Welfare Impacts of Import Controls in Botswana's Horticulture

BIDPA Working Paper No. 26
June 2005

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ISBN: 99912-0-558-6

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Acknowledgements

The author gratefully acknowledges comments of Jay Salkin, Joel Sentsho and P. Mohanan Pillai on earlier versions of this manuscript.

Abstract

An import demand equation is estimated to capture the impact of import controls on horticultural imports (oranges and potatoes) in Botswana. Elasticity estimates are then employed to endogenously compute Nominal Protection Rates (NPRs) and to conduct welfare simulations. Model-generated NPRs are recorded at 55 and 118 percent for oranges and potatoes, respectively. Consumer losses from the policy regime have risen over time for both commodities. However, producer gains declined in the case of oranges and marginally rose in the case of potatoes. Quota rents have expanded under both cases, since imports have risen much faster than domestic production over time. The net loss in social welfare has also risen over time, implying that import controls have become increasingly burdensome over time.

Key Words: Botswana; Southern African Customs Union; Import Restrictions; Welfare Impacts.

1. Introduction

When Botswana attained its independence in 1966, its agricultural sector was the leading economic activity, accounting for about 40 percent of the country's Gross Domestic Product (GDP) (Ministry of Finance and Development Planning, 1997). Over time since then, agriculture witnessed a relative decline, and by 2000/01, its share in GDP had fallen to 2.4 percent (Central Statistics Office, 2002). The sector's relative decline was mainly propelled by the rapid growth of other economic activities, particularly mining – which is currently the leading sector. However, the declining trend was partly induced by the stagnant growth of the sector itself. When evaluated independently, agriculture remained stagnant over the period from 1974 to 2000, whereas all other sectors grew markedly during the same period (Botswana Institute for Development Policy Analysis, 2004).

Despite its relative decline over time, agriculture has historically received substantial public support, geared at promoting the development of all its sub-sectors, including both traditional and non-traditional activities.[2] Public support in non-traditional agriculture has been extended in pursuit of the national objectives of economic diversification, employment creation and income generation. One of the key aspirations of such intervention has been to promote import substitution. Both production and market oriented public support programs/policy instruments have been launched to stimulate growth and development in non-traditional agriculture. At the production level, the most prominent public support initiative was the Financial Assistance Policy (FAP), which operated during the period from 1982 to 2000. FAP was an economy-wide program providing grants (free money) to entrepreneurs for the development of productive enterprises. The key objectives of the program were to promote employment creation and economic diversification, and thereby lessen the country's dependence on large-scale mining, the public service and beef production (Molokomme, 1992). FAP grants have been utilized to fund the establishment of the majority of the non-traditional agricultural enterprises existing today in the country (Rebaagetse, 1999).

Border controls have also been adopted to promote the development of Botswana's non-traditional agriculture; horticulture, piggery, dairy and poultry. Quantitative import restrictions have been used to cushion domestic producers against intensive cross-border competition, and to further nurture the development of the so-called infant industries. This has

[2] Traditional activities include grain/cereal production and cattle/smallstock (meat) production, whereas non-traditional activities include, among others, horticulture, dairy, piggery, beekeeping, fisheries and poultry (egg and broiler) production.

been achieved through the adoption of an import permit system, to regulate the importation of key domestically produced non-traditional commodities. In horticulture, import permits have been applied on the importation of cabbages, tomatoes, onions, potatoes, green mealies and oranges since 1985 (Kealeboga, 1998). Crop coverage was broadened in 1996 to include choumollier, rape and spinach.

The continued use of import permits is likely to prompt cross-border policy disputes in future. This is because the renegotiated Southern African Customs Union (SACU) agreement (signed in 2002 by Botswana, Lesotho, Namibia, Swaziland (BLNS), and South Africa), stipulates that customs duties and quantitative import restrictions should not be applied on intra-SACU trade.[3] Although the renegotiated agreement has a provision for BLNS to levy duties on both intra- and inter-SACU imports, where protection of infant industries is justified, whether or not the infant-industry argument would continue to hold for Botswana's horticultural industry is a subject for future cross-border negotiations. The renegotiated agreement is silent regarding how existing quantitative import restrictions are to be phased-out – for example, it is unclear whether an abrupt or gradual phasing-out (say, through initial tariffication, and subsequent step-wise removal) would be adopted.

