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Should Regional Trade Liberalization of Agriculture be a Policy Priority in Southern Africa?

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ABSTRACT

We develop a detailed trade analysis to assess the potential impacts of a free trade agreement (FTA) on the agricultural sector of Southern African countries. We do this by combining the use of a partial equilibrium analysis with bilateral trade data at the four-digit Standard International Trade Classification (SITC) level for 193 agricultural industries in 14 Southern African countries. Results show that the overall welfare effects of a FTA would be positive but small in most countries. Largest benefits would go to countries with a regional comparative advantage for agriculture, while still being inefficient producers of regionally traded commodities. No direct gains for importing countries are expected because a FTA would increase imports from inefficient regional producers, with trade diversion dominating trade creation. These results suggest that the region should be looking at regional policies and interventions beyond trade arrangements, such as those targeting investment, agricultural productivity and diversification to enhance benefits of regional trade liberalization.

Key words: regional trade agreement, Southern Africa, agricultural trade

JEL Codes: F15, Q17, Q18

SHOULD REGIONAL TRADE LIBERALIZATION OF AGRICULTURE BE A POLICY PRIORITY IN SOUTHERN AFRICA?

INTRODUCTION

In the last two decades Southern Africa has witnessed a growing number of regional cooperation and integration initiatives. The Southern African Development Community (SADC) was formed in 1992¹ and a new economic environment has emerged in the region with the adoption of the protocol on trade in 1996 with the aim of establishing a free trade area (FTA) by 2008 and full liberalisation of trade by 2012.²

Most of the SADC countries have undertaken substantial trade policy reforms since the mid-1980s, in line with market liberalisation policies and regional integration initiatives. The driving force behind the engagement of these countries in trade agreements has been to secure an improvement in market access for exports and attain efficiency in sourcing imports (ESRF 2003). Since most SADC economies are predominantly agriculture-based, and food dominates agricultural trade among the SADC countries, enhanced trade in agricultural products potentially provides a tool for fighting poverty in the region, promoting integration and increasing economic growth and welfare.

What could be expected from trade liberalization among SADC countries? Several studies have looked at the impact of a FTA in southern Africa and tried to answer this question (see Nin-Pratt

¹ Member countries are: Angola, Botswana, the Democratic Republic of Congo (DRC), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

² Angola and the DRC are currently not applying the trade protocol (SARDC 2008).

et al., 2008 for references and a discussion of some of this work). The great diversity of approaches, the contrasting results between some of these studies, and limited information about integration in agriculture, justifies further exploration of the impact of a FTA on agriculture in Southern Africa. To complement previous studies mainly using CGE or econometric approaches at a relatively high level of aggregation, we develop a detailed analysis of the impact of a FTA on the agricultural sector of SADC countries combining the use of the most disaggregated bilateral trade data available and a methodology that is at the same time simple and theoretically sound. Our goal is to assess the potential welfare impacts of a FTA on the agricultural sector of southern African countries and to determine opportunities and challenges faced by the region as a consequence of the agreement. In the next section we present the conceptual framework and methodology used for this analysis. This methodology is then used in section 3 to evaluate the welfare impact of a FTA on agriculture. Section 4 concludes.

