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## Agricultural price policy in the Republic of South Africa, the Southern African Customs Union, and food security in Botswana

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Working Paper No. 289

Agricultural Price Policy in the Republic  
of South Africa, the Southern African Customs  
Union, and Food Security in Botswana

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## 1. Introduction

The literature on the food situation in developing countries has demonstrated that food security is highly dependent upon the stability of world food markets. Indeed one aspect of the problem of food insecurity is defined in terms of the fluctuations of world food prices (Bigman/Reutlinger, 1979; Sarris, 1980; Valdés/Konandreas, 1981; Bigman, 1982). There are, however, countries who are not exposed to world market instability, but they nevertheless still face the influence of external factors on their food sectors which significantly affects their food security policy options. One example of such countries are Botswana, Lesotho and Swaziland (the BLS countries) who with the Republic of South Africa are members of the Southern African Customs Union (SACU). The BLS countries are characterized by a relatively high dependence on food imports and food aid<sup>1</sup>, and food security is a major policy objective in these countries. Food security in the BLS countries is affected by SACU membership both directly and indirectly. The direct effects arise from the fact that the regulation of food markets in the Republic of South Africa determines the import prices of the BLS countries. Indirect effects result from SACU-induced linkages and income effects<sup>2</sup> in the non-food sectors of the BLS countries which can lead to changes in food consumption in these countries.

This analysis is concerned with the direct impacts of the regulation of food markets under SACU on food security in the BLS countries. There are two basic rules in SACU determining trade in food and non-food products (Ettinger, 1974; Maasdorp, 1986). The first of these is that common tariffs exist for trade with the rest of the world. The second is that the internal market of SACU represents a free-trade area. The common external tariffs of SACU are fixed by the Republic of South Africa. These rules of SACU link the agricultural price policy in the Republic of South Africa with food imports and food security in the BLS countries. It is the objective of this paper to investigate this linkage which has been hitherto ignored in the literature. The paper analyzes

quantitatively how the agricultural policy of the Republic of South Africa affects food security in Botswana and particularly how this was transmitted via the rules of SACU during the period 1969-84.

The analysis begins by describing the institutional relationship between agricultural price policy in South Africa and food security in the BLS countries. Section 3 considers empirically what impacts agricultural policy in South Africa has had upon the food import sector of Botswana, and the magnitude, trends and instabilities of these economic variables are investigated. The analysis is based upon econometrically estimated food import demand equations for Botswana. Section 4 takes into consideration the effects of the customs union remittances received from SACU by Botswana. The effects of customs union membership, as they apply to food security in Botswana are tested by the hypothesis as to whether the joint impact of the external tariff policy on food and of customs union revenues was positive or negative. Finally, in section 5 the main results of the analysis are summarized and suggestions for further research are indicated.

2. The Institutional Relationship between Agricultural Price Policy in the Republic of South Africa and Food Security in the other Countries of the Southern African Customs Union

The Southern African Customs Union Agreement of 1969 is the formal basis for the current cooperation between the Republic of South Africa and the BLS countries<sup>3</sup>. The agreement contains amongst other things the rules which apply for both food and non-food trade within the customs union. Import, excise and sales duties are set for the external trade of SACU by the Republic of South Africa. For food products, a close relationship exists between the tariff policy and the national agricultural policy of South Africa. Through the tariff policy the BLS agricultural and food policies are in effect constrained and determined by that of South African agricultural and food policies.

The national agricultural policy of South Africa has a number of general aims and objectives which are similar to those found in other customs unions (Koester, 1986). Agricultural policy in South Africa aims to stabilize and support prices for its farmers<sup>4</sup>. The wheat and maize markets are regulated by monopolistic marketing boards, paying the producer a fixed price and selling on international and domestic markets at different prices. Domestic food consumption is subsidized by the bread subsidy (Moll, 1984).

The degree of protection has been higher for agricultural products with a self-sufficiency ratio which approximates 100%, e.g. wheat and maize, than it has for typical export products like sugar. In tendency, a higher degree of protection in a South African agricultural product implies a higher import prices for the BLS countries in that product than would be the case in an agricultural product with a lower degree of protection.

Table 1 gives some empirical evidence on the close relationship between the import prices in BLS countries and Southern African prices. It shows that Botswana's maize and sugar import prices are highly correlated with the producer prices for maize and sugar in the Republic of South Africa.

Table 1: Correlation Coefficients Between Food Import Prices in Botswana and Agricultural Prices in the Republic of South Africa, 1969-84<sup>a</sup>

Prices in Botswana Prices in South Africa	Maize import price	Sugar import price
Producer price for yellow maize	0.89*	0.80*
Producer price for sugarcane	0.90*	0.83*

\* Statistically different from zero at the 0.1%-level of statistical significance.

<sup>a</sup> The logarithms of prices in Rand were taken in all cases.

Source: Authors' calculations with data from FAO, Trade Yearbook. Rome, various years, and Department of Agricultural Statistics and Marketing (1986), 1986 Abstract of Agricultural Statistics. Pretoria, tables 7 and 29.

### 3. The Impacts of Agricultural Price Policy in South Africa on Food Security in Botswana: A Quantitative Approach for 1969-84

A joint agricultural price policy in a customs union theoretically may lower or raise import prices, imports, and import expenditures for the members of the union. Where a price-stabilizing agricultural policy is pursued this may increase or decrease the instability of food imports and food import expenditures since this will have similar effects to those of the established relationship between price and earnings instability (Herrmann/Schmitz, 1984). South African agricultural price policy, as it operates through the rules of SACU, affects the prospects of food security in Botswana. The purpose of this paper is to empirically analyze how Botswana was affected by the South African price policy in agriculture. The definition of food security adopted is an aggregate definition and is considered as the ability of food-deficit countries to meet target consumption levels on a year-to-year basis<sup>5</sup>. The definition excludes distributional effects within Botswana and as a consequence it is only the import side of the food security issue which is examined. It is assumed that food security will be enhanced if food imports increase, food import expenditures decrease and the instability of food imports and food import expenditures decrease as a consequence of membership of the customs union. The definition includes the level of instability of food imports on a year-to-year basis and the analysis covers the period 1969-84.

#### 3.1 The method of analysis

The influence of South African agricultural price policy on Botswana's food security can be analyzed by comparing the actual situation which results from membership of SACU with a benchmark situation which would exist were Botswana no longer a member of that union. The existing and the hypothetical import situation of Botswana are explained as follows. The small-country assumption would apply in both the actual and hypothetical situations.