Botswana is also one of the signatories of the protocol on trade of the Southern African Development Community (SADC), which calls for the phasing-out and ultimate elimination of all quantitative trade barriers and tariffs (Southern African Development Community, nd).[4] The trade protocol, which was signed in 1996, stipulates that complete elimination of quantitative trade barriers should be achieved in eight years from the time of entry of the protocol into force. According to Stahl (2000), SADC has agreed to commence gradual liberalization on September 1, 2000, with a target to liberalize 85 percent of intra-SADC trade by 2008 and to liberalize trade in sensitive commodities by 2012.

The primary objective of this paper is to quantify the welfare impacts of import controls in Botswana's horticulture. The paper contributes in three ways. Firstly, by quantifying the impact of import controls, it

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[3] The Southern African Customs Union was inherited from the colonial times. The first SACU agreement was signed in 1910 by South Africa and Britain. This agreement allowed for the adoption of the South African tariff system in the entire SACU region and for South Africa to collect and apportion customs and excise revenues among member states. SACU was renegotiated following the attainment of independence by Botswana, Lesotho and Swaziland (BLS), culminating in the signing of a new agreement in 1969, between BLS and South Africa. For an extensive background on SACU, see for example Landell-Mills (1971), Turner (1971), Mosley (1978; 1979), Robson (1978), Cobbe (1980), Hall (1980), Maasdorp (1986), Walters (1989) and Leith (1992).

[4] Additionally, no new tariffs and quantitative trade restrictions should be introduced. However, there is a provision for a member state to temporarily suspend certain obligations of the protocol, to protect infant industries.

adds to the current understanding of how quantitative import restrictions have affected the country's horticultural industry. Secondly, in the event SACU/SADC decides to tariffy all quantitative trade restrictions, as a first step toward overall trade liberalization, this paper would serve as a useful source of information. Finally, elasticities generated in this study would be useful in future cross-border policy analyses.

The rest of this paper is organised as follows. In section 2, we present the model in three parts. The first part presents a graphical analysis of the welfare impacts of import controls. In the second part, an econometric model for quantifying the impacts of import restrictions on import volume is specified. The third part utilizes the results of the second part to develop a simulation model for quantifying the welfare impacts of import controls. Section 3 discusses the empirical results, and section 4 concludes.

2. The model

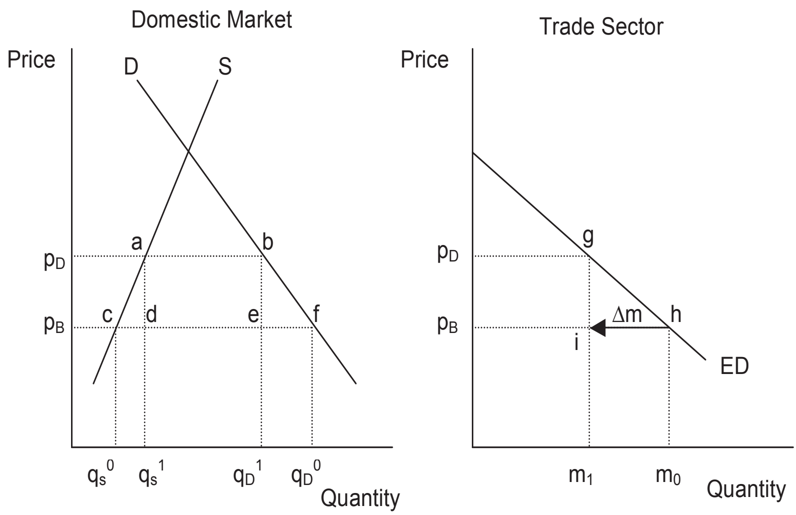
2.1. Welfare implications of import controls: a graphical illustration

Figure 1 presents a graphical illustration of the impact of import controls. Domestic supply and demand curves are given in the domestic market panel as S and D, respectively. The excess demand curve, which was derived as the horizontal difference between D and S, is denoted as ED in the trade sector panel. Before the imposition of import controls, domestic producers and consumers face the border price p_B, and supply and demand quantities are q_S^0 and q_D^0, respectively. In the trade sector panel, imports are recorded at m_0.

The imposition of import controls causes a reduction in imports from m_0 to m_1, ceteris paribus. Thus, the horizontal distance Δm represents the policy-induced reduction in imports. Since domestic supply and demand curves remain unchanged, the domestic price would rise to p_D in the trade sector panel, in order to clear the new import volume m_1. However, the border price would remain unchanged at p_B, due to the small country assumption. That is, the border price p_B is not influenced by policy changes in Botswana.

