Trade Policy Reforms in the Cereals Sector of the SADC Region: Implications on Food Security

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1. Introduction

Policy makers in the southern Africa region have the big challenge of reconciling domestic and foreign policy, in order to maintain stability in food supply and prices. Improving intra-regional trade, through reduction of tariff and non-tariff measures has been widely advocated for as a critical piece in the food insecurity puzzle. Recommendation have included the facilitation of freer grain movement to address isolated shortfalls (SADC FANR 2003, Mano 2003), simplification and harmonization of trade regulations (Tschirley et al 2004), and integration of the region into the global markets (World Bank DTIS studies 2004) as critical components of a comprehensive food strategy. Production and consumption trends in the region indicate that although the region is on net, a surplus producer of cereals (SADC FANR, 2003), significant food insecurity persists in parts of the region (1/3 of the SADC population, WDI 2005) – a result of severe inter and intra-seasonal supply and price fluctuations. As policy makers increasingly turn to alternative supply sources to stabilize local output, regional markets become as important in addressing food security issues as domestic markets. However, the lack of a clear understanding of the welfare effects of specific trade policy options on individual countries and economic groups, necessary to reduce ambiguity in policy recommendations and to accurately anticipate potential negative effects, has forced countries to remain significantly closed with regards to trade in food commodities. Efforts to quantify micro and macro level benefits from freer trade in grains in the region have been limited, and specific effects of trade reforms remain largely unknown[1]. This study contributes towards bringing quantitative evidence to the trade – food policy debate, through evaluation of the price and welfare effects of tariff reforms in the cereals sector of the southern Africa region. The specific objectives are to (1) compute the expected price responses to tariff reforms in the cereals sector, (2) assess the potential welfare implications on consumers and producers in each country of the region, and (3) establish the potential effects of these reforms on price responsiveness to external supply shocks.

[1] Previous literature has either focused on evaluating welfare effects at a broad macro level (Chauvin *et al* 2002, Poonyth *et al* 2002, Jere 2002, Kahuika 2002, Madola *et al* 2002, Mafusire 2002, Mukherje 1996), or on understanding trade policy (SADC FANR, 1996-2005) and monitoring cross-border grain movements (FEWS/WFP, 2004-2005).

2. Trade Policy and Food Security in Southern Africa

The Southern Africa Development Community (SADC) region is an integration block made up of 14 countries in sub-Sahara Africa (SSA). Through mostly unilateral national policy, countries of the SADC region have undergone market liberalization policy reforms in the past two decades, aimed at promoting freer trade among members. Although SADC is not a regional trading block per se, promoting intra-regional trade has become one of its core objectives, as evidenced by the ratification of the Trade Protocol in 2000, under which countries agreed to gradually phase-out tariffs in most economic sectors by 2012. In addition, half of SADC countries are already members in autonomous free trading agreements (FTAs) in existence in SSA: the Southern African Customs Union (SACU) and the Common Market for Eastern and Southern Africa (COMESA), under which trade is either tariff-free (SACU), or almost tariff-free (COMESA). Despite these reforms, intra-regional trade in southern Africa remains low, accounting for about 5% of total trade, and trade restrictions are maintained in most strategic sectors. Regional trade in grains (especially the region's staple – maize) is a case in point, subject to tariffs averaging 12%, import and export regulatory requirements, and special sanitary and phyto-sanitary (SPS) restrictions. Trade policy in this sector remains marred with unpredictability, often justified as being necessary to stabilize producer incomes and food prices (Mano et al, 2003; Jayne et al, 2005). Extra-regional exports are observed (23% of total exports), even as severe food shortages persist in parts of the region (SADC Food Security Network, 2003). Cross-hauling is also observed (24% of total regional trade), and policy coordination on pertinent issues such as production and sale of genetically modified (GM) grains is limited. South Africa and Zimbabwe are the only countries with clear legislation on production and sale of GM grain, but even for these countries, regulations differ.

On a sub-regional level, distinct features of trade policy can be identified. Member of SACU: Botswana, Lesotho, Namibia, Swaziland, and South Africa, have relatively low tariffs (the same across all SACU countries) on trade with the SADC region[2]. No licenses are required for trade, although special

[2] In South Africa, for example, tariff protection on maize is based on a tariff band formula which delivers a tariff only when world prices fall below US $110/ton US Gulf coast free-on-board prices - current tariff rates on maize are 0%.