Hence, the import price  $p$  is exogenously given, in the existing SACU situation as the import price determined by South Africa ( $\bar{p}_s$ ) and in the hypothetical non-SACU situation ( $p^*$ ) as the world market price ( $\bar{p}_w$ ):

$$(1) \quad p = \bar{p}_s ; \quad (1') \quad p^* = \bar{p}_w .$$

A loglinear import demand function is introduced for Botswana's food import demand in both situations:

$$(2) \quad q = a\bar{p}_s^\epsilon ; \quad (2') \quad q^* = a\bar{p}_w^\epsilon .$$

$q$  ( $q^*$ ) indicates actual (hypothetical) imports and  $\epsilon$  is the price elasticity of import demand.  $a$  is a parameter of the import demand function characterizing the influence of non-price variables as well as stochastic influences on imports. The impacts of SACU on import prices, imports, and import expenditures for various food products can now be derived from the equations (1) to (2'). Welfare impacts will be additionally measured by applying the traditional surplus concept to the import market<sup>6</sup>:

$$(3) \quad \Delta W = \int_{\bar{p}_s}^{\bar{p}_w} (ap^\epsilon) dp .$$

Generally, the actual prices, quantities, and expenditures for food are given from published statistics. The unobservable prices, quantities, and expenditures in the hypothetical situation are quantified as follows. The average world import price is used for  $\bar{p}_w$ . In order to calculate  $q^*$ ,  $\bar{p}_w$  and the observed  $a$  ( $= q/(\bar{p}_s^\epsilon)$ ) can be used, but price elasticities of import demand have to be computed additionally. Therefore, food import demand functions for Botswana will now be estimated econometrically.

### 3.2 Food import demand functions for Botswana

Import demand functions for Botswana are estimated econometrically for cereals, maize, and sugar. Cereals and sugar are the

two major agricultural import goods of Botswana. Their share in the country's agricultural import value was 43.4% on average for 1983-85<sup>7</sup>. The results of this empirical analysis are presented in Appendix 1.

The estimation results confirm economic theory<sup>8</sup>: Import demand for cereals, maize, and sugar increases if the import price falls and income rises. The income variable used is the gross domestic product of Botswana. Import demand for maize and cereals increase with a declining availability of arable agricultural products in Botswana. This availability is measured via the sum of food aid and domestic production in arable agriculture. All the estimated elasticity coefficients are at least at the 10%-level of statistical significance different from zero, given a two-sided test.

The point estimates of price elasticities of import demand are -1.96 for cereals, -2.36 for maize, and -0.57 for sugar. Given a statistical level of significance of 95%, the confidence interval<sup>9</sup> for the true price elasticity of import demand is

$$(4) \quad -3.8993 \leq \epsilon \leq -0.0205$$

for cereals,

$$(5) \quad -3.3407 \leq \epsilon \leq -1.3797$$

for maize, and

$$(6) \quad -0.7702 \leq \epsilon \leq -0.3624$$

for sugar. For the resulting impacts of SACU on import expenditures, it is very important whether the price elasticities of import demand are absolutely lower or higher than 1. On the basis of (4)-(6), a clear-cut answer can be given for maize and sugar, but not for all cereals. Whereas each calculated price elasticity is significantly different from zero, the statistical significance level of 95% only allows the conclusions that the true

price elasticity of maize import demand is absolutely higher than 1 and that of sugar import demand is absolutely lower than 1. Although the true price elasticity of import demand for cereals may be lower or higher than -1, the point estimates of the elasticities will be used for all the following calculations.

### 3.3 The influence of the Southern African Customs Union on the variables of Botswana's food import sector

Based on the methodological approach shown in section 3.1, the impacts of the agricultural policy within SACU on the level of import prices, imports, import expenditures, and economic welfare are calculated for Botswana. Table 2 shows average impacts for the period 1969-84. The following major results can be derived:

1. The single most important agricultural import product for Botswana is cereals. For 14 of the 16 years during 1969-84, the membership of SACU increased Botswana's import prices for cereals. It has lowered imports and due to the price-elastic import demand it has also lowered Botswana's import expenditures if this is compared to the hypothetical situation of importing at world market prices. Only in 1974 and 1975, years with booming world market prices, the reverse was true. On average for 1969-84, the trade-weighted import price for Botswana increased as a consequence of customs union membership by 24.2%. Imports decreased by 24.3% and import expenditures were by 5.9% lower than they would have been in a non-customs union situation. The price-increasing effect of South African agricultural policy lowered economic welfare in the cereals markets of Botswana in 14 of the 16 years. The average annual welfare decrease in the period 1969-84 amounts to 3.4 million \$.
2. Within the group of cereals, the imports of maize had a share of 22% in the import bill in the period 1983-85. The rest accrued to other cereals, including wheat flour with a share of 34% in the cereal import bill and rice with 10%. Table 2 disaggregates Botswana's cereal imports into those

Table 2: Impacts of the Southern African Customs Union on the Levels of Import Prices, Imports, Import Expenditures, and Economic Welfare in the Food Sector of Botswana, 1969-84<sup>a</sup>

Situations Variables	With Southern African Customs Union	Without Southern African Customs Union	Policy-induced Change (%)
<u>Import prices (\$/t):</u>			
Cereals:	187.80	151.17	+24.2
- Maize:	125.01	131.95	-5.3
- Other cereals:	211.87	155.60	+36.2
Sugar:	296.10	382.98	-22.7
Food:	219.13	194.98	+12.4
<u>Imports (t):</u>			
Cereals:	57116	75418	-24.3
- Maize:	15829	14121	+12.1
- Other cereals:	41287	61296	-32.6
Sugar:	23249	17572	+32.3
Food:	80366	92989	-13.6
<u>Import expenditures (1000\$):</u>			
Cereals	10726.3	11401.2	-5.9
- Maize:	1978.9	1863.3	+6.2
- Other cereals:	8747.4	9537.9	-8.3
Sugar:	6884.3	6729.7	+2.3
Food:	17610.5	18130.8	-2.9
<u>Economic welfare (1000\$):</u>			
Cereals:	-	-	-3404 <sup>b</sup>
- Maize:	-	-	-84 <sup>b</sup>
- Other cereals:	-	-	-3320 <sup>b</sup>
Sugar:	-	-	+1753 <sup>b</sup>
Food:	-	-	-1651 <sup>b</sup>

<sup>a</sup> The numbers for imports and import expenditures characterize the arithmetic means for the period 1969-84, the numbers for import prices characterize trade-weighted arithmetic means for the same period. The hypothetical situation without Southern African Customs Union is modelled with the method described in the text.