In the domestic market panel, new supply and demand quantities, corresponding to price p_D, are q_S^1 and q_D^1, respectively. The welfare consequences of imposing import controls are as follows. Producers gain area p_Dacp_B, whereas consumers lose area p_Dbfp_B in the domestic market panel. Since import permits are not accompanied by any licensing charges, importing firms (traders) capture area abed, as quota rent, which is equivalent to area $p_D gi p_B$ in the trade sector panel. Areas acd and bef jointly represent the dead weight loss, which may also be measured in the trade sector panel as area gih.

Figure 1: Welfare Implications of Import Controls



2.2. Econometric estimation and data

As a preparatory step towards quantifying the welfare impacts of quantitative import restrictions, an import demand equation was specified and estimated. At any given price, the import demand is derived as domestic demand less supply (Ortalo-Magné and Goodwin, 1992). This implies that the import demand is theoretically a function of the import price and both domestic supply and demand shifting variables.

The common approach in modelling demand for imports is to specify the quantity of imports as a function of the import price and domestic demand shifting variables (Armah and Epperson, 1997; Lanclos et al., 1997; Ortalo-Magné and Goodwin, 1992; and Tanyeri-Abur and Rosson, 1997). However, when domestic supply is hypothesized to be an important determinant of imports, the standard approach is to include domestic production amongst the explanatory variables, to capture the total effect of supply shifting variables (Abbott and Young, 1999; Kargbo, 1992; Konandreas et. al., 1978; Le et. al., 1997). It is also possible to include relevant variables for capturing the impacts of policies – for example, advertising or promotion expenditure – on the demand for imports/exports (Armah and Epperson, 1997; Lanclos et. al., 1997; Le et. al., 1997).

In the present study, where the primary objective is to quantify the impacts of quantitative import restrictions on imports, the import demand equation was specified as:

$$\ln m_t = \alpha + \beta \ln p_t + \psi \ln y_t + \omega d_t + \phi T_t + u_t \qquad (1)$$

where m denotes net imports (imports minus exports) in metric tons (mt), p is the real border price of imports in 1995 Botswana Pula (henceforth Pula) per mt, y represents real GDP in 1995 Pula, d is a dummy variable for capturing the impact of quantitative import restrictions (dt = 1 for years with import controls in place and dt=0 otherwise), T is the trend variable, α, β, ψ, ω and ϕ are parameters to be estimated, ln is the natural logarithm, u is the error term, and t denotes year.[5] The parameters β and ψ are import demand elasticities with respect to variables p and y, respectively. The parameter ω is the differential intercept coefficient for capturing the impact of quantitative import restrictions on imports. *A priori* expectations on the parameter estimates are: β, ω<0; ψ >0. The trend variable coefficient ϕ may take any sign, depending on whether imports have, ceteris paribus, declined of risen over time.

The variable p was computed as 100EP/CPI, where E is the exchange rate in Pula/US Dollar, P is the unit value of imports in US Dollars and CPI is the consumer price index for Botswana (base year = 1995). Real GDP was computed as y=100Y/CPI, where Y denotes nominal GDP for Botswana. Data were obtained from FAO (2002) and IMF (2001). FAO data were on imports (quantity and value) and domestic production. IMF data were on the consumer price index (CPI), exchange rates, and gross domestic product (GDP). The ordinary least squares (OLS) procedure was used to estimate the import demand equations for oranges and potatoes, covering the period from 1974 to 1998.[6] The choice of the period was based on data availability. Although FAO reported data up to 2002, the entries for 1998 and 1999 were identical for all commodities. Therefore, we decided to exclude the data for 1999 and onwards.

From the econometric model, the policy-induced change in imports was computed as:

$$\Delta \hat{m}_t = \hat{m}_{1t} - \hat{m}_{0t} \qquad (2)$$

[5] The inclusion of exchange rate (nominal or real) and domestic production among the explanatory variables produced fruitless results. Two-stage least squares estimation with these variables included also produced fruitless results. However, the lack of responsiveness of imports to domestic production should not be perceived as problematic because, according to FAO data (used in this study), production was not highly variable during the model period. Import controls were introduced as a policy instrument in 1985. However, there is no record on when implementation started. In this study, we assumed that the effects may have been felt beginning in 1986, implying that d_t=1 for 1986-98 and d_t=0 otherwise.