CONCEPTUAL FRAMEWORK AND METHODOLOGY

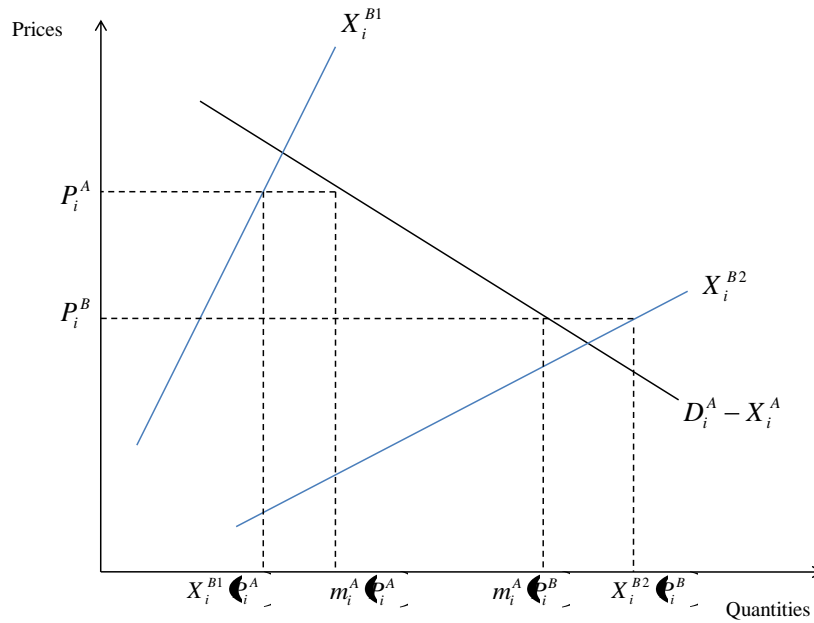
We adopt Grossman and Helpman's (1995) framework and in particular the adaptation of their framework by Vaillant and Ons (2003). We present this framework for two small economies (A and B), which could represent respectively regional import and export markets. We assume that all goods are produced with constant returns to scale, using labor and a sector specific factor; consumers within each economy have identical preferences which are represented by a quasi-linear utility function. The economy is small and therefore world prices are given exogenously. Without loss of generality, all international prices (P_i^*) are normalised to one, while domestic prices in country Z are equal to the international price increased by an *ad valorem* tariff:

$$P_i^Z = P_i^*(1 + t_i^Z) \quad (1)$$

Initially, the most favoured nation (MNF) principle holds. We assume that country B is at least a more efficient producer of commodity i than A, which means that domestic prices of good i in A and B are:

$$P_i^A > P_i^B > 1, \text{ with } P_i^B=1 \quad \text{if B is an efficient exporter of good } i \quad (2)$$

Figure 1 Effects of a regional trade agreement



Source: Adapted from Grossman and Helpman (1995).

Figure 1 shows the demand for imports by country A and two different total supply curves for country B.³ The location of B's supply depends on the endowment of the specific factor used by

³ Notice that this is not export supply but total supply of industry i of country B.

B to produce i . If the production capacity of B is small, then total supply of i from country B is represented by X_i^{B1} . The opposite extreme case is that the specific endowment in B is so large that country B's supply of i can satisfy A's import demand at the lower price P_i^B and still export to the rest of the world. In this case B's supply response is represented by the curve X_i^{B2} . The relevant cases in this framework are given by those products which are initially imported by at least one of the countries, subject to a most favoured nation (MFN) tariff rate different from zero (sensitive commodities). If this is the case, and as stressed by Grossman and Helpman (1995), depending on the size of B's potential supply, three different outcomes from integration could result in this market: a) enhanced protection; b) reduced protection; and c) the intermediate case. We briefly discuss the first two cases and its implications for each country/region. The intermediate case is a combination of the effects of the two extreme cases and will not be discussed here (see Vaillant and Ons, 2003).

Reduced protection

Supply in country B (X_i^{B2} in figure 1) at the lowest initial price P_i^B can satisfy all of country A's import demand,

$$X_i^B(P_i^B) > m_i^A(P_i^B) \quad (3)$$

Under a trade agreement A stops importing from the rest of the world (ROW) and its domestic price falls to P_i^B . The producers in A enjoy less protection under the trade agreement than in the initial equilibrium. Producers in B are the only foreign suppliers in A's market, and they also satisfy at least a part of their domestic market. The price paid by consumers in B for good i and the price obtained by producers in B remains unchanged at the level P_i^B .

Enhanced protection

An FTA results in enhanced protection for the exporter when at the initial price in A (P_i^A), the aggregate supply of country B (X_i^{B1} in Figure 1) is not enough to satisfy all the import demand of country A;