SPS measures and tariff quota restrictions apply for some commodities[3]. Malawi, Zambia and Zimbabwe – the SADC countries that are also members of COMESA – also enjoy tariff-free trade with each other for most cereal products, though having autonomous policies on trade with the rest of the world (ROW). These countries also have a similar state-interventionist history in their cereals production and trade policy however, with market oriented reforms implemented in the past few years, countries have adopted more liberal trade policy. In Malawi tariffs on maize grain have been eliminated, though import licenses are required to engage in trade, and tariffs of up to 25% are maintained for products such as wheat flour. Zambia has no import license requirements for trade in cereals, but imports are subject to tariffs of up to 25%, and numerous antidumping, rules of origin and SPS measures[4]. For Zimbabwe, cereal imports are subject to relatively high tariff rates (up to 30%), and several SPS restrictions. Import levies are generally applied on imports, such as the US$3.50/50kg bag levied on private imports of maize grain, maize meal or rice in excess of one bag (FEWNET 2005). Only the state trading enterprise – the Grain Marketing Board (GMB) – has legal authority to engage in, or provide license for, trade of grains. Ad-hoc policy shifts are not uncommon. Mozambique's cereals sector, one of the least protected in the region, has tariff rates ranging between 2.5 and 7.5%, higher only for wheat and maize flour at 25%. Nonetheless, trade is governed by trading licenses, extensive inspections, and non-trivial taxes. In Tanzania, exports are generally restricted, trade can only be conducted through state-issued licenses, and an almost flat tariff rate of 25% is applied to imports of cereals and cereal products. Tanzania trades more closely with Uganda and Kenya under the East African Community (EAC) than with SADC in import/export of cereals. A summary of selected descriptive statistics on the structure of the cereals sector of the SADC region between 1999 and 2002[5] – the study period – is presented in Table 1, where Angola, DRC and Mauritius are aggregated into 'other SADC', and Madagascar, SADC's newest addition, is excluded from the analysis. In accordance with the GSIM model discussed in Section 3, the variables 'imports/exports' include trade with self (local production consumed locally, valued at world prices).

[3] South Africa applies tariff quota restrictions of 269,000tons for maize, 108,279 tons for wheat, and 21,116 tons sorghum.
[4] The Zambian government for example, maintains, and has used, the right to ban exports during poor harvest seasons.
[5] 2002 tariff rates may differ from current rates, where countries have engaged in further reforms.

Table 1: Descriptive statistics – SADC Cereals sector, 1999-2002

	Average tariff on ROW imports (%)	Average tariff on imports from SADC (%)	Major regional source of imports (% of Imports)	Major regional export market (% of Exports)	Domestic Absorption (%)	Domestic contribution to local needs (%)	Membership in other Regional Integration Agreements
Botswana	9.0	4.0	S.Africa (61.5)	S.Africa (39.2)	26.4	1.6	SACU
Lesotho	9.0	4.0	S.Africa (51.4)	S.Africa (18.5)	81.4	45.6	SACU
Malawi	16.0	6.0	S.Africa (9.4)	Zimbabwe (0.1)	98.5	72.7	COMESA
Mozambique	9.0	5.0	S.Africa (3.0)	Malawi (4.6)	94.8	76.0	-
Namibia	9.0	4.0	S.Africa (31.4)	Angola (9.0)	90.3	41.2	SACU
South Africa	9.0	4.0	Lesotho (0.3)	Botswana (1.8)	87.7	87.0	SACU
Swaziland	9.0	4.0	S.Africa (67.2)	S.Africa (12.9)	82.6	31.0	SACU
Tanzania	25.0	25.0	S.Africa (0.4)	Malawi (0.55)	98.1	86.0	EAC
Zambia	12.0	8.0	S.Africa (8.0)	Zimbabwe (0.2)	98.3	86.2	COMESA
Zimbabwe	20.0	16.0	S.Africa (5.2)	Botswana (2.7)	94.4	91.2	COMESA
Other SADC	12.0	12.0	S.Africa (2.6)	Zambia (0.03)	97.7	42.7	-

The structure of the industry and the nature of existing trade relations among SADC countries, are expected to influence the welfare gains from implementing region-wide tariff reforms for specific countries and country sub-groups. For example, welfare effects on net-exporters to the SADC region (South Africa, Tanzania, Mozambique and Zimbabwe) are expected to differ from those expected on net importers, with producer surplus responses from a given price change expected to always exceed the consumer surplus response from an equivalent price change; whereas the opposite is expected for net importers. The effects of tariff reforms for countries already participating in one or more regional FTAs may also differ non-trivially from those expected for the rest SADC, as implementing region-wide tariff reforms in these countries may result in preference erosion. Generally, we expect regional tariff reforms to lead to either trade creation through increased trade volumes among existing regional trading partners, or trade diversion, as new trading partners established within the region replace trade with the ROW. Accordingly, trade creation is strictly beneficial for the countries within the FTA, and at least as beneficial for the rest of the world, since it leads to increased overall trade volumes. Trade diversion, on the other hand, generally causes welfare loss to both the importing country (through the shifting of imports to a more expensive regional source, and through revenue losses) and the ROW (through lost trade). Therefore the welfare impacts of a FTA are generally ambiguous a priori, and depend considerably on the extent to which trade creation effects exceed the trade diversion effects (Hoekman and Scheiff 2002).