[6] The Onion model was discarded as it produced fruitless results. Data for other horticultural commodities for which import permits are applied (for example, tomatoes, green mealies and cabbages) were scanty; hence, the commodities were not included in the analysis.

where the first and second expressions represent the predicted values of imports with and without import controls, respectively, and $\Delta\hat{m}_t < 0$. The policy-induced rate of decrease in imports was expressed as:

$$\delta = \left|\Delta\hat{m}_t\right| / \hat{m}_{0t} \qquad (3)$$

where 0<δ<1 (in this particular case where the country still remains a net importer after the imposition of import controls – hence $|\Delta\hat{m}_t| < \hat{m}_{0t}$). This is the applicable situation under prevailing trade flows in Botswana. The coefficient δ does not vary with t because of the log-linear specification of the import demand equation.

2.3. Welfare simulation procedure

A closer examination of Figure 1 would reveal that variables p_B, q_S^1, q_D^1 and m_1 are exogenous (observable), whereas p_D, q_S^0, q_D^0 and m_0 are endogenous (unobservable). In what follows, a sequential procedure for solving for the endogenous variables and quantifying the welfare impacts is presented. From equations 2 and 3, we may write:

$$m_0 = \left(\frac{1}{1-\delta}\right) m_1 \qquad (4)$$

where the hats (^s) have been dropped since m_1 now represents the observed volume of imports with policy in place, m_0 denotes pre-policy imports (unobserved), and the t's have been omitted to simplify the presentation of the model (this would be the case henceforth). Since 0<δ<1, it follows that 1/(1-δ)>1, implying that $m_0>m_1$ as in Figure 1.

From the econometric model, the Cobb-Douglas import demand equation in m, p space may be defined as $m = \phi p^{\beta}$, where β is the estimated import demand elasticity and ϕ is the import demand shift parameter. Using point h (Figure 1) as the reference, we computed $\phi = m_0 / p_B{}^{\beta}$, where p_B is the observed border price, and m_0 is now known from equation 4. Since points h and g fall on ED, we then expressed imports at point g as $m_1 = \phi p_D{}^{\beta}$, where p_D is the unobserved policy-induced domestic price. Rearranging terms yields:

$$p_D = \left(\frac{m_1}{\phi}\right)^{1/\beta} \qquad (5)$$

Having endogenously computed the domestic price, we can now derive domestic supply and demand equations. Assuming that the domestic supply equation in q, p space takes the form $q = \theta p^{\varepsilon}$, where ε>0 is the price elasticity of supply, we can compute $\theta = q_S{}^1 / p_D{}^{\varepsilon}$, where point a is the reference. Since p_B is observable, pre-policy quantity supplied at point c was then computed as:

$$q_S{}^0 = \theta p_B{}^{\varepsilon} \qquad (6)$$

To maintain a theoretical relationship between supply, demand and imports, the domestic demand equation in q, p space was expressed as $q = \phi p^{\beta} + \theta p^{\varepsilon}$, which measures the horizontal sum of import demand and domestic supply. From the demand equation, pre-policy quantity demanded, evaluated at point f, was therefore expressed as:

$$q_D{}^0 = \phi p_B{}^{\beta} + \theta p_B{}^{\varepsilon} \qquad (7)$$

The domestic demand elasticity was then derived as $\eta = \beta(m / q_D) + \varepsilon(q_S / q_D)$, where q_D and q_S are demand and supply quantities, and m denotes imports (see for example, Rosson et. al., 1993; Reed, 2001). Simulations were conducted with varying levels of ε, maintaining the theoretical relationship $|\beta| < |\eta|$ -- import demand is more elastic than domestic demand.

The nominal protection rate (as a percentage) was then derived as:

$$NPR = 100((p_D / p_B) = 1) \qquad (8)$$

which measures the level of protection in the horticultural industry (see Swinnen and Bojnec, 1997). The NPR measures the rate (in percentage terms) at which consumers and producers are taxed or subsidized. A positive NPR would reflect the level of consumer (producer) taxation (subsidization), whereas a negative NPR would reflect the reverse. In the present case, NPR>0, since $p_D > p_B$.

Having computed all the endogenous variables of the model, we then computed the following welfare measures:

$$\Delta PS = \theta \int_{p_B}^{p_D} p^{\varepsilon} dp = \frac{\theta}{\varepsilon + 1}\left(p_D^{\varepsilon+1} - p_B^{\varepsilon+1}\right) \qquad (9)$$

$$\Delta CS = -\phi \int_{p_B}^{p_D} p^{\beta} dp - \theta \int_{p_B}^{p_D} p^{\varepsilon} dp = \frac{\phi}{\beta + 1}\left(p_B{}^{\beta+1} - p_D{}^{\beta+1}\right) + \frac{\theta}{\varepsilon + 1}\left(p_B{}^{\varepsilon+1} - p_D{}^{\varepsilon+1}\right) \qquad (10)$$

$$QR = m_1(p_D = p_B) \qquad (11)$$

$$\Delta SW = \Delta CS + \Delta PS + QR \qquad (12)$$

where ΔPS represents the change in producer surplus, ΔCS denotes the change in consumer surplus, QR is the quota rent, and ΔSW is the net change in social welfare.[7] These welfare measures are consistent with the graphical analysis presented earlier.