$$X_i^B(P_i^A) < m_i^A(P_i^A) \quad (4)$$

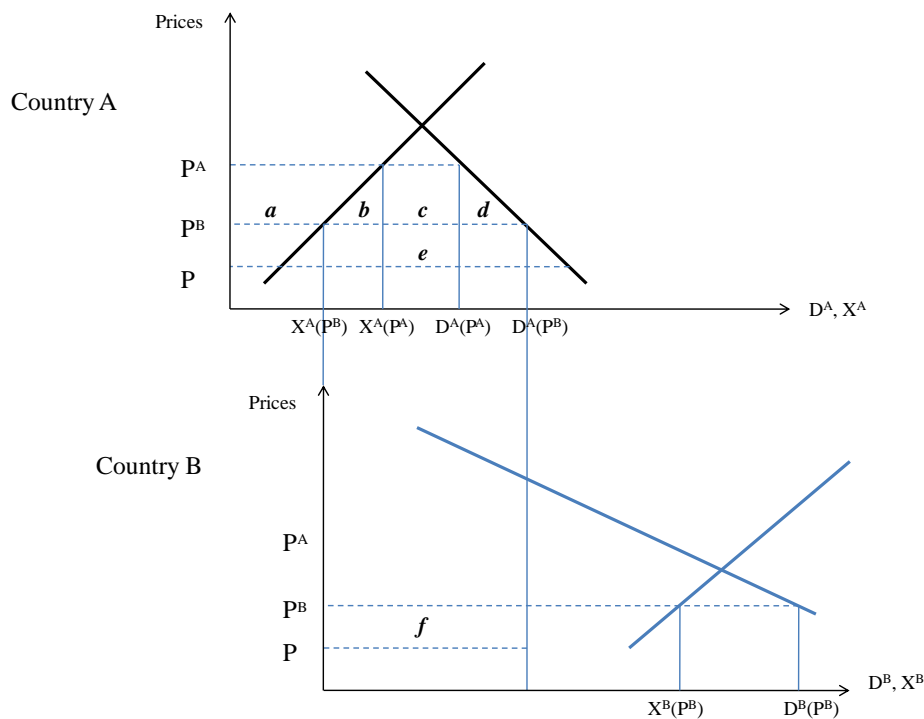
Therefore, under an eventual FTA, A has to continue importing from the ROW and its domestic price remains unchanged. Given that $P_i^A > P_i^B$, producers in B divert all their production to A's market, while consumers in B have to satisfy all their demand by purchasing from the ROW at the initial price. The only effect of the FTA in this case is an increase in those prices paid to producers in the more efficient country. This results in enhanced protection for producers in country B.

Trade diversion and trade creation

Figure 2 shows the welfare changes in an importing country (A) and an exporting country (B) in the case of reduced protection and an inefficient exporter. When A eliminates tariffs imposed on regional exporter B, consumers in A import from B instead of from the ROW because now they pay P_i^B for product i instead of P_i^A (with $P_i^A > P_i^B$). With lower domestic prices, producers in A lose area a ; consumers' surplus increases by area $a+b+c+d$ but area e corresponds to a loss for consumers in tariff revenue given that all imports come from B, a regional partner. As production from B is now being exported to A, country B imports from the rest of the world at price P^B to meet its domestic demand. Consumers in country B gain tariff revenue f as a result of these imports. Given that $f > e$ (e is only a fraction of f), the region as a whole gains unambiguously. Consumers in B also gain, while results in the importing country depend on the

relative size of areas e (trade diversion) and $b+d$ (trade creation). If trade creation is bigger than trade diversion ($e < b+d$) then an FTA benefits consumers in A. In the case of an efficient exporter, $P_1^B = P_1^*$, consumers in importing country A unambiguously gain, while exporting country B is not affected by the FTA.

Figure 2 Supply and demand curves in importing and exporting countries in the case of an FTA resulting in reduced protection



Source: Adapted from Vaillant and Ons (2003)

A similar analysis can be done for the enhanced protection and intermediate cases. The different situations resulting from these cases are summarised in Table 1. The total effect on the region of the different cases shows that enhanced protection results in unambiguously negative impacts for

the region as a whole. On the other hand, reduced protection unambiguously results in trade creation with positive effects on the region as a whole.⁴

Table 1 Summary of regional welfare effects of a trade agreement

Country	Consumers	Producers	Total country	Region
<i>Enhanced protection</i>				
A (importer)	Negative	Nil	Negative	Negative
B (exporter)	Positive	Positive	Positive	
<i>Reduced protection</i>				
<i>Efficient exporter</i>				
A (importer)	Positive	Negative	Positive	Positive
B (exporter)	Nil	Nil	Nil	
<i>Inefficient exporter</i>				
A (importer)	Negative or Positive	Negative	Negative or Positive	Positive
B (exporter)	Positive	Nil	Positive	
<i>Intermediate</i>				
A (importer)	Ambiguous	Negative	Ambiguous	Ambiguous
B (exporter)	Nil	Positive	Positive	

Source: Adapted from Vaillant and Ons (2003).