3. The Model

The global simulation model (GSIM), due to Francois and Hall (2003), was used in this analysis to estimate the potential welfare effects of tariff reforms implemented in thirteen SADC countries. This static, partial equilibrium model allows for multi-country modeling, to capture welfare effects of policies implemented at regional and global levels. The partial equilibrium nature implies that analyses can be focused to tariff-line level (the source of tariff changes), and by aggregating all countries in which no policy changes are expected, the analysis can be focused only on those countries of interest. The model is detailed, utilizing comprehensive bilateral trade and tariff data at highly disaggregated levels, as well as data such as exports, domestic production and domestic absorption (captured as trade with self). The inclusion of export statistics adds the requirement of export market clearing to the global market clearing conditions, thus improving precision of results through consolidation of import and export trade flows, and enabling the analysis of global export market access policies. The inclusion of domestic production and absorption allows for the prediction of self-sufficiency effects, a critical policy issue in food markets. This framework also offers extensive analytical capacity compared to conventional partial equilibrium tools, providing for the analysis of simultaneous policy changes in domestic production, taxes or subsidies; export taxes or subsidies; and tariff rates. Compared to global general equilibrium models, the GSIM model is more flexible, allowing for disaggregated sector specific analysis while capable of maintaining global scope – computable general equilibrium models typically provide estimates at aggregate levels. GSIM also offers transparency, so that welfare evaluation, measured in explicit income terms, can be disaggregated into producer, consumer and state level effects; and sources of economic adjustments can be clearly identified (Francois and Hall 2003).

The GSIM model is based upon the assumption of national product differentiation. The Armington assumption recognizes that commodities may not be homogenous across borders, implying that imports are imperfect substitutes of each other. In accordance with Armington 1969, we adopt the constant elasticity of substitution assumption for products competing in any market, so that elasticities are independent of market share and are the same between any pair of products competing in the same

market. Assuming weak separability of demand and homothetic preferences represented by a constant elasticity of substitution (CES) utility function, we obtain an unambiguous demand for any subset of products in each market. Both the elasticity of aggregate demand and elasticity of export supply are held constant; and import demand and export supply take on the log-linear form. Following Francois and Hall 2003, the elements of the GSIM model can be summarized as:

Import demand	$M_{(i,v),r} = f(P_{(i,v),r}, P_{(i,v),s\neq r}, y_{(i,v)})$
Export supply	$X_{i,r} = f(P^{w}_{i,r})$
Consumer price of good *i*	$P_{(i,v),r} = (1+t_{(i,v),r})P^{w}_{i,r} = T_{(i,v),r}P^{w}_{i,r}$, *and* $P_{(i,v)} = \sum_r(\theta_{(i,v),r} . P_{(i,v),r})$
Income effect	$N_{(i,v),(r,s)} = \theta_{(i,v),s}(E_m + E_s)$
Substitution effect	$N_{(i,v)(r,r)} = \theta_{(i,v),r}E_m - (1-\theta_{(i,v),r})E_s$
Change in Consumer price	$\Delta P_{(i,v),r}/P_{(i,v),r} = \Delta P^{w}_{i,r}/P^{w}_{i,r} + \Delta T_{(i,v),r}/T_{(i,v),r}$
Change in Export supply (%)	$\Delta X_{i,r}/X_{i,r} = E_{X(i,r)}(\Delta P^{w}_{i,r}/P^{w}_{i,r})$
Change in Import demand (%)	$\Delta M_{(i,v),r}/M_{(i,v),r} = N_{(i,v),(r,r)}(\Delta P_{(i,v),r}/P_{(i,v),r}) + \sum_{s\neq r}N_{(i,v),(r,s)}(\Delta P_{(i,v),s}/P_{(i,v),s})$
Global market clearing for *r*	$\Delta M_{i,r}/M_{i,r} = \Delta X_{i,r}/X_{i,r}$, *where* $M_{i,r} = \sum_v M_{(i,v),r}$
Change in consumer surplus[6]	$\Delta CS_{(i,v)} = \sum_r(R^0_{(i,v),r}T^0_{(i,v),r}).(\frac{1}{2}E_{m,(i,v)}(\Delta P_{(i,v)}/P_{(i,v)})^2 - (\Delta P_{(i,v)}/P_{(i,v)}))$
Change in producer surplus	$\Delta PS_{(i,r)} = X^0_{(i,r)}\Delta P^{w}_{i,r} + \frac{1}{2}\Delta P^{w}_{i,r} . \Delta X_{i,r}$
Change in government revenue	$\Delta GR_{(i,v)} = (\sum_r R^1_{(i,v)r} . T^1_{(i,v),r} - \sum_r R^1_{(i,v),r}) - (\sum_r R^0_{(i,v)r} . T^0_{(i,v),r} - \sum_r R^0_{(i,v),r})$