[7] Note from Figure 1 that area abfc in the domestic market panel is equivalent to area $p_D ghp_B$ in the trade sector panel. Therefore, the consumer surplus change, area $p_D bfp_B$, is equivalent to area ($p_D acp_B$ + $p_D ghp_B$). Since consumers lose from protection, these two components of consumer surplus change carry negative signs as reflected in equation 10.

3. Empirical results and implications

3.1. Econometric models

Table 1 reports OLS estimates of the import demand models. As evident, all coefficients are consistent with *a priori* expectations, and are statistically significant at the 10 percent level of significance. That is, as hypothesized, parameter estimates for variables ln p and d carry negative signs, whereas that for ln y carries a positive sign.[8] The orange import demand elasticities with respect to the import price and income stand at -0.81 and 0.79, respectively. The potato import demand elasticities with respect to price and income stand at –0.29 and 0.39, respectively. The results also indicate that quantitative import restrictions (import permits) had negative impacts on orange and potato imports. It is also evident from the potato model that the trend variable carries a positive coefficient, implying that potato imports have risen over time. In the case of oranges, the trend variable was excluded because it introduced multicollinearity problems; hence that model did not pass the multicollenearity test discussed below. [9]

Table 1: OLS Estimates of the Import Demand Equations, 1974-98

Explanatory variable/ Statistical Measure	Orange	Potato
Intercept	-3.962	0.372
	(-0.902)	(0.067)
ln p	-0.813	-0.288
	(-2.986)[a]	(-2.566)[a]
ln y	0.789	0.389
	(5.476)[a]	(1.533)[c]
d	-0.356	-0.224
	(-1.975)[b]	(-1.525)[c]
T		0.104
		(5.025)[a]
		-1.312
d75		(-7.796)[a]
R^2	0.899	0.985
Adjusted R^2	0.885	0.981
Durbin-Watson	1.422	1.758
Number of observations	25	25

[a]; [b]; [c]: statistically significant at 1%; 5%;10%.
t-values are in parentheses below parameter estimates.

The Durbin-Watson statistics for both models show no evidence of the existence of positive first-order autocorrelation at the 1 percent level of significance (see Johnston, 1984). To detect whether or not multicollinear-

[8] Note that a dummy variable d75 (d75=1 for 1975 and d75=0 otherwise) was included for the potato model to correct for the outlier problem.

[9] Although this was the case, simulations with the discarded model produced similar welfare results. For example, the nominal protection rate under the current model is 55 percent (see forthcoming results), compared to 52 percent for the discarded model.

ity was a problem, each independent variable was regressed against other independent variables of the model. According to this test, multicollinearity is considered to be a problem if any of the auxiliary regressions has an R^2 that is greater than the full model R^2 (Kennedy, 1992; Le et. al., 1997). This test showed no evidence that multicollinearity was a serious problem for both models.

Table 2 reports predicted values of imports under the with- and the without-import controls scenarios, for selected years during the 1986-98 period. As seen from the table, the average predicted values of orange imports with (and without) import controls stood at about 3.5 (and 5.0) thousand mt per year. On average, this implies that import controls led to an annual reduction of about 1.5 thousand mt in orange imports – or a 30% reduction.

Table 2: Impact of Import Controls on Trade Flows

Commodity: Year	Quantity (metric tons)				Value (million constant 1995 Prices)			
	With Policy ($\hat{m}_1$)	Without Policy ($\hat{m}_0$)	Change ($\Delta\hat{m}$)	Percent Decrease (100δ)	With Policy ($p_B\hat{m}_1$)	Without Policy ($p_B\hat{m}_0$)	Change ($p_B\Delta\hat{m}$)	Percent Decrease (100δ)
Oranges:								
1986	1,881	2,690	-808	30.06	2.673	3.821	-1.149	30.06
1990	3,505	5,011	-1,506	30.06	4.153	5.937	-1.785	30.06
1994	4,195	5,998	-1,803	30.06	4.092	5.850	-1.759	30.06
1998	5,236	7,486	-2,250	30.06	4.990	7.134	-2.144	30.06
1986-1998	3,499	5,003	-1,504	30.06	3.956	5.656	-1.700	30.06
Potatoes:								
1986	4,013	5,023	-1,010	20.10	4.097	5.128	-1.031	20.10
1990	7,125	8,918	-1,793	20.10	9.519	11.914	-2.395	20.10
1994	12,318	15,417	-3,099	20.10	10.844	13.572	-2.728	20.10
1998	18,980	23,755	-4,775	20.10	22.413	28.051	-5.638	20.10
1986-1998	9,973	12,481	-2,509	20.10	11.506	14.400	-2.898	20.10