<sup>b</sup> Absolute changes in economic welfare. The welfare levels in the situations with and without the Southern African Customs Union are not computed.

Source: Authors' calculations on the basis of Appendices 2 to 7.

of maize and other cereals. South African maize policy changed between the periods 1969-76 and 1977-84. In each year of the period 1969-74, maize import prices in Botswana were lower than if they had been imported at world market prices<sup>10</sup>. Maize import prices would have been higher outside the customs union and import expenditures would also have been higher, due to the price-elastic import demand. The reverse situation existed during the period 1977-84, with the exception of 1981. Higher maize import prices were the outcome of South African agricultural price policy, which led to a lower level of imports and import expenditures compared to being outside SACU. The aggregate impact for the whole period 1969-84 was dominated by the first years. Import prices decreased by 5% and imports and import expenditures increased by 10% and 6% respectively as a consequence of the SACU membership. The impacts of the SACU membership on other cereals determined the net impact on cereals. Average impacts were parallel to those for cereals, but were stronger in the magnitude. On average for 1969-84, the membership of SACU led to an increase in Botswana's import price for other cereals of 36%, a fall in both imports of 33% and in import expenditures of 8% if compared to the hypothetical situation of importing at world market prices.

3. Sugar is not a protected import good in the South African agricultural policy, but is historically an exportable sold under world market conditions. Sugar is however subject to stock policy and in earlier periods was subject to the International Sugar Agreement. However, lower transportation costs can explain why sugar can be exported cheaper from South Africa to SACU members than from other sources in the world market. This held true for the whole period 1969-84, except for 1977. Imports were higher than in the benchmark situation (except for 1977), and import expenditures for sugar were in most years lower. On average, SACU membership lowered Botswana's import price for sugar by 23%, increased imports by 32% and raised import expenditures slightly (by

2%). Due to the lower import price, Botswana's economic welfare increased in the sugar market in 15 of the 16 years. The average annual welfare gain was 1.8 million \$.

4. An aggregate analysis of the impacts for the constructed category "food" shows that the impacts for cereals over-compensated those for sugar. The net welfare effect in Botswana's food import sector was negative in nine and positive in seven years. The average annual impact was a loss of 1.7 million \$ in economic welfare compared to the hypothetical situation of importing at world market prices. The weighted food import price increased in most years, on average by 12%. The SACU membership led to a decline in food imports on average by 14%. Due to the price-elastic food import demand, it also led in most years to a decrease in import expenditures. This decrease was always lower than 10%, and the average impact reached -3%.

Table 3 gives additional information on trends in Botswana's food import sector as a member and as a non-member of SACU. It shows how the impacts of SACU changed over time during the period 1969-84. The patterns of change are measured with the regression coefficients of various trend functions. The following results can be derived from Table 3:

1. The welfare impacts of SACU on Botswana became more negative over time in the cereals and food sector. In the course of 1969-84, the regression coefficients show an additional annual welfare loss of 0.82 mill.\$ for cereals and 0.62 mill.\$ for food. Both coefficients are statistically different from zero, given a significance level of at least 95%. The per-caput welfare changes due to SACU show a negative trend for cereals and food, too, but only the coefficient for cereals is statistically different from zero. The trend of the SACU-induced welfare changes in the sugar market is opposite to the trend in cereals, but the coefficients are not statistically different from zero.

Table 3: Trends in Variables of Botswana's Food Import Sector in the Situations with and without the Southern African Customs Union, 1969-84<sup>a</sup>

Variable	Situation	With Southern African Customs Union	Without Southern African Customs Union
<u>Import prices (\$/t):</u>			
Cereals:			
	- Maize:	+9.9***	+6.8***
	- Other cereals:	+9.1***	+6.5***
	- Other cereals:	+10.0***	
Sugar:			
Food:			
		+9.9**	+9.1***
		+10.0***	+7.8***
<u>Imports (t):</u>			
Cereals:			
	- Maize:	+2.0	+6.9
	- Other cereals:	+1.7	
	- Other cereals:	+2.1	
Sugar:			
Food:			
		+11.0***	+10.8***
		+4.3	+6.8
<u>Import expenditures (1000\$):</u>			
Cereals:			
	- Maize:	+11.9***	+13.7**
	- Other cereals:	+10.9**	
	- Other cereals:	+12.1***	
Sugar:			
Food:			
		+20.9***	+19.9***
		+14.3***	+14.5***
SACU-induced changes in economic welfare in the food sector <sup>b</sup> :			
Cereals:			
	- Absolute welfare impact:	-816.9***	
	- Welfare impact per caput:	-0.80***	
Sugar:			
	- Absolute welfare impact:	+193.8	
	- Welfare impact per caput:	+0.21	
Food:			
	- Absolute welfare impact:	-623.1*	
	- Welfare impact per caput:	-0.59	

\* The regression coefficient of the trend function is significant at the 5%-level, \*\* at the 1% level, \*\*\* at the 0.1% level of statistical significance.

<sup>a</sup> The trends in the variables are measured with the regression coefficients of loglinear trend functions. The coefficients are in percentage terms.

<sup>b</sup> The trends in the welfare impacts are measured with the regression coefficients of linear trend functions. The coefficients are shown in 1000\$ for the absolute welfare impacts and in \$ for the per-caput welfare impacts.

Source: Authors' calculations on the basis of Appendices 2 to 7.

2. The negative trend in the welfare impacts of SACU for cereals and food as opposed to sugar is caused by different growth rates of import prices in the situations with and without SACU. The import prices for cereals and food increased faster in the existing SACU situation than in the benchmark situation of importing from the world market: by 9.9 and 10% as against 6.8 and 7.8%. This is consistent with an increasing level of protection in the cereals sector in South Africa during the period 1969-84. The difference between growth rates in import expenditures is less distinct. Although prices increased faster in the existing situation than in the non-SACU situation, import expenditures did not. For cereals and food, the faster growth of import prices was overcompensated by a slower growth of imports in the existing situation than in the hypothetical situations under world market conditions.

It can be summarized from Tables 2 and 3, that the membership of SACU resulted in a decrease in economic welfare within the food sector of Botswana. This effect was dominated by the welfare-decreasing impact in the cereals sector. Moreover, a negative trend was underlying the SACU-induced welfare impacts for food. Again, the negative trend for the cereals sector determined the result. The underlying cause of this is that Botswana's food import prices, particularly import prices of cereals, were higher and grew faster in 1969-84 than did world market prices.