Where $M_{(i,v),r}$ is quantity of good *i* from region *r* in country *v*, $P_{(i,v),r}$ is its price and $y_{(i,v)}$ total expenditure in *v* on good *i*; $X_{i,r}$ quantity of good *i* from region *r*; $t_{(i,v),r}$ import taxes; $P^{w}_{i,r}$ world price of *i* originating from region *r*; $P_{(i,v)}$ composite consumer price of *i* in region *v*; $N_{(i,v),(r,s)}$ cross price elasticity; $N_{(i,v)(r,r)}$ own price elasticity; $\theta_{(i,v),s}$ expenditure share of imports of *i* from *s* in region *v*; E_m the composite demand elasticity in importing region *v*; E_s elasticity of substitution; E_X elasticity of export supply; $T^0_{(i,v),r}$ initial tariff level on imports of good *i* from *r* into *v*; $M^0_{(i,v),r}$ is the base quantities of *i* from *r* into *v*, and $R^0_{(i,v)r} = P^{w}_{i,r} . M^0_{(i,v),r}$ initial expenditure on good *i* from *r* in *v* at world prices, $R^0_{(i,v)r} . T^0_{(i,v),r}$ initial expenditure at internal price; and $R^0_{i,r} = P^{w}_{i,r} . X^0_{i,r}$ the benchmark export revenue for region *r* from exports of *i*.

A few limitations of the GSIM model are noted. First, a partial equilibrium model, GSIM fails to capture inter-sectoral linkages, thus may suppress potentially significant economic interactions. Consequently, gains/losses from tariff reforms tend to be overestimated, as resource re-allocation among sectors is not taken into account. This hypothesis is tested in section 4.5 by running comparable policy simulations using a global general equilibrium model – GTAP[7]. Second, like most applied global models, GSIM is based on the representative agent assumption. However, in a region where diversity exists among different producer and consumer groups, in terms of responsiveness to changes in income or prices, household welfare effects may differ non-trivially from aggregate effects. Price transmissions are also assumed to be complete, and to the extent that changes in border parity prices are only partially

[6] Approximate value, since import demand is defined as a log-linear function, not a linear function as such.
[7] The GSIM model is chosen because it enables decomposition and quantification of welfare effects into monetary terms for different household groups – the study's main objective. With GTAP welfare effects cannot be disaggregated into producer/consumer surplus.

transmitted to the household and producer levels, actual welfare responses to reforms may be less severe.

4. Empirical Application

4.1 Data

The data required for this analysis include (1) bilateral trade volumes by source and destination, (2) domestic production and absorption, (3) tariff rates, and (4) elasticities of composite demand, supply and substitution. Data were obtained from the World Integrated Trade Solution (WITS) database, SADC Secretariat, GTAP Database, US International Trade Commission (USITC), Food and Agriculture Organization (FAO) database FAOSTAT, and national statistics offices. Comprehensive bilateral trade data were available from WITS for 11 of the 13 SADC countries included in the study for a period of 4 years from 1999 to 2002 (statistics for Angola and DRC were deduced from inverse sides of these statistics and from aggregate FAOSTAT statistics). The sector 'cereals' is defined as all grains and processed products of maize, wheat, rice, sorghum, millet, and other small grains[8] as they appear in Chapters 10 and 11 of the 2002 Harmonized Commodity Description and Coding System. Using WITS elasticities and import volumes at tariff line level, sector elasticities of demand were computed by the import weighted average method, to obtain elasticities of 'composite demand' ranging from -0.55 to -1.01 for the countries in the region. Specific duties were converted to their ad valorem equivalents using the WTO formula[9], and tariff rates were aggregated across tariff lines using the global unit value weighted sum method[10] to avoid the problem of endogeneity associated with import weighted averages. The analysis employed a symmetric supply elasticity of 0.8 adopted from Jayne et al 1994, and an elasticity of substitution of -5 adopted from the USITC[11]. Considering the usual sensitivity of results to choice of parameters such as elasticities, robustness tests were performed in Section 4.4, using varying elasticities of substitution and supply, and tariff rates obtained from the different tariff-line aggregation methods.

[8] Includes rye, barley, oats, buckwheat, and canary seed. These collectively account for a very small percentage total trade volumes.
[9] Ad valorem Equivalent rate = Specific Duty x Quantity Imported ÷ Value of Imports at world prices
[10] 'Global unit value' is Global value of trade at tariff line level/Total quantities traded.
[11] USITC Office of Economic Research Note No. 2004-01-A

4.2 Simulations

The policy simulations performed in this section included: (1) elimination of intra-regional tariffs, assuming that SADC tariffs on ROW imports are maintained at current rates (to assess the potential impacts of tariff reforms in the cereals sector according to the SADC Trade protocol); (2) elimination of tariffs on imports from the region and the ROW (to compare welfare effects of intra-regional to global tariff reforms); and (3) exposure to external supply shock (to assess response to a supply shock in a SADC country, first in the absence of liberalization, then with liberalization).