The methodology employed here, based in Grossman and Helpman's and Vaillant and Ons' conceptual framework involves three steps (see Appendix for details). In the first step, we estimate indices of RCA and RCD for each industry in each country using the RCA measure proposed by Balassa (1965) and determine the set of industries showing high complementarity. Trade complementarity between agricultural industries in SADC is defined as the set for which

⁴ As discussed in Vaillant and Ons (2003) in each of the three cases presented above we can have two different situations depending on exporter B being an efficient exporter or a less inefficient producer than importer A. We only present results for efficient and inefficient exporters for industries with reduced protection because this group comprises most of the sensitive industries in our results.

one or more countries in SADC show a comparative advantage ($RCA > 1$) and at the same time, at least one country shows a comparative disadvantage ($RCD > 1$) for those industries.

In the second step we identify the group of sensitive industries, those industries showing trade complementarity for which the exporting country faces an ad valorem tariff different from zero in regional markets.

In the last step we determine which of the sensitive industries face reduced or enhanced protection in the different SADC countries. To do this we refer to our conceptual framework where industries with reduced or enhanced protection and intermediate industries are defined based on the relative size of import demand ($m_i^A(P_i)$) and supply of exporting countries ($P_i X_i^B(P_i)$). We use the information on initial value of imports and estimated value of imports at exporter's price together with information on tariffs and import elasticities to estimate the welfare results of the FTA. The value of imports after a FTA is calculated by using import elasticities and relative prices defined by means of tariff information. With this information and information on current supply, the areas under the demand and supply curves as presented in Figure 2 for all reduced protection industries in all countries can be quantitatively measured.

Trade data used is bilateral data from UN Comtrade at the 4-digit SITC level, while data on tariffs is from Bouët et al. (2004). Broda and Weinstein (2006) describe the import demand elasticities (ε_i^A in the Appendix) used to calculate imports at exporter price in detail. They report elasticities for 73 countries in the world using six-digit harmonised system (HS) import data (1992 classification system) from the UN Comtrade database from 1994–2003 to estimate these elasticities. Information was available for three SADC countries: Madagascar, Malawi and Mauritius. The information from Madagascar and Malawi was used to define elasticity values for

low-income countries and the information from Mauritius was used to define elasticities for middle income countries.

IMPACTS OF A FTA ON SADC'S AGRICULTURE

Table 2 shows the general results of our classification of agricultural industries in those showing trade complementarity, sensitive industries and within this group, those facing reduced and enhanced protection. The top three rows in Table 2 present total value of exports and imports from all agricultural industries for the region as a whole (\$6.5 billion of imports and \$10 billion of exports) and by country. The average tariff imposed on agricultural inputs for the region (8.5 percent on average) and for the different countries is also shown. From the total set of importing and exporting industries we identify the number of industries showing strong trade complementarity in the region. We found trade complementarity in a total of 106 industries, representing 40 per cent of total imports (\$2.6 billion) and 29 per cent of exports (\$3.2 billion). The average tariff on imports of complementary industries for the region is 10.7 per cent.

The most important group for our analysis is the subgroup of sensitive industries. We found a total of 85 sensitive industries with export and import values of \$1.7 and \$3.1 billion, and an average tariff in importing industries of 14.5 per cent. Most of the sensitive industries will see reduced protection, which means that an FTA would reduce domestic production of these industries in importing countries and increase imports from the region. Opportunities for enhanced protection for exporting countries are small and are related to 12 industries with total imports of \$143 million and exports of only \$43 million.