#### 3.4 The influence of the Southern African Customs Union on instabilities in Botswana's food import sector

The actual and the hypothetical time series for Botswana's food import sector can also be used to measure the instability effects of the membership in SACU. By use of a variance decomposition method<sup>11</sup>, it is possible to measure the magnitude of instabilities as well as a decomposition of instabilities that are additively combined. Given a linear relationship

$$(7) \quad A = B + C,$$



the method allows the following decomposition of the variance of A:

$$(8) \quad \text{Var}(A) = \text{Var}(B) + \text{Var}(C) + 2 \text{Cov}(B,C).$$

From (8), percentage shares can be calculated that are attributable to the individual components:

$$(9) \quad SB = 100 \cdot \text{Var}(B) / \text{Var}(A);$$

$$(10) \quad SC = 100 \cdot \text{Var}(C) / \text{Var}(A);$$

$$(11) \quad SBC = 100 \cdot 2\text{Cov}(B,C) / \text{Var}(A).$$

The variance and covariance terms are either calculated around the arithmetic means of the series or the values of a linear trend function, if a significant trend exists in the series. Multiplicative relationships are linearized by using logarithms of the original values. The instability of individual variables is measured with the standard deviation that is compatible with the chosen variance decomposition approach.

Table 4 shows the instability of import prices, imports and import expenditures in the situations with and without SACU and Table 5 presents the decomposition of the instability of the food import bill in its major components according to equations (9)-(11). The most remarkable finding is that the membership in SACU induced impacts on the instability of Botswana's food imports, prices and expenditures that are crucially different from its impact on the level of the respective variables:

1. The instability of the food import price under SACU was, with a standard deviation of 21% around the logarithmic trend values, clearly lower than in the hypothetical situation of importing at world market prices (35.6%). It is the stabilizing impact of the SACU membership on the import price for cereals, especially non-maize cereals, that gave rise to this result. On the other hand, the import prices for maize and sugar were less stable in the existing situation than under world market conditions.

Table 4: Impact of the Southern African Customs Union on the Instability of the Food Import Bill and its Components in Botswana, 1969-84<sup>a</sup> (%)

Situations Variables	With Southern African Customs Union	Without Southern African Customs Union	Policy-induced Change
<u>Import prices:</u>			
Cereals:	11.0	20.1	-45.3
- Maize:	25.1	17.1	+46.8
- Other cereals:	10.6	20.1	-47.3
Sugar:	44.4	35.2	+26.1
Food:	21.0	35.6	-41.0
<u>Imports:</u>			
Cereals:	47.5	93.3 <sub>b</sub>	-49.1
- Maize:	68.6	88.0 <sub>b</sub>	-22.0
- Other cereals:	51.7	89.0	-41.9
Sugar:	25.2	21.1	+19.4
Food:	37.2	57.0	-34.7
<u>Import expenditures:</u>			
Cereals:	42.2	79.2 <sub>b</sub>	-46.7
- Maize:	55.1	89.5 <sub>b</sub>	-38.4
- Other cereals:	44.2	75.4	-41.4
Sugar:	29.4	29.9	-1.7
Food:	24.2	29.0	-16.6

<sup>a</sup> The measure of instability is the standard deviation of the logarithms of the actual values from the logarithmic trend values.

<sup>b</sup> The instability measure of Cuddy/Della Valle (1978), which is derived from the coefficient of variation, is used.

Source: Authors' calculations on the basis of Appendices 2 to 6.

2. Table 4 shows that the instability of food imports is relatively high in Botswana, higher than the instability of food import prices and food import expenditures. As food imports are highly price-responsive in Botswana, the price-stabilizing impacts of Botswana's SACU membership induced stabilizing impacts on food imports. The instability of food imports was reduced as a consequence of the SACU membership from 57 to 37.2% and the instability of food import expenditures from 29 to 24.2%. These impacts are caused by the stabilizing impacts on imports and import expenditures for cereals. The imports of sugar were slightly more unstable in the SACU situation than in the hypothetical situation, whereas the import expenditures for sugar remained nearly unaffected by the South African agricultural policy under SACU.

The variance decomposition analysis in Table 5 additionally shows that the instability of the food import price would explain a larger share in the instability of food import expenditures in a non-SACU situation than in the existing situation. On the other hand, the sugar price instability would explain a lower part of the sugar import bill than in a hypothetical world market situation. Apart from those changes, the relative importance of individual components in the instability of Botswana's food import bill did not significantly change due to its SACU membership.

Table 5: Impact of the Southern African Customs Union on the Relative Importance of the Individual Components in the Instability of Botswana's Food Import Bill, 1969-84<sup>a</sup>

Situations Variables	With Southern African Customs Union	Without Southern African Customs Union	Policy-induced Change (%)
Disaggregation of the instability in the food import bill:			
a) Import expenditures for cereals:	74.7	75.9	-1.6
Import expenditures for sugar:	8.1	10.8	-25.0
Expenditures for cereals/sugar:	17.2	13.3	+29.3
b) Food import price:	75.4	150.9	-50.0
Food imports:	236.8	385.6	-38.6
thereof:			
- imports of cereals:	81.5	86.7	-6.0
- imports of sugar:	5.3	1.7	+211.8
- imports of cereals/sugar:	13.2	11.6	+13.8
Food import price/food imports:	-212.2	-436.5	-51.4
Disaggregation of the instability in the cereal import bill:			
a) Import expenditures for maize:	31.5	6.6	+377.3
Import expenditures for other cereals:	77.4	60.4	+28.1
Expenditures for maize/other cereals:	-8.9	33.0	-73.0 <sup>b</sup>
b) Import price for cereals:	6.8	6.4	+6.3
Imports of cereals:	126.7	138.7	-8.7
thereof:			
- imports of maize:	12.2	7.4	+64.9
- imports of other cereals:	48.4	60.4	-19.9
- imports of maize/other cereals:	39.4	32.3	+22.0
Import price/imports of cereals:	-33.5	-45.1	-25.7
Disaggregation of the instability in the sugar import bill:			
Import price:	228.5	138.0	+65.5
Imports:	73.8	49.6	+48.8
Import price/imports:	-202.3	-87.6	+130.9
Disaggregation of the instability in the maize import bill:			
Import price:	20.8	0.2	+10300.0
Imports:	155.3	107.2	+44.9
Import price/imports:	-76.1	-7.4	+928.4
Disaggregation of the instability in the import bill for non-maize cereals:			
Import price:	5.8	7.1	-18.3
Imports:	136.7	139.6	-2.1
Import price/imports:	-42.5	-46.7	-9.0

<sup>a</sup> The variance decomposition is based on the equations (8) to (11) in the text. The first two numbers in each decomposition are the SB and SC values according to (9) and (10), the third number is the SEC value measured by (11). Multiplicative relationships are linearized by using logarithms. In each case, variances are around-trend variances.