4.3 Results

a. Intra-regional versus MFN Tariff Reforms

Results from the first 2 simulations are presented in table 2, with the parenthesized values representing results from the second simulation – indiscriminate elimination of tariffs on imports into SADC.

Table 2: Intra-regional vs MFN Tariff Elimination

	Overall Consumer Price Change %	Producer Price for Home Goods Change %	Output Change %	Domestic Absorption Change %	Imports from SADC Change %	Imports from ROW Change %	Aggregate Supply Change %	Producer Surplus Change US$'000	Consumer Surplus Change US$'000	Tariff Revenue Change US$'000	Net Welfare Effect US$'000	Net Welfare as % of total value of cereals trade
Bots	-2.14 (-3.95)	-0.53 (-1.94)	-0.42 (-1.6)	-6.1 (-6.5)	3.2 (1.4)	-8.7 (24.6)	1.9 (3.6)	-85 (-311)	1884 (3503)	-1901 (-2296)	-102 (895)	-0.12 (1.06)
Les	0.16 (-1.08)	0.15 (-0.85)	0.12 (-0.7)	-0.1 (-0.4)	-0.3 (-0.3)	1.4 (36.2)	-0.1 (0.8)	87 (-490)	-142 (968)	-125 (-186)	-181 (291)	-0.20 (0.33)
Mal	1.00 (-1.77)	-0.69 (-1.25)	-0.56 (-1.0)	-0.6 (-1.0)	20.3 (23.4)	-4.1 (20.7)	0.9 (1.6)	-3640 (-6528)	5858 (10396)	-2321 (-3093)	-103 (774)	-0.02 (0.13)
Moz	0.24 (-1.94)	0.35 (-1.19)	0.28 (-1.0)	-0.7 (-2.2)	17.5 (14.6)	0.3 (15.4)	-0.2 (1.5)	1088 (-3731)	-923 (7436)	-201 (-3703)	-37 (0.9)	-0.01 (0.0002)
Nam	0.53 (-3.36)	1.00 (-2.04)	0.80 (-1.6)	-2.8 (-3.7)	0.5 (-10.4)	2.5 (26.2)	-0.5 (2.9)	242 (-488)	-275 (1756)	97 (-1141)	-33 (126)	-0.01 (0.25)
S.A	0.50 (-1.78)	0.57 (-0.92)	0.46 (-0.7)	-0.9 (-2.5)	7.1 (2.6)	2.0 (33.7)	-0.5 (1.8)	15807 (-25270)	-13823 (49778)	380 (-26917)	2364 (-2410)	0.09 (-0.09)
Swa	0.39 (-1.01)	0.35 (-0.74)	0.28 (-0.6)	-0.1 (-0.5)	-0.1 (-0.1)	1.9 (36.6)	-0.3 (0.8)	66 (-140)	-183 (476)	-38 (71)	-155 (263)	-0.33 (0.56)
Tan	-0.11 (-7.09)	-0.02 (-4.93)	-0.01 (-3.9)	-0.4 (-4.9)	98.8 (72.8)	-0.4 (70.1)	0.1 (5.9)	-123 (-36584)	929 (63315)	-926 (-24914)	-120 (1816)	-0.01 (0.22)
Zam	-1.72 (-2.76)	-1.27 (-2.05)	-1.01 (-1.6)	-1.3 (-2.0)	20.0 (21.0)	-7.6 (24.4)	0.9 (1.5)	-4200 (-6785)	6555 (10563)	-2497 (-3173)	-142 (604)	-0.04 (0.16)
Zim	-1.58 (-3.30)	-0.96 (-2.28)	-0.77 (-1.8)	-2.2 (-3.3)	57.2 (53.6)	-7.0 (53.9)	0.9 (1.9)	-7232 (-17068)	12468 (26119)	-3992 (-9255)	-756 (-205)	-0.10 (-0.03)
other SADC	-0.42 (-8.59)	-0.28 (-5.79)	-0.23 (-4.6)	-0.3 (-5.5)	42.4 (-4.9)	-1.7 (19.0)	0.4 (7.7)	-1024 (-20517)	3555 (74768)	-3494 (-51281)	-963 (2969)	-0.12 (0.37)

Effects of Intra-regional and (MFN) tariff elimination.