In constant 1995 prices, average predicted orange imports with (and without) import controls stood at about 4.0 (and 5.7) million Pula, implying that imports were reduced by about 1.7 million Pula per year, as a result of implementing the import permit system – or a 30% reduction. The potato model reveals that import permits reduced import volume from 12.5 to 10.0 thousand mt, which amounts to an annual average reduction of 2.5 thousand mt – or a 20 percent reduction. In monetary terms, the policy-induced reduction in potato imports stands at 2.9 million pula per year. It is also clear that the reduction in import volume and value rose over time for both commodities.

3.2. Welfare simulations

3.2.1. Oranges

Table 3 reports average model solutions for the 1986-98 period. Table 3 variables are defined in the appendix. As seen from Table 3, the results are presented in two scenarios. In both scenarios, the import demand elasticity was set at –0.813, to conform to the econometric model.

Table 3: Annual Welfare Changes, 1986-1998

Variable	Oranges		Potatoes	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
	β=-0.813	β=-0.813	β=-0.288	β=-0.288
	ε= 0.000	ε=2.600	ε= 0.000	ε=0.530
	η=-0.654	η=-0.403	η=-0.197	η=-0.030
Imports (mt):				
m_0	5,153	5,153	12,431	12,431
m_1	3,604	3,604	9,933	9,933
Δm	-1,549	-1,549	-2,499	-2,499
Demand (mt):.				
q^0	5,646	5,310	17,012	15,462
q^1	4,097	4,097	14,513	14,513
Δq	-1,549	-1,214	-2,499	-947
Supply (mt):				
q^0	492	157	4,580	3,031
q^1	492	492	4,580	4,580
Δq	0	335	0	1,550
Prices (1995 Pula):				
P_B	1,175	1,175	1,149	1,149
P_D	1,825	1,825	2,505	2,505
NPR (%)	55	55	118	118
Parameters				
θ	492	$1.63X10^{-6}$	4,580	72
ϕ	1,615,071	1,615,071	94,596	94,596
Welfare Changes (million 1995 Pula):				
ΔCS	-3.096	-2.974	-21.086	-20.099
ΔPS	0.320	0.198	6.209	5.222
QR	2.340	2.340	13.464	13.464
ΔSW	-0.436	-0.436	-1.413	-1.413

In scenario 1, the supply elasticity was set at zero, leading to model-simulated domestic demand elasticity of about –0.654. This is the lower bound estimate of the supply elasticity. In Scenarios 2, domestic supply elasticity was set at 2.600, the highest figure that could be reached to keep the model-generated domestic demand elasticity negative. Thus, this is the upper-bound supply elasticity estimate for maintaining the theoretical relationship $|\beta| < |\eta|$. The resulting model-generated domestic demand elasticity was –0.403. Hence, supply elasticity falls within the range [0, 2.600] and demand elasticity the range [-0.65, -0.40].

The orange NPR figure reported in Table 3 implies that import permits are associated with a consumer (producer) tax (subsidy) of 55 percent. Scenario 1 generated annual consumer surplus change of -3.10 million Pula, and annual producer surplus change of 0.32 million Pula, all expressed in constant 1995 prices. Quota rent, captured by importing firms, averaged 2.34 million Pula per year. In sum, import permits were associated with a net social cost of 0.44 million Pula per year. In the second scenario, only producer and consumer surplus changes were different from those generated under scenario 1: the annual change in consumer surplus was recorded -2.97 million Pula and the annual change in producer surplus at 0.20 million Pula.

Given the fact that orange production was not variable during 1986 through 1998, it is tempting to conclude that supply may be highly (or almost perfectly) inelastic. Therefore, Scenario 1 results seem to be the most realistic. However, the results do not vary greatly across scenarios– except for producer surplus changes (in relative terms). When considering both scenarios, the annual producer surplus change ranged from 0.20 to 0.32 million Pula, and the annual consumer surplus change from –3.10 to -2.97 million Pula. Annual quota rent and net social cost stand at 2.34 and 0.44 million Pula, respectively.