Table 2 Value of agricultural imports and exports, and classification of agricultural industries of SADC countries in industries with trade complementarity, sensitive industries and protection regimes resulting from an FTA

	Angola	DRC	Madagas.	Malawi	Mauritius	Mozambique	Tanzania	Zambia	Zimbabwe	SACU	Total	
Total trade	Imports (million \$)	884	223	216	144	600	309	320	162	263	3,333	6,454
	Exports (million \$)	40	79	573	488	498	312	717	271	1,081	6,069	10,128
	Tariff (%)	10.1	7	1.8	3.7	6.5	6.5	8.8	5.5	5.5	9.2	8.5
Trade complementarity	Imports (million \$)	511	88	142	52	276	149	79	60	122	1,087	2,567
	Exports (million \$)	1	20	280	130	349	48	314	170	453	1,440	3,205
	Tariff (%)	16.9	15.1	2.1	6.8	9.6	10.1	22.1	8.5	22	7.2	10.7
Sensitive industries	Imports (million \$)	511	88	50	32	84	149	79	58	121	543	1,713
	Exports (million \$)	0	19	259	130	331	46	286	140	437	1,417	3,067
	Tariff (%)	16.9	15.1	6.1	11	31.4	10.1	22.3	8.9	22.3	9.4	14.5
Reduced protection ¹	Imports (million \$)	462	78	48	28	82	142	119	67	52	491	1,570
	Exports (million \$)	0	14	251	130	330	46	281	140	424	1,407	3,024
	Tariff (%)	17.7	15.1	6.2	11	31.8	10.3	24.3	9.4	22.4	9.6	12
Enhanced & intermediate protection ¹	Imports (million \$)	49	9	1	4	2	6	2	11	6	52	143
	Exports (million \$)	0	5	9	0	1	0	5	-	13	9	43
	Tariff (%)	8.8	15.3	4.7	11.2	15.5	5	10	5.6	13.6	11.8	10.5

Notes: 1. Industries with reduced protection are those threatened by the FTA, with domestic production in importing countries displaced by imports while not affecting production in exporting countries. Industries with enhanced protection are those industries in exporting countries that find opportunities to increase production as a result of an increase in prices paid for their exports to regional markets.

Source: Authors' calculation based on UN Comtrade data.

Country level results in Table 2 show that Angola, the DRC and Mozambique appear at present to have comparative disadvantages for agricultural production in the region. These countries are mainly importers of products from industries with reduced protection (importing \$462, \$78 and \$142 million respectively). SACU is the major net exporter and also the major exporter and importer of products from industries with reduced protection. Other major net exporters are Zimbabwe, Mauritius, Tanzania and Madagascar. Domestic production of industries with reduced protection would be less affected in these exporting countries showing regional comparative advantages.

In terms of the welfare impact of an FTA in agriculture, our analysis indicates that while a FTA will have a positive welfare impact for the regional economy as a whole, such benefit is small (Table 3). We estimate the total value of trade creation to be \$177 million (adding trade creation in import and export industries) or 1.1 per cent of total agricultural trade of SADC countries, and the net effect between trade creation and trade diversion to be \$129 million or 0.75 per cent of total agricultural trade.

Main factors explaining this result are the relatively small share of sensitive industries in total trade (below 30 per cent) and the low level of tariffs on agricultural products in most countries (an average of 14.5 percent for sensitive industries). Structural characteristics of SADC countries, like the concentration of agricultural exports among a few commodities and markets, as well as the fact that most SADC countries export a similar group of commodities seems to affect complementarity and constrained the expansion of regional trade and for opportunities of trade creation under a FTA.⁵

⁵ For a detailed characterization of exports and import industries in SADC see Nin-Pratt et al. (2008).

Table 3 Welfare gains and losses for importing and exporting industries as a result of a FTA (Millions \$)

	Importing industries			Exporting industries	Total Net welfare gain	Share of total gain	Share of total Ag trade
	Trade creation	Trade diversion	Net welfare gain from imports	Trade creation			
Low-income	7,173	-16,474	-9,302	96,784	87,482	68	29
Madagascar	120	-876	-756	5,191	4,436	3	5
Malawi	305	-973	-668	16,182	15,514	12	4
Mozambique	706	-5,134	-4,428	12,135	7,706	6	4
Tanzania	1,706	-4,701	-2,995	18,036	15,041	12	6
Zambia	584	-1,545	-961	2,078	1,117	1	3
Zimbabwe	3,751	-3,245	506	43,162	43,668	34	8
Other	12,355	-31,631	-19,276	60,693	41,417	32	71
Angola	3,037	-16,126	-13,088	4	-13,085	-10	6
DRC	797	-4,594	-3,798	304	-3,494	-3	2
Mauritius	3,072	-9,555	-6,483	22,691	16,208	13	7
SACU	5,449	-1,356	4,093	37,694	41,787	32	57
Total	19,528	-48,106	-28,578	157,477	128,899	100	100