<sup>b</sup> It is ignored that the covariance terms in the situations with and without SACU have different signs.

Sources: Authors' calculations on the basis of Appendices 2 to 6.

4. The Implications of Agricultural Policy and Customs Union Remittances in the Southern African Customs Union for Food Security in Botswana: An Extension of the Empirical Analysis

Up to this point, the implications of the SACU membership on food security were analyzed on the basis of the import price effects for food. This approach is incomplete, even from a partial-equilibrium point of view. Botswana receives customs union revenues from SACU for its imports, including its food imports. These revenues would not exist in the non-SACU situation, unless of course Botswana would tax its own food imports<sup>12</sup>. The analysis now takes into account how the measured impacts change when the food-related customs union revenues are added. Customs union revenues to Botswana (R) are calculated according to the formula<sup>13</sup>

$$(12) \quad R = 1.42 \times (C+E+S) \cdot (i+p)/(I+P).$$

(C+E+S) indicates total collection of customs, excise, and sales duties within SACU. i(I) is the total c.i.f. value at the border for Botswana's imports (SACU), inclusive of customs and sales duties. p(P) is the total value of dutiable goods produced and consumed in Botswana (SACU), inclusive of duties. Formula (12) was applied on the imports of cereals and sugar to calculate the food-related customs union revenue for Botswana. This revenue was added to the welfare impact and subtracted from the impact on import expenditures calculated in section 3. The results measure the aggregate welfare and financial impacts of agricultural price policy and customs union revenues under SACU on the level, the trends and the instability in Botswana's food import sector.

Table 6 shows the following major results:

1. If the food-related customs union revenues are taken into account, the magnitude of the impacts of SACU on Botswana's food import sector are mitigated, but the direction remains unaffected. On average for 1969-84, the food import bill is

lowered from 0.52 to 0.25 mill.\$ and economic welfare from 1.65 to 1.40 mill.\$. There is still a negative trend in the impacts of SACU on the food import bill, but the average annual change in this impact is now -0.09 instead of -0.14 mill.\$. The negative trend in the welfare impact of SACU over the period 1969-84 is also weaker if the customs union revenue is taken into account: -0.56 as against -0.62 mill.\$.

Table 6: Implications of Agricultural Policy and Customs Union Revenues under the Southern African Customs Union on the Food Import Sector in Botswana, 1969-84<sup>a</sup>

Variable	Implications of Agricultural Policy	Implications of Agricultural Policy and Customs Union Revenues
Average change in food import expenditures (1000\$):	-520	-246
Average change in food import expenditures (%):	-2.9	-1.4
Average change in economic welfare in the food import sector (1000\$):	-1651	-1404
Trend in the impact on the food import bill (1000\$):	-137.1*	-93.0
Trend in the impact on economic welfare in the food import sector (1000\$):	-623.1**	-579.1**
Effect on the instability of the food import bill (%):	-16.6	-19.0

\* The regression coefficient of the linear trend function is significant at the 10%-level, \*\* at the 5%-level of statistical significance (two-sided test).

<sup>a</sup> The impacts are measured by comparing actual values and hypothetical values in a situation of importing at world market prices.

Source: Authors' calculations.

2. The food import bill, corrected downwards by the food-related customs union revenues, had an instability of 23.5% in the period 1969-84. The instability of the food import bill without customs union revenues was 24.2% in the actual situation and 29% in the hypothetical non-SACU situation. This means that the stabilizing impact of SACU on the food import bill is even more distinct when the customs union revenues are taken into account.

It can be concluded from Tables 2 to 6 that the import prices for food in Botswana were raised above world market prices due to the agricultural policy within South Africa. Hence, economic welfare in Botswana's food import sector was reduced. On the other hand, food import prices were stabilized due to the membership in SACU. Possibly, a welfare-increasing impact arose from this and has to be set off against the welfare loss from rising import prices. The magnitude of the price-induced welfare loss increased over time as did the policy-induced change in the food import bill. These general results are valid whether the SACU-induced customs union revenues are taken into account or not.

## 5. Summary and Conclusions

This article has shown that external factors affect food security in the BLS countries although these countries are not directly exposed to world market instability. The mechanisms of SACU affect the food import sectors of the BLS countries. This holds especially true for the agricultural tariff policy which South Africa determines for SACU and for the distribution of the customs union revenues. A quantitative assessment of the implications of SACU for Botswana's food import sector was provided for the period 1969-84 and it can be concluded that:

1. Within SACU, agricultural import prices for important goods like grain are insulated from world market prices. On average for 1969-84, cereal import prices were 24% higher than world market prices. A stronger percentage decline in cereal imports and diminishing cereal import expenditures were due to a price-elastic import demand. The effect on cereals was dominant in Botswana's food import sector and the membership in SACU led to an increase in the food import price and a decline in food imports, the food import bill and economic welfare. Food import prices under SACU grew faster than world market prices. Therefore, a policy-induced decline in the food import bill and in economic welfare became stronger over time.
2. South African agricultural tariff policy did provide a stabilizing impact on cereal and food import prices and on the cereal and food import bill of Botswana. Whether the performance of the food import sector of Botswana is preferred in the SACU or non-SACU situation, will depend upon the policy-makers' preference for either lower or more stable food prices.

Of course, this analysis has to be extended in order to show the impacts of SACU membership on the BLS countries comprehensively. A choice of a general-equilibrium rather than a partial equilibrium approach would make it possible to analyze the implications



of a changed level and stability of food prices for redistribution. A macro-economic approach for Botswana shows that unstable food import prices would be a major threat to the food security of the urban poor<sup>14</sup>. A general equilibrium approach could also take into account that the membership in SACU affects the non-food sectors with repercussions on food security. Moreover, this or an extended analysis could be applied to Lesotho and Swaziland.