Table 4 provides welfare changes for selected years during the 1986-1998 period. When evaluating the trend in consumer surplus change, it becomes apparent that the consumer loss generally rose over time. For example, under scenario 1 consumers lost 2.25 million Pula in 1986, compared with 3.80 million Pula in 1998. This was caused by the steadfast rise in income, which has further led to an increase in consumer demand – note from Figure 1 that if the demand curve shifted to the right, ceteris paribus, area $p_D bfp_B$ (the consumer surplus change) would expand in size.

The producer gain has generally declined over time. For instance, the scenario 1 change in producer surplus was recorded at 0.39 million Pula in 1986, compared to 0.21 million Pula in 1998. Orange production has not expanded over time, implying that the expansion in demand over time has mainly been met through imports. Therefore, an important implication of the results is that the protection of domestic producers through import controls may not have yielded significant expansion in domestic production – implying the ineffectiveness of the policy instrument in achieving one of its desired ends. This might signal the fact that the extent to which horticulture can be expanded, given existing infrastructure and institutions, is limited.

Table 4: Welfare Changes in Constant 1995 Pula, Selected Years (1986-1998)

Variable		Oranges		Potatoes	
		Scenario 1 ß=-0.813 ε= 0.000	Scenario 2 ß=-0.813 ε=2.600	Scenario 1 ß=-0.288 ε= 0.000	Scenario 2 ß=-0.288 ε= 0.530
1986:					
η		-0.650	-0.130	-0.187	-0.002
Welfare:	ΔCS	-2.254	-2.105	-7.719	-7.317
	ΔPS	0.392	0.243	2.529	2.272
	QR	1.569	1.569	4.697	4.697
	ΔSW	-0.293	-0.293	-0.493	-0.493
1988:					
η		-0.663	-0.181	-0.201	-0.040
Welfare:	ΔCS	-2.260	-2.123	-8.634	-8.246
	ΔPS	0.363	0.225	2.440	2.052
	QR	1.599	1.599	5.605	5.605
	ΔSW	-0.298	-0.298	-0.588	-0.588
1990:					
η		-0.692	-0.303	-0.198	-0.032
Welfare:	ΔCS	-2.538	-2.413	-16.711	-15.934
	ΔPS	0.327	0.203	4.884	4.108
	QR	1.863	1.863	10.703	10.703
	ΔSW	-0.347	-0.347	-1.124	-1.124
1992:					
η		-0.727	-0.452	-0.201	-0.042
Welfare:	ΔCS	-3.958	-3.822	-30.946	-29.567
	ΔPS	0.359	0.223	8.670	7.292
	QR	3.033	3.033	20.159	20.159
	ΔSW	-0.566	-0.566	-2.116	-2.116
1994:					
η		-0.714	-0.397	-0.193	-0.019
Welfare:	ΔCS	-2.574	-2.472	-20.108	-19.126
	ΔPS	0.269	0.167	6.178	5.196
	QR	1.943	1.943	12.607	12.607
	ΔSW	-0.362	-0.362	-1.323	-1.323
1996:					
η		-0.729	-0.459	-0.190	-0.009
Welfare:	ΔCS	-3.232	-3.123	-24.941	-23.676
	ΔPS	0.287	0.178	7.955	6.690
	QR	2.482	2.482	15.373	15.373
	ΔSW	-0.463	-0.463	-1.614	-1.614
1998:					
η		-0.760	-0.591	-0.201	-0.042
Welfare:	ΔCS	-3.803	-3.723	-40.442	-38.643
	ΔPS	0.211	0.131	11.319	9.519
	QR	3.028	3.028	26.357	26.357
	ΔSW	-0.565	-0.565	-2.767	-2.767

ΔCS= Policy-induced change in consumer surplus; ΔPS= Policy-induced change in producer surplus; QR= Quota rent; ΔSW =Policy-induced net change in social welfare; and η = domestic demand elasticity.

The results reveal that quota rent has expanded markedly over ti

For example, in 1986, scenario 1 quota rent stood at 1.57 million pula, compared with 3.03 million pula in 1998. Again, this is due to the fact that imports have expanded over time in response to expanding domestic demand, while there has not been any corresponding expansion in domestic production. It is also clear from the results that quota rent, which accrues to importing firms, far outstrips producer surplus gains -- again this is due to the smallness in domestic output, compared to imports.