Source: Authors' calculation

At the country level (Table 3), two-thirds of region-wide welfare gains from a FTA in agricultural would go to low-income countries while almost one-third would go to SACU. Countries that benefit the most are those, like Zimbabwe, with a comparative advantage for agriculture in the region, while still being inefficient producers of regionally traded commodities. Producers in these countries don't benefit from regional exports, however, consumers in exporting countries benefit from the fact that these countries need to import from the rest of the world to compensate for the supply that is now being directed to importing countries in the region. As the inefficient exporting country has a tariff on imports from the rest of the world, imports generate additional tariff revenue that benefits consumers.

The inefficiency of the main regional exporters also explains the negative welfare impacts of the agreement on regional net importers like Angola and the DRC. This is because the elimination of tariffs on regional imports in these countries would increase imports from inefficient regional producers, with trade diversion dominating trade creation, and no direct gain for low-income importing countries in SADC from opening their agricultural markets to regional imports.

From a political economy perspective and based only on our comparative static results, it could be inferred that a FTA offers little incentives to agricultural producers in the region given that no gains are expected for producers in regionally competitive industries, while producers in protected domestic industries are threatened by output reductions and welfare losses. The small size of regional import markets is also a negative factor for producers because it leaves very limited scope for enhanced protection. On the other hand, benefits to consumers in exporting countries appear to be small.

Focusing only on low-income countries, we look at the impact of different industries on total welfare at the country level (column 5 in Table 4). Biggest welfare gains result from cotton, beer, maize, oilseed cakes, rice and tea. Exports from industries like meat of swine; cigarettes; leather of other bovine; malt; meal and flour of wheat; refined sugar and other products; bakery products; tobacco, manufactured; and margarine, also contribute with significant welfare gains. Most welfare gains go to regional exporters of these industries, many of which are protected by tariffs from the ROW in exporting countries. Zimbabwe receives almost half of total welfare gains of low-income countries mainly from beer, raw cotton, oil seed cake, leather, cigarettes, malt and tea. The other half is shared by Tanzania (raw cotton and tea), Malawi (rice and tea) and Mozambique (maize and meat of swine), Madagascar (refined sugar), and Zambia (meal and flour of wheat). Similarly to Zimbabwe, SACU benefits from protection of regional markets from the rest of the world and its comparative advantage as an agricultural producer in the region. Meal and flour of cereals; wine; beer; and maize are the industries explaining most of the welfare gains of SACU countries.

Table 4 Low-income countries: net welfare gains¹ of a FTA in industries facing reduced protection as a result of eliminating tariffs between SADC countries

