), with less significant imports observed from Malawi, Zambia and more recently, Mozambique.

Global comparative advantage is observed for maize, and maize flour, sustained on net. At regional trade level, although an export-specific disadvantage in maize flour is observed, the import advantage ensures that a > 1 net-trade RCA is maintained. Overall, South Africa dominates the competitiveness scene, showing the highest export potential in both maize and maize flour. By regional standards, Tanzania and Madagascar show the least comparative disadvantage in maize grain in the rest of SADC, and Lesotho and Namibia appear most competitive in maize flour. On a global advantage scale, a similar trend is revealed,

except now, net advantages (RCAs > 1) are actually observed for most of these cases.

## Conclusion

The main objective of this study was to assess revealed comparative advantages and competitiveness in the maize sector of the SADC region, with the purpose of establishing (1) if substantial (diverse) competitiveness exists in maize production and export within the region, and (2) if significant room exists for improved regional trade. Results show that insufficient output is a greater concern for SADC than insufficient regional trade; nonetheless, specific opportunities for increased regional trade exist. Competitiveness in the maize sector is restricted to a few countries that possess the capacity to produce and export significant quantities; and with the exception of a few specific countries, the SADC region generally lacks net comparative advantage in maize and maize flour production on a global scale. These results suggest a need for concurrent policy interventions in improved production, increased regional trade, and increased international trade. A food security strategy that focuses solely on improving regional trade, while beneficial to specific regional producers, is unlikely to produce major food security benefits, since these countries are themselves only at the verge of food self-sufficiency.

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**Table 2**: Descriptive Statistics and RCA Indices, Average 1996-2004

| | Maize Production (Cons.) metric tons | Maize Self Suffic-iency Ratio | MFN Ad Valorem Rate (NTM Incidence) % | | SADC Imports (Exports) % of total imports (exports) | | Proportion of Net Trade to Total Trade (G-L Index) | | Regional Net-trade RCA | | Global Net-trade RCA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Grain | Flour | Grain | Flour | Grain | Flour | Grain | Flour | Grain | Flour |
| Botswana | 10,647 (87,150) | 12.22 | 2^ | 9.4^ | 0.987 (0.998) | 0.999 (0.997) | -0.97 (0.03) | -0.91 (0.09) | 0.005 | 0.003 | 0.0071 | 0.0203 |
| Lesotho | 123,955 (382,180) | 32.43 | 2 | 9.4 | 0.958 (1) | 1.000 (0.999) | -0.71 (0.29) | -0.42 (0.58) | 0.194 | 0.188 | 0.7479 | 1.3707 |
| Madagascar | 208,201 (209,823) | 99.22 | 5 | 5 | 0.435 (0.004) | 0.0493 (0.011) | 0.32 (0.68) | -0.97 (0.03) | 0.507 | 0.002 | 1.9543 | 0.0162 |
| Malawi | 1,848,448 (1,985,560) | 93.09 | 0 (100) | 10 (100) | 0.734 (0.658) | 0.549 (0.877) | -0.85 (0.15) | -0.96 (0.04) | 0.074 | 0.006 | 0.3934 | 0.0469 |
| Mauritius | 331 (95,360) | 0.35 | 0 (100) | 15 (100) | 0.166 (0) | 0.534 (0) | -0.99 (0.01) | -0.99 (0.01) | 0.004 | 0.008 | 0.0137 | 0.0568 |
| Mozambique | 1,178,671 (1,450,340) | 81.27 | 2.5 (100) | 25 (100) | 0.619 (0.599) | 0.993 (0.950) | -0.63 (0.37) | -0.80 (0.20) | 0.089 | 0.056 | 0.2071 | 0.4060 |
| Namibia | 28,694 (163,189) | 17.58 | 2 | 9.4 | 0.967 (0.984) | 0.894 (0.999) | -0.99 (0.01) | 0.29 (0.71) | 0.010 | 0.894 | 0.0283 | 6.5059 |
| South Africa | 9,861,159 (9,050,330) | 108.9 | 2 | 9.4 | 0.074 (0.672) | 0.937 (0.991) | 0.38 (0.62) | 0.89 (0.11) | 1.440 | 75.617 | 3.0180 | 550.04 |
| Swaziland | 99,911 (140,887) | 70.92 | 2 | 9.4 | 0.997 (1.000) | 1.000 (0.999) | -0.93 (0.07) | -0.66 (0.34) | 0.014 | 0.019 | 0.0296 | 0.1351 |
| Tanzania | 2,821,778 (2,273,550) | 124.1 | 25 (100) | 25 (100) | 0.296 (0.674) | 0.266 (0.550) | 0.001 (~1) | -0.74 (0.26) | 0.326 | 0.069 | 0.7843 | 0.5015 |
| Zambia | 907,669 (1,590,380) | 57.07 | 15 (100) | 15 | 0.923 (0.902) | 0.867 (0.575) | -0.48 (0.52) | -0.57 (0.43) | 0.166` | 0.102 | 0.3991 | 0.7389 |
| Zimbabwe* | 659,386 (1,478,926) | 44.59 | 25 (100) | 30 | 0.642 (0.948) | 0.949 (0.994) | -0.84 (0.16) | -0.98 (0.02) | 0.032 | 0.000 | 0.0706 | 0.0031 |

*Statistics for the post-2000 periods. ^Converted to ad valorem equivalent from specific SACU rates. `Excluding outlier values for 1996 and 1997 *Sources*: World Development Indicators 2005; FAOSTAT 2006; WITS 2005, TRAINS 2006, Author's Calculations