Notes

- 1 An analysis of food imports and food aid is given for Botswana in Cathie/Dick (1987), Chapter II. The food sectors of all SADCC countries are analyzed in Koester (1986).
- 2 The most important linkages are the labour remittances from workers of the BLS countries in the South African gold mines and the customs union revenue of the BLS countries. The first category influences income in the BLS countries significantly, particularly for poor households in rural areas. It has, therefore, consequential effects on food security. The second category determines a relatively large extent of governmental income in the BLS countries and, hence, the possibilities for active food policies. These issues are discussed for Botswana in Cathie/Dick (1987), Chapter II. A general discussion on costs and benefits of the SACU membership for the BLS countries can be found in Mosley (1978) and the following contributions of Robson (1978), Landell-Mills (1979), Mosley (1979), and Cobbe (1980).
- 3 On the text, see Ettinger (1974), Appendix F. The trade relationships between the Republic of South Africa and the BLS countries prior to 1969 are described in Ettinger (1974), Chapters 1 and 2.
- 4 On the South African wheat policy, see Wheat Board (1985). A description of the South African corn and wheat markets is given in Shapouri (1983), and a data base on South African agriculture including data on regulated prices is provided by Department of Agricultural Economics and Marketing (1986).
- 5 The definition is derived from Valdés/Siamwalla (1981), p.2.
- 6 See, e.g., Just/Hueth/Schmitz (1982) for the basis and extension of this concept.
- 7 See FAO, FAO Trade Yearbook 1985, Rome 1986, passim.
- 8 The regression results in per-caput terms are quite similar:  
(a)  $\ln \text{CERQC} = 10.873 - 1.6737 \ln \text{CERP} + 0.5720 \ln \text{GDPDC}$   
                          (1.79)           (2.23)                           (1.20)  
                          - 0.5994  $\ln \text{AVAIC}$   
  (3.18)  
 $(\bar{R}^2 = 0.41; F = 4.43; DW = 2.10)$   
(b)  $\ln \text{MAIQC} = 5.5860 - 2.3085 \ln \text{MAIP} + 0.9005 \ln \text{GDPDC}$   
                          (1.12)           (4.92)                           (2.88)  
                          - 0.6561  $\ln \text{AVAIC}$   
  (3.06)  
 $(\bar{R}^2 = 0.62; F = 9.13; DW = 2.29)$

$$(c) \ln \text{SUGQC} = -3.5006 - 0.5512 \ln \text{SUGP} + 0.8374 \ln \text{GDPDC}$$

(2.58)      (5.93)                      (9.81)

$$(\bar{R}^2 = 0.87; F = 51.15; DW = 1.33)$$

The symbols and test coefficients are the same as in Appendix 1 with the extension "C" indicating per-caput numbers.

- 9 The method is described in Pindyck/Rubinfeld (1982), pp. 56 et seq.
- 10 This observation is consistent with the fact that South African maize prices were lower than world market prices in the period 1950-74. See Rees (1979), p. 109.
- 11 Various methods of decomposing economic instability, including the method used here, are described in Brodsky (1980).
- 12 A variety of different assumptions could be made for the benchmark situation, e.g. that Botswana would tax its imports by "iso-price-tariffs" leaving the import price unchanged. For such an analysis, see Ettinger (1974), pp. 160 et seq.
- 13 The revenue distribution formula of SACU is discussed in Hall (1980), pp. 268 et seq. and analyzed theoretically in Granberg (1985).
- 14 For a macro-economic approach on these impacts, see Cathie/Dick (1987), Chapter III.

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Appendix 1: Import Demand Functions of Botswana for Cereals, Maize and Sugar, 1969-84

Commodity	Estimation Results	$\bar{R}^2$	F	DW
Cereals	$\ln CERQ = 4.5585 - 1.9599 \ln CERP$ (0.91) (2.20)  $+ 0.9516 \ln GDPD - 0.5960 \ln AVAI$ (2.04) (2.82)	0.34	3.56	1.78
Maize	$\ln MAIQ = 2.5952 - 2.3602 \ln MAIP$ (0.77) (5.25)  $+ 1.0649 \ln GDPD - 0.7110 \ln AVAI$ (4.46) (3.14)	0.65	10.13	2.28
Sugar	$\ln SUGQ = -4.3915 - 0.5663 \ln SUGP$ (4.32) (6.00)  $+ 0.8845 \ln GDPD$ (12.85)	0.93	99.44	1.33

<sup>a</sup> CERQ (MAIQ, SUGQ) is the net import demand for cereals (maize, sugar) in Botswana, CERP (MAIP, SUGP) is the import price for the respective commodity in US-\$. GDPD indicates the gross domestic product of Botswana in US-\$. AVAI indicates the availability of arable agricultural products in Botswana, calculated as the sum of production and food aid. The values in parentheses are |t|-values.  $\bar{R}^2$  = adjusted coefficient of determination, F = F-value, DW = Durbin-Watson coefficient.

Source: Authors' calculations with data from FAO, Trade Yearbook, Rome, various years; International Monetary Fund, International Financial Statistics: Yearbook 1986. Washington, D.C., pp. 232-233; Cathie/Dick (1987), Table 3.

Appendix 2: Impacts of the Southern African Customs Union on Import Prices of Cereals in Botswana, 1969-84<sup>a</sup>

Variables Years	Import Prices for Cereals			Import Prices for Maize			Import Prices for Non-maize Cereals		
	With Southern African Customs Union (\$/t)	Without Southern African Customs Union (\$/t)	Policy-induced Change (%)	With Southern African Customs Union (\$/t)	Without Southern African Customs Union (\$/t)	Policy-induced Change (%)	With Southern African Customs Union (\$/t)	Without Southern African Customs Union (\$/t)	Policy-induced Change (%)
1969	79.49	77.04	+3.2	53.22	62.30	-14.6	89.50	79.76	+12.2
1970	83.54	76.15	+9.7	62.00	69.43	-10.7	90.00	77.25	+16.5
1971	89.74	78.93	+13.7	60.00	74.19	-19.1	95.88	79.24	+21.0
1972	86.25	76.59	+12.6	60.00	68.51	-12.4	98.18	78.26	+25.5
1973	122.35	110.76	+10.5	96.00	97.72	-1.8	133.33	114.82	+16.1
1974	122.73	179.24	-31.5	75.00	141.39	-47.0	180.00	146.73	+22.7
1975	158.00	181.78	-13.1	90.00	151.64	-40.7	175.00	177.30	-1.3
1976	172.86	161.11	+7.3	126.83	134.08	-5.4	192.32	169.04	+13.8
1977	180.34	149.26	+20.8	138.95	125.10	+11.1	196.47	157.70	+24.6
1978	255.51	155.50	+64.3	293.89	126.06	+133.1	252.79	158.34	+59.7
1979	213.52	175.56	+21.6	155.91	142.84	+9.2	241.92	189.14	+27.9
1980	237.51	202.83	+17.1	172.00	166.58	+3.3	269.39	216.47	+24.4
1981	265.83	212.00	+25.4	145.97	176.43	-17.3	315.29	216.22	+45.8
1982	280.72	187.38	+49.8	177.76	149.82	+18.7	321.41	198.93	+61.6
1983	269.52	180.82	+49.1	168.55	154.68	+9.0	316.75	188.69	+67.9
1984	311.03	179.39	+73.4	172.73	162.28	+6.4	343.00	181.67	+88.8

<sup>a</sup> The import prices are unit values derived from FAO statistics. The hypothetical situation without Southern African Customs Union is modelled on the basis of average world import prices. Import prices for non-maize cereals are calculated residually from data on import expenditures and imports for cereals and maize.