SITC	Industry	Madagascar	Malawi	Mozambique	Tanzania	Zambia	Zimbabwe	Total	Contribution (%)
2631	Raw cotton, other than linters	0	61	409	7,380	246	5,206	13,303	15.2
1123	Beer including ale, stout, porter	0	0	-69	0	0	12,462	12,394	14.2
0440	Maize (corn), unmilled	0	992	7,618	773	16	531	9,931	11.4
0813	Oil seed cake & meal & other veg. Oil residues	1,953	382	354	1,697	0	4,680	9,066	10.4
0422	Rice, glazed or polished, not further prepared	0	9,427	-1,943	1,121	0	0	8,605	9.8
0741	Tea	0	3,782	0	2,432	46	2,023	8,283	9.5
0113	Meat of swine, fresh, chilled or frozen	0	0	3,741	0	0	98	3,839	4.4
1222	Cigarettes	0	0	0	906	0	2,842	3,748	4.3
6114	Leather of other bovine cattle & equine leather	0	0	0	0	0	3,638	3,638	4.2
0482	Malt including malt flour	0	4	0	68	15	2,677	2,765	3.2
0460	Meal and flour of wheat or of meslin	-364	0	209	1,340	740	142	2,066	2.4
1223	Tobacco, manufactured for smoking, chewing snuff	0	32	28	0	0	1,748	1,808	2.1
0914	Margarine, imitn lard & preprd edible fats nes	-152	-22	47	46	-140	1,711	1,489	1.7
0484	Bakery products	0	0	-452	0	0	1,866	1,414	1.6
0470	Meal & flour of cereals exc. wheat or meslin	0	-66	0	674	0	281	889	1.0
0481	Cereal grains, flaked, pearled	0	-144	-250	100	-212	-321	-827	-0.9
1121	Wine of fresh grapes including grape must	0	0	-1,093	0	0	0	-1,093	-1.2
0612	Refined sugar & other prod.of refining,no syrup	1,572	163	0	-3,332	0	307	-1,289	-1.5
0752	Spices, exc. pepper & pimento ground or not	412	0	-99	107	-93	0	327	0.4
4313	Acid oils, fatty acids and solid residues	188	-59	0	-412	0	0	-283	-0.3
2929	Materials of vegetable origin, nes	413	0	0	235	0	0	648	0.7
	Other	415	961	-795	1905	500	3777	6762	7.7
	Total	4,436	15,514	7,706	15,041	1,117	43,668	87,482	100.0

Note: 1. Calculated as the sum of welfare gains of each country as an importer and an exporter of each industry from the previous tables.

Source: Authors' calculation based on UN Comtrade data

CONCLUSIONS

Given policy priorities of improving market access for exports and attain efficiency in sourcing imports, our results discussed in the previous section suggest that regional trade liberalization does not appear to be the most effective mean to achieve these goals. SADC countries should rather be looking at regional policies and interventions beyond trade arrangements, such as those targeting investment, agricultural productivity and diversification. With growing productivity and enhanced diversification in agricultural production, regional trade liberalisation could play a much more significant role in achieving main policy goals. With respect to the future customs union in SADC, our analysis suggests that high common external tariffs resulting from a compromise to protect inefficient industries in some SADC countries could have negative impacts on consumers and would not benefit producers.

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APPENDIX: METHODOLOGY

A.1 Indexes of Revealed Comparative Advantage and Disadvantage

An RCA index for commodity i in country k is defined as the ratio of the share of this commodity in total exports from k (x_i^k) and the share of exports of i in total exports of a reference group of countries (x_i^R).

$$RCA_{ik} = \frac{x_i^k}{x_i^R}$$

Similarly, an RCD index for commodity i in country k is the ratio of the share of k 's imports of this commodity in total imports to k (m_i^k) and the share of i 's imports in total imports of a reference group of countries (m_i^R):

$$RCD_{ik} = \frac{m_i^k}{m_i^R}$$

A.2 Trade Complementarity, sensitive industries and protection regimes

Formally, the set of industries showing complementarity in SADC (TCI) is defined as:

$$TCI^{AB} = \left\{ i \in \frac{C}{RCA_i^B} > 1 \text{ and } RCD_i^A > 1 \right\} \text{ with } A \neq B$$

where A and B are importing and exporting SADC countries respectively.

The group of sensitive industries is a subset of the set of industries showing trade complementarity. This is the set of industries with regional trade complementarity and protected by tariffs. We use ad valorem equivalent measure of tariff duties and tariff rate quotas at the six-digit level of the harmonised system (5,111 products) from Bouët et al. (2004) to determine industries in SADC countries protected by tariffs. As in Vaillant and Ons (2003), we consider that an industry i is sensitive when:

- The industry belongs to the group of industries with regional trade complementarity;
- Country B in SADC exports products of industry i

- Country A in SADC imports products of industry i
- A's imports of products of industry i coming from country B face an ad valorem tariff different from zero.