At a sub-regional and country-level, results indicate that with intra-regional tariff reforms, COMESA countries (Malawi, Zambia, Zimbabwe) are expected to experience a decrease in producer prices, as broader SADC tariff reforms encourage greater import response, and aggregate supply (output + imports

– exports) increases in each market. Domestic absorption and imports from each other generally drops (a result of preference erosion) as trade with other countries in the SADC region increases, whereas trade with the rest of the world decreases. The lower consumer prices imply gains in consumer surplus, and these outweigh the losses in producer surplus in all three countries, as expected for net importers from the region[12]. Botswana follows similar trends, differing from other SACU countries mainly because of its relatively high trade with non-SACU SADC countries[13]. Lower prices in these markets lead to increased imports into Botswana, hence lower prices. For the rest of SACU, prices are expected to increase, as the increase in exports to the SADC region outweighs the expected rise in both domestic output and total imports. As expected for net-importer SACU countries, the gains in producer surplus are outweighed by the losses in consumer surplus, and net welfare gains are generally negative – even when government revenue effects are not considered. For South Africa – a net-exporter – the increase in producer surplus exceeds the loss in consumer surplus and net welfare is positive. Notably, the general price trends differ between countries in the SACU free-trade region and those in COMESA, plausibly because in the SACU case when preferential access is extended to the whole region, it is still profitable for SACU countries to continue importing from South Africa, whereas for COMESA, SADC-wide tariff reforms reveal more profitable import sources and countries switch. For Mozambique, smaller price and welfare effects are expected, not surprising given the already low tariff rates. Mozambique also imports only 4% of domestic needs from SADC, and exports a similar proportion of local production, so that regional tariff reforms do not generate major responses on the domestic market. Tanzania is only different in that its tariff rates are the highest in the region, however, it also trades more with the ROW (notably EAC countries) than with SADC (imports from SADC account for only 0.5% of local needs), and has high domestic absorption rates. Therefore intra-SADC tariff reforms, though triggering up to a 98% increase in trade with the region, also generate small responses on the domestic market. Both Tanzanian and Mozambican exports to the ROW currently face very low tariff rates, so that intra-SADC tariff reforms

[12] Zimbabwe is a net exporter to the region, during the study period, but since the expected decrease in producer prices is almost twice the expected drop in consumer prices, we also get a net increase in (producer + consumer) surplus.
[13] Zimbabwe, for example, supplies 30% of Botswana's cereals needs.

provide limited incentive for increased trade[14]. We note again that private net welfare effects (excluding government revenues) are also positive for these 2 countries. Overall, results from this simulation indicate that on net, elimination of intra-regional tariffs is welfare reducing for the region (a robust result, as indicated by the sensitivity tests performed in section 4.4).

Unilateral elimination of tariffs on all imports, on the other hand, is welfare improving[15]. These results are interesting in that they seem to indicate an absence of capacity in most of SADC to respond sufficiently to price incentives (aggregate supply also fails to respond, even with higher supply elasticities). The results thus support the notion that exclusionary regional trade agreements could be welfare reducing, since they risk diverting trade away from more efficient producers, towards less efficient, preferred producers (Hoekman and Scheiff 2002). We observe that when tariff reforms are intra-regional, imports from the ROW drop for most net-importer SADC countries, while trade with the SADC region generally increases (indicating trade diversion); whereas non-discriminate tariff reforms generally lead to increased imports from both the region and the world. South Africa appears to benefit from being both the largest producer in the region (produces about 50% of regional output) and a convenient market for ROW exports (due to location and relatively low protection rates compared to the ROW[16]). Thus when only SADC trade is freed, both South Africa's exports to SADC, and its imports from the ROW[17], increase. When the region opens to the global markets, this competitive edge is lost.

b. Response to Intra-Regional Supply shock

In this simulation, the effects of a supply shock originating from one SADC country, South Africa, is evaluated – chosen because it is the only country that trades bilaterally with all of SADC[18]. The effects of incremental hypothetical drops in South Africa's output are evaluated and results from a 20% decrease in output presented here (inter-seasonal output variability in South Africa has ranged from -45% to 67% around the mean in the past 25years). Two simulations were run: first evaluating the effects of the supply

[14] Both Mozambique and Tanzania are coastal countries thus trading with the world by sea may be cheaper than trading with the SADC region by rail or road.
[15] Positive net welfare effects are also expected if only external tariffs are eliminated, maintaining current tariffs on imports from the region.
[16] Import-weighted tariff rates in the cereal world market is about 38%, WITS 2005
[17] In response to higher internal prices in the South African market. Notice that South Africa's tariff revenues increase as well
[18] Ordinarily, given the similarity in climatic conditions for distinct subsets within the region, climate related supply shocks will likely affect more than one country. To maintain tractability of the analysis, we assume that the supply shock is only experienced in one country.

shock in the absence of tariff reforms, then after region-wide tariff reforms. The results presented in Table 3 indicate that a supply shock generated in South Africa is likely to cause major price increases throughout the region, highest for SACU countries and lowest for countries whose trade with South Africa is limited, such as Tanzania. Domestic absorption is also expected to increase universally (countries reduce exports), but aggregate supply is expected to drop in each country due to lower imports from the region. The magnitude of these responses seems to not change much after tariff reforms, although in this case, the price increases expected for SACU countries is lower, and that for the rest of the region higher, than in the restricted trade case. Tariff reforms therefore seem to serve the purpose of spreading risk of a supply shock, making it less intense for South Africa and other SACU countries, and more intense for the rest of SADC, considering though that the differences are small.