Source: Authors' calculations with data from FAO, Trade Yearbook, Rome, various years.

Appendix 3: Impacts of the Southern African Customs Union on Botswana's Cereal Imports, 1969-84<sup>a</sup>

Variables Years	Imports of Cereals			Imports of Maize			Imports of Non-maize Cereals		
	With Southern African Customs Union (t)	Without Southern African Customs Union (t)	Policy-induced Change (%)	With Southern African Customs Union (t)	Without Southern African Customs Union (t)	Policy-induced Change (%)	With Southern African Customs Union (t)	Without Southern African Customs Union (t)	Policy-induced Change (%)
1969	39500	41888	-5.7	10898	6512	+67.4	28602	35376	-19.1
1970	65000	76271	-14.8	15000	10759	+39.4	50000	65512	-23.7
1971	58500	72311	-19.1	10000	4418	+126.3	48500	67892	-28.6
1972	80000	97554	-18.0	25000	16633	+50.3	55000	80921	-32.0
1973	85000	100783	-15.7	25000	23941	+4.4	60000	76842	-21.9
1974	22000	2146	+925.3	12000	0 <sup>b</sup>	+ <sup>b</sup>	10000	2146	+366.1
1975	50000	35249	+41.8	10000	0 <sup>b</sup>	+ <sup>b</sup>	40000	35249	+13.5
1976	20190	22880	-11.8	6000	5190	+15.6	14190	17689	-19.8
1977	33880	45324	-25.2	9500	11734	-19.0	24380	33589	-27.4
1978	27240	48135	-43.4	1800	4226	-57.4	25440	43909	-42.1
1979	69970	94351	-25.8	23103	27674	-16.5	46867	66677	-29.7
1980	70270	90381	-22.3	23000	24709	-6.9	47270	65672	-28.0
1981	51010	71255	-28.4	14900	7562	+97.0	36110	63693	-43.3
1982	60950	100668	-39.5	17265	23670	-27.1	43685	76998	-43.3
1983	121770	200316	-39.2	38802	46337	-16.3	82968	153979	-46.1
1984	58580	107170	-45.3	11000	12570	-12.5	47580	94600	-49.7

<sup>a</sup> The imports in the existing situation with Southern African Customs Union are taken from FAO statistics. The hypothetical imports in the situation without Southern African Customs Union are calculated on the basis of equation (2') with the price elasticities of import demand for cereals and maize presented in Appendix 1. The actual and hypothetical imports of non-maize cereals are computed residually from the respective imports of cereals and maize.

<sup>b</sup> In the case of hypothetical maize imports, the relatively elastic import demand for maize would have caused negative imports according to the chosen methodological approach for 1974 and 1975. For plausibility reasons, it was assumed that the imports were reduced to nil, and this led to an infinitively high policy-induced change.

Source: Authors' calculations on the basis of data from FAO, Trade Yearbook, Rome, various years and the method described in footnote a.



Appendix 4: Impacts of the Southern African Customs Union on Botswana's Import Expenditures for Cereals, 1969-84<sup>a</sup>

Variables Years	Import Expenditures for Cereals			Import Expenditures for Maize			Import Expenditures for Non-maize Cereals		
	With Southern African Customs Union (1000\$)	Without Southern African Customs Union (1000\$)	Policy-induced Change (%)	With Southern African Customs Union (1000\$)	Without Southern African Customs Union (1000\$)	Policy-induced Change (%)	With Southern African Customs Union (1000\$)	Without Southern African Customs Union (1000\$)	Policy-induced Change (%)
1969	3140	3227	-2.7	580	406	+43.0	2560	2821	-9.3
1970	5430	5808	-6.5	930	747	+24.5	4500	5061	-11.1
1971	5250	5708	-8.0	600	328	+83.0	4650	5380	-13.6
1972	6900	7472	-7.7	1500	1139	+31.6	5400	6333	-14.7
1973	10400	11163	-6.8	2400	2340	+2.6	8000	8823	-9.3
1974	2700	385	+602.0	900	0 <sup>b</sup>	+∞ <sup>b</sup>	1800	385	+368.0
1975	7900	6408	+23.3	900	0 <sup>b</sup>	+∞ <sup>b</sup>	7000	6408	+9.2
1976	3490	3686	-5.3	761	696	+9.3	2729	2990	-8.7
1977	6110	6765	-9.7	1320	1468	-10.1	4790	5297	-9.6
1978	6960	7485	-7.0	529	533	-0.7	6431	6953	-7.5
1979	14940	16564	-9.8	3602	3953	-8.9	11338	12611	-10.1
1980	16690	18332	-9.0	3956	4116	-3.9	12734	14216	-10.4
1981	13560	15106	-10.2	2175	1334	+63.0	11385	13772	-17.3
1982	17110	18863	-9.3	3069	3546	-13.5	14041	15317	-8.3
1983	32820	36221	-9.4	6540	7167	-8.8	26280	29054	-9.5
1984	18220	19226	-5.2	1900	2040	-6.9	16320	17186	-5.0

<sup>a</sup> The import expenditures in the situations with and without Southern African Customs Union are calculated by multiplying the respective price and quantity data from Appendix 2 and Appendix 3.

<sup>b</sup> See footnote b in Appendix 3 which explains the import expenditures for maize being nil in the hypothetical situation without Southern African Customs Union in 1974 and 1975.

Source: Authors' calculations on the basis of Appendices 2 and 3.