Industries are not sensitive if the exporting country faces a zero tariff before the FTA comes into force. Sensitive industries are then defined as:

$$SI^{AB} = \left\{ i \in S \in \frac{C}{X_i^B} > 0, \text{ and } M_i^A > 0, \quad \text{and } t_i^{AB} > 0 \right\} \text{ with } A \neq B$$

The group of industries facing reduced protection is a subset of the set of sensitive industries with the following characteristics:

- The industry in country A (importer) is threaten by the FTA. This means that as a consequence of the FTA, domestic production of i in A is displaced by imports:

$$THI^{AB} = \left\{ i \in \frac{K}{\square} \in S \text{ and } X_i^{A-FTA} < X_i^A \right\}$$

- Industry i does not offer a trade opportunity to exporter B, meaning that production in B would not be affected by the FTA.

As the set of industries offering trade opportunities to B is defined as:

$$OP^{AB} = \left\{ i \in \frac{U}{\square} \in S \text{ and } X_i^{B-FTA} > X_i^B \right\}$$

then, industries facing reduced protection (RPI) are those that:

$$RPI^{AB} = \left\{ i \in \frac{RP}{\square} \in K \text{ and } i \notin U \right\}$$

Industries with enhanced protection on the other hand are those industries i that:

$$EPI^{AB} = \left\{ i \in \frac{EP}{\square} \notin K \text{ and } i \in U \right\}$$

A.3 Trade regimes

Given the the previous definitions, industries expected to face reduced protection in importing SADC markets (A) are those for which import demand at exporter's prices is smaller than exporter's supply at the same prices:

$$1 > \frac{P_i^B m_i^A(P_i^B)}{P_i^B X_i^B(P_i^B)}$$

Industries expected to face increased protection as a result of regional trade liberalisation are those for which the ratio of import demand at importer's price and the value of exporter's supply at importers price is bigger than 1:

$$1 < \frac{P_i^A m_i^A(P_i^A)}{P_i^A X_i^B(P_i^A)}$$

Finally, intermediate industries are those where:

$$1 > \frac{P_i^B m_i^A(P_i^B)}{P_i^B X_i^B(P_i^B)} \text{ and } 1 < \frac{P_i^A m_i^A(P_i^A)}{P_i^A X_i^B(P_i^A)}$$

Because of limited information on supply and supply elasticities of industries at this level of disaggregation we were able to classify sensitive industries in two groups: one group of those industries facing reduced protection and a second group with all other industries (enhanced protection and intermediate). We did this by estimating the ratio between import demand of a particular industry i in SADC importing markets (A) and the aggregate value of supply in the group of SADC countries exporting products from that industry (B) both at exporter's price. As in Vaillant and Ons (2003), the value of import demand at exporter's price is calculated using observed values as:

$$P_i^B m_i^A(P_i^B) = \frac{P_i^A m_i^A(P_i^A)}{\theta^{AB}} \left(1 + \left(\frac{1}{\theta^{AB}} - 1 \right) \varepsilon_i^A \right)$$

where $\theta^{AB} = P_i^A / P_i^B$ is a measure of relative efficiency between the importer A and the exporter B and ε_i^A is the import elasticity in A⁶.

⁶ Derived from a simple calculation using import demand elasticity:

$$P_i^B m_i^A(P_i^B) = P_i^A m_i^A(P_i^A) \times \left[\frac{(P_i^A - P_i^B)}{P_i^A} \right] \times \varepsilon_i^A$$

For those industries for which the value of import demand at exporter's price was smaller than exports from the region there was no need to determine supply in exporting countries. In those cases where the value of imports is bigger than exports, we used data of supply from different sources depending upon the industry. For basic agricultural products, information was collected from the FAOSTAT (FAO 2008) database. For processed manufactured products, we used production data from similar industries from the GTAP database (Dimaranan et al. 2006). Because of the lack of information on production for some of the industries we relied on information on production of similar industries as a proxy for the missing values.⁷

⁷ To check how this constraint might have affected the allocation of sensitive industries among industries with reduced protection and other industries we estimated the ratio of import demand at export prices and supply at current prices using exports as a proxy for supply. Allocation of industries using exports as a proxy for supply results in 52 of the 85 sensitive industries showing an import/export ratio lower than one (61 per cent of all sensitive industries). Of the 33 industries with import/export ratio greater than one, there are 16 industries with ratios bigger than 2 and tariffs bigger than 10 per cent, and for only 13 of these industries we used data from similar or more aggregated industries to estimate supply. We conclude that inaccuracies in supply estimates for lack of data should not have a significant effect on our results.