Table 3: 20% Production Shock in South Africa

	Composite Consumer Price (% change)	Regional Imports (% change)	Regional Exports (% change)	Domestic Absorption (% change)	Total Supply (% change)	Overall Welfare Effects ($'000)
Botswana	4.97 (4.56)	-10.35 (-9.15)	2.88 (2.70)	7.08 (6.79)	-7.43 (-6.70)	-3 310 (-3 283)
Lesotho	5.60 (5.50)	-13.56 (-13.40)	0.76 (0.75)	5.22 (5.12)	-4.70 (-4.48)	-2 520 (-2 469)
Malawi	1.43 (1.56)	-12.97 (-12.32)	0.01 (-0.09)	1.38 (1.52)	0.33 (0.32)	-1 903 (-1 828)
Mozambique	0.52 (0.58)	-31.51 (-30.74)	4.21 (4.56)	0.37 (0.38)	-0.27 (-0.34)	-811 (-755)
Namibia	3.14 (3.05)	-24.6 (-24.32)	2.80 (2.64)	3.83 (3.98)	-2.33 (-2.23)	-1 025 (-998)
South Africa	6.60 (6.48)	9.97 (10.24)	-24.4 (-25)	-11.50 (-11.40)	-6.56 (-6.39)	11 837 (14 414)
Swaziland	6.28 (6.17)	-11.38 (-11.25)	0.75 (0.51)	6.90 (6.82)	-5.26 (-5.14)	-2 210 (-2 170)
Tanzania	0.09 (0.13)	-28.16 (-27.36)	4.90 (4.97)	0.04 (0.08)	-0.06 (-0.13)	-425 (-317)
Zambia	1.51 (1.76)	-22.98 (-23.78)	4.52 (2.90)	1.60 (1.88)	-1.95 (-2.41)	-2 854 (-2 688)
Zimbabwe	1.22 (1.56)	-28.30 (-27.36)	9.25 (8.20)	0.90 (1.25)	-1.20 (-1.89)	-4 036 (-3 407)
otherSADC	0.29 (0.37)	-28.70 (-27.84)	7.83 (8.34)	0.29 (0.36)	-0.18 (-0.32)	-1 879 (-1 572)

*Pre and (post) tariff reform effects

4.4 Sensitivity Analyses

Results from the sensitivity tests support the overall results discussed in section 4.3, if not with similar magnitudes of change, at least with the same direction of change. Higher supply elasticities are associated with smaller producer price effects and larger output effects than those predicted with an export supply elasticity of 0.8. However, even at very high elasticity values of say 100, net welfare effects are still negative for most of SADC, although SACU countries fare better with higher regional output responses. Lower elasticities of substitution are consistent with lower quantity and price

responses, hence smaller welfare effects. Here again, increasing degree of substitutability by as much as twenty-fold will neither affect the expected direction of change, nor move the region into the positive net welfare range. Different tariff aggregation methods produce, in specific cases[19], some non-trivial differences in sector-level tariff protection rates. These differences translate to some significant differences in net welfare effects. When the higher 'simple average' tariff rates are used, for example, a few additional countries would now expect positive net welfare gains from intra-regional tariff reforms, an indication that if indeed effective protection in this highly regulated sector exceeds tariff rates used in this analysis, the net welfare effects computed here would be an underestimation of what we can expect with full-fledged trade policy reforms.

A General Equilibrium Assessment:

To compute the expected welfare effects of tariff reforms in a general equilibrium setting, the Global Trade Analysis Project (GTAP) [20] was used. In addition to allowing for inter-sectoral adjustments, this analysis also captures a unique feature of the SADC cereals sector: the fact that producer and consumer groups are not always mutually exclusive, by assuming a single regional household that is both an owner of the factors of production and a consumer. In comparing results, we note that because the GSIM and GTAP models are based on different underlying assumptions about the structure of preferences, measures of welfare and underlying data such as elasticities, country group aggregation and tariff line concordances, direct comparisons of results would be erroneous. Processed cereals, for example, are aggregated into the broader 'food' sector in GTAP, and it is not clear that the tariff aggregation method for each sector is similar to that used in the GSIM model in this study. Therefore the purpose of the sensitivity analysis is not to make one-for-one comparisons of predicted welfare effects, but to evaluate the robustness of the *general trends* predicted by the GSIM analysis.

[19] In Malawi, for example, the average tariff rate obtained from the *import weighted* average aggregation method is 1 percent, whereas the *global unit value weighted sum* method gives a 4 percent rate, and the *simple average* method a 16 percent rate.

[20] The GTAP model is a static general equilibrium model, comprising a regional household involved in consumption, savings and government spending decisions, where expenditure is distributed in fixed shares among these household decisions. The model assumes a Cobb Douglas aggregate utility function modeled through a non-homothetic CDE function, that simplifies to a CES function elasticity of substitution is assumed constant. Changes in private incomes and utility from policy reforms is measured by the percentage change in private utility in a given region, which is a function of changes in private household incomes (the sum of the value household endowments), the share of the specific good in total consumption, and the income elasticity of demand (Hertel, 1997).