Appendix 5: Impacts of the Southern African Customs Union on Botswana's Import Prices, Imports and Import Expenditures of Sugar, 1969-84<sup>a</sup>

Variables Years	Import Prices for Sugar			Imports of Sugar			Import Expenditures for Sugar		
	With Southern African Customs Union (\$/t)	Without Southern African Customs Union (\$/t)	Policy-induced Change (%)	With Southern African Customs Union (t)	Without Southern African Customs Union (t)	Policy-induced Change (%)	With Southern African Customs Union (1000\$)	Without Southern African Customs Union (1000\$)	Policy-induced Change (%)
1969	83.32	108.17	-23.0	11522	9576	+20.3	960	1036	-7.3
1970	92.00	121.86	-24.5	10870	8872	+22.5	1000	1081	-7.5
1971	91.13	133.87	-31.9	11522	8462	+36.2	1050	1133	-7.3
1972	102.21	165.21	-38.1	11740	7642	+53.6	1200	1263	-5.0
1973	154.76	209.67	-26.2	11631	9294	+25.1	1800	1949	-7.6
1974	376.35	414.47	-9.2	11957	11271	+6.1	4500	4672	-3.7
1975	585.43	618.18	-5.3	11957	11578	+3.3	7000	7157	-2.2
1976	336.94	395.01	-14.7	13044	11771	+10.8	4395	4650	-5.5
1977	380.97	315.68	+20.7	15001	16457	-8.8	5715	5195	+10.0
1978	175.08	354.21	-50.6	33893	14256	+137.7	5934	5050	+17.5
1979	177.12	369.90	-52.1	43965	16866	+160.7	7787	6239	+24.8
1980	274.56	579.66	-52.6	37038	13729	+169.8	10169	7958	+27.8
1981	453.63	557.31	-18.6	32619	28397	+14.9	14797	15826	-6.5
1982	399.86	412.53	-3.1	33667	33063	+1.8	13462	13639	-1.3
1983	371.97	387.34	-4.0	41345	40377	+2.4	15379	15640	-1.6
1984	372.96	384.17	-2.9	40219	39534	+1.7	15000	15188	-1.2

<sup>a</sup> The actual import prices are unit values derived from FAO statistics. Hypothetical prices in the situation without Southern African Customs Union are modelled on the basis of average world import prices. Actual imports are taken from FAO statistics. The hypothetical imports in the situation without Southern African Customs Union are calculated on the basis of equation (2') with the price elasticity of import demand for sugar presented in the Appendix 1. Import expenditures are computed by multiplying the respective numbers for import prices and imports.

Source: Authors' calculations with data from FAO, Trade Yearbook, Rome, various years.

Appendix 6: Impacts of the Southern African Customs Union on Botswana's Food Import Prices, Food Imports and Food Import Expenditures, 1969-84<sup>a</sup>

Variables Years	Food Import Prices			Food Imports			Food Import Expenditures		
	With Southern African Customs Union (\$/t)	Without Southern African Customs Union (\$/t)	Policy-induced Change (%)	With Southern African Customs Union (t)	Without Southern African Customs Union (t)	Policy-induced Change (%)	With Southern African Customs Union (1000\$)	Without Southern African Customs Union (1000\$)	Policy-induced Change (%)
1969	80.36	82.83	-3.0	51022	51464	-0.9	4100	4263	-3.8
1970	84.75	80.91	+4.7	75870	85143	-10.9	6430	6889	-6.7
1971	89.97	84.69	+6.2	70022	80773	-13.3	6300	6841	-7.9
1972	88.29	83.03	+6.3	91740	105196	-12.8	8100	8735	-7.3
1973	126.25	119.11	+6.0	96631	110077	-12.2	12200	13112	-7.0
1974	212.03	376.85	-43.7	33957	13417	+153.1	7200	5056	+42.4
1975	240.49	289.69	-17.0	61957	46827	+32.3	14900	13565	+9.8
1976	237.26	240.57	-1.4	33234	34650	-4.1	7885	8336	-5.4
1977	241.91	193.59	+25.0	48881	61780	-20.9	11825	11960	-1.1
1978	210.92	200.91	+5.0	61133	62391	-2.0	12894	12535	+2.9
1979	199.47	205.03	-2.7	113935	111217	+2.4	22727	22803	-0.3
1980	250.30	252.52	-0.9	107308	104111	+3.1	26859	26290	+2.2
1981	339.08	310.40	+9.2	83629	99652	-16.1	28357	30932	-8.3
1982	323.11	243.05	+32.9	94617	133731	-29.2	30572	32503	-5.9
1983	295.49	215.46	+37.1	163115	240693	-32.2	48199	51861	-7.1
1984	336.24	234.58	+43.3	98799	146705	-32.7	33220	34414	-3.5

<sup>a</sup> Food is defined as the sum of cereals and sugar which represent the major agricultural import goods of Botswana. The actual and hypothetical import prices, imports and import expenditures of food are derived from Appendices 2 to 5.

Source: Authors' calculations with data from FAO, Trade Yearbook, Rome, various years.

Appendix 7: Impacts of the Southern African Customs Union on Economic Welfare in Botswana's Food Import Sector, 1969-84 (in 1000\$)<sup>a</sup>

Variables Years	Policy-Induced Welfare Changes in the Import Sector of...				
	Food	Cereals	Maize	Non-maize Cereals	Sugar
1969	+165.4	-99.9	+82.2	-182.1	+265.3
1970	-227.1	-526.1	+97.5	-623.6	+298.9
1971	-277.7	-717.1	+110.6	-827.7	+439.4
1972	-227.2	-867.8	+182.0	-1049.8	+640.6
1973	-502.0	-1086.2	+42.2	-1128.4	+584.2
1974	+1300.8	+857.4	+252.5	+604.9	+443.4
1975	+1422.0	+1036.4	+252.4	+784.0	+385.6
1976	+469.4	-254.2	+40.7	-294.9	+723.5
1977	-2299.1	-1267.3	-148.9	-1118.3	-1031.8
1978	+462.6	-4427.9	-841.0	-3586.9	+4890.6
1979	+3538.5	-3217.5	-334.9	-2882.5	+6756.0
1980	+6130.5	-2844.7	-129.3	-2715.4	+8975.2
1981	-241.2	-3427.0	+363.3	-3790.4	+3185.8
1982	-8026.4	-8449.3	-590.9	-7858.4	+422.9
1983	-15335.5	-15963.8	-595.6	-15368.2	+628.3
1984	-12762.3	-13209.4	-123.7	-13085.7	+447.1

<sup>a</sup> The welfare changes for cereals, maize and sugar are calculated with equation (3) by use of the actual and hypothetical import prices shown in Appendices 2, 5 and 6, the imports given in Appendices 3, 5 and 6 and the price elasticities of import demand presented in Appendix 1. The welfare changes for food and non-maize cereals are calculated residually.

Source: Authors' calculations. For the method, see footnote a.