In this simulation, intra-regional tariffs are eliminated on cereals imported from the SADC region, but maintained on cereals imported from the world. With a few exceptions[21], the general trend in expected welfare responses is similar to that expected in the GSIM model, though at smaller magnitudes. Notably, net welfare effects are either negative or almost negligible for most of SADC, COMESA countries are still expected to experience drops in producer and consumer prices, producer prices are expected to increase in SACU countries, welfare gains are highest for South Africa, and negligible welfare effects are expected for Tanzania. Domestic absorption is still expected to drop universally, and the supply response to be small. These results thus seem to highlight similar trends and support the earlier conclusion that expected price and welfare effects of intra-regional tariff reforms in the cereals sector of the SADC region are small and generally negative[22].

Table 3: General Equilibrium Assessment, GTAP model

	Composite Market Price (% change)	Domestic Supply Price (% change)	Domestic Output (% change)	Domestic Absorption (% change)	Equivalence Variation (% change)	Overall Welfare Effects (% change)
Botswana	-0.02	0	-0.01	-0.05	-0.04	-0.03
Malawi	-1.54	-0.23	-0.94	-13.74	-0.42	-0.29
Mozambique	-0.38	-0.09	-0.39	-4.75	-0.25	-0.19
South Africa	0.03	0.06	0.64	-0.63	3.64	2.55
otherSACU	-0.02	0.01	0.02	-0.03	0.04	0.04
Tanzania	-0.04	-0.01	0.03	-0.51	-0.08	0.00
Zambia	-0.55	-0.14	-0.87	-8.37	-0.07	0.01
Zimbabwe	-0.16	-0.02	-0.2	-5.32	-0.17	-0.11
otherSADC	-0.57	-0.04	-0.2	20.26	-0.21	-0.10

5. Conclusion and Areas of Further Research

This study uses the GSIM model to evaluate the welfare effects of tariff reforms in the cereals sector of the SADC region. The objective is to assess if intra-regional tariff reforms hold the potential to improve food security in the SADC region, through increased physical and economic assess to food. Results from the analysis indicate that intra-regional tariff reforms alone would have small price and output effects in the short run, with negative net welfare effects expected for all but South Africa. In the best case

[21] Botswana and Mozambique: with price and welfare effects expected to be smaller and slightly higher respectively, than earlier predicted.
[22] We also note that because applied welfare analyses, such as the one performed here, are second best evaluations that take into account the policy distortions already in existence in an economy, in principle, trade liberalization may fail to improve welfare if it leads to resource re-allocation from one distorted sector to an even more distorted one (Francois and Reinert, 1997).

scenario, when only 'private' net welfare effects are considered (by excluding government revenue losses), positive regional net welfare is expected – implying increased private incomes. However when government revenues are included, results indicate that overall income available to pursue physical and economic access to food would decrease with intra-regional tariff reforms. Combined with reforms of external tariffs, regional and national net welfare is expected to increase considerably from region-wide tariff reforms, although at higher costs to regional producers. Therefore, if the objective of the tariff reforms in SADC's cereals sector is to improve regional wealth, as a means for improved economic access to food, intra-regional tariff elimination, *on its own*, is not a sufficient policy option.[23].

A few caveats to the general conclusions drawn above are in order. First, food security is generally a household phenomenon, and although this study attempts to disaggregate welfare effects at national producer and consumer level, a deeper understanding of household decomposition for each country would shed more light on the more micro level effects of the reforms discussed in this paper. Second, this study uses annual data, and while these data capture inter-seasonal variability of quantity and price trends within the study period, they mask intra-seasonal variability – an important component of food security especially for vulnerable consumer groups. This study, while indicating increased grain mobility within the region as a result of tariff reforms, does not address the issue of continuity in supply at regional, national and household levels. Lastly, the quantitative analyses performed here enable us to evaluate only the welfare effects resulting from tariff reforms, and do not capture either the potential implications of concurrent non-tariff responses, such as improved trade policy coordination and border efficiencies, or the effects of removing non-tariff barriers to trade. Non-tariff barriers, where they exist, imply higher effective rates of protection, and their removal – higher price and welfare effects.

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[23] Weber 1988 and Kydd 2004 also reach similar conclusions. Hoekman and Schieff 2002 predict that developing countries are more likely to lose from a South-South FTA because such an arrangement entails little or no beneficial trade creation. They argue that a high probability exists that one of the members may gain – usually the most advanced country with a more developed manufacturing sector and is thus the closest competitor with the ROW – whereas the rest of the region would lose; and suggest that in order to reduce asymmetric distribution of the gains/losses of integration, and lessen the chances of trade diversion, member of an FTA must also reduce external tariffs. The results from this study support these arguments.

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