3.2.2. Potatoes

Table 3 provides average solution figures for the potato model as well. The results are presented in 2 scenarios. In scenario 1, the price elasticity of import demand was set at -0.288 (to conform to the econometric model), supply was assumed to be perfectly inelastic, and the domestic demand elasticity was endogenously determined. In scenario 2, the import demand elasticity remained the same as in scenario 1, supply elasticity was set at 0.530, and demand elasticity was model-generated. Setting supply elasticity greater than this figure produced theoretically incorrect results for some years – the model-generated demand elasticity was positive for some years. Therefore, this implies that the supply elasticity falls within the range [0, 0.53]. As seen from the table, the endogenously generated domestic demand elasticity thus falls within the range [-0.197, -0.030].

As indicated in Table 3, the NPR stands at 118 percent, implying that the potato industry is highly protected. The high NPR is caused by the highly inelastic import demand elasticity (-0.289), which suggests that a small quantitative restriction in imports would cause the domestic price to rise sharply. The results indicate that producers gained from 5.2 to 6.2 million Pula per year, whereas consumers lost 20 to 21 million Pula per year as a result of import controls. Annual quota rent stood at 13 million Pula. The net social cost of the program was recorded at 1.4 million Pula per year.

As with the orange results, consumer losses have risen over time due mainly to the expansion in demand over time (Table 4). However, unlike the orange case, producer gains from protection have also risen over time, albeit not substantially (Table 4). Quota rents have also risen over time as was the case with oranges, reinforcing the conclusion that imports have expanded much faster than domestic production.[10]

[10] Note that, ceteris paribus, quota rent would expand in response to a rise in imports.

3.3. The distributional consequences of the policy regime

The distributional consequences of import controls are clear from the above results. The results indicate that the current policy regime is equivalent to *ad valorem* tariffs of 55 and 118 percent for oranges and potatoes, respectively. However, if an intra-SACU import licensing scheme, at these same rates, had instead been adopted, quota rents would not have accrued to importing firms. Instead, the same amounts would have been collected by government and gone into the SACU customs revenue pool, out of which the Botswana Government would have gotten some proportion, based on the country's share of total imports as a share of total SACU imports. On the basis of this understanding, one would have expected that policymakers would have preferred to issue import permits with licensing charges to capture some, and possibly all, of the quota rent.

The results also indicate that the net social cost of the program has generally risen over time. For example, in the case of oranges, scenario 1 net social costs were recorded at 0.29 million Pula in 1986, compared with 0.57 million Pula in 1998. Similar trends are observed for scenario 2 of the orange model, and the two scenarios of the potato model. This means that the policy regime is associated with increasing net social costs over time, and, hence, it is becoming increasingly burdensome.

3.4. Verification of nominal protection rates

Although the results of the two econometric models conform to *a priori* expectations and exhibit good econometric fit, a relevant question pertains to the accuracy of the dummy variable in capturing the impact of import controls. To determine if these estimates are reasonably accurate, we compared model-generated NPRs (reported above) with new NPRs generated from the comparison of South Africa's and Botswana's retail prices.

Along the lines of equation 8, the retail price based NPR may be derived as:

$$NPR_R = 100((P_B / P_{SA}) = 1) \qquad (13)$$

where P_B and P_{SA} are retail prices of a particular commodity in Botswana and South Africa, respectively. Two methods were adopted to compute these NPRs. Method 1 involved the computation of the period-based NPR as a simple average of monthly NPRs computed from equation 13. In method 2, we estimated the regression equation:

$$P_B = \theta P_{SA} + \varepsilon \qquad (14)$$

where θ is the nominal protection coefficient and ε the error term. The NPR was then computed as:

$$NPR_R = 100(\theta - 1) \qquad (15)$$

where $\theta = P_B / P_{SA}$ from equation 14.

Due to the unavailability of SA retail prices for oranges from published sources, NPR verifications were not conducted for this commodity. Therefore, only the potato NPR was verified. The adjustment of SA prices was made under three assumptions regarding the costs of moving the product from Botswana to South Africa; (1) transfer costs are equal to zero, (2) transfer costs amount to five percent of SA's retail price and (3) transfer costs amount to 10 percent of SA's retail price. It is noteworthy that we took the Gaborone (Botswana's capital city) price as a proxy for Botswana's retail price (Central Statistics Office, Various Issues). Since Gaborone is on the border with SA and it is next to the main borders where products enter Botswana from SA, we do not expect that transfer costs are substantial.

NPR estimates were based on out-of-sample data for 2000:01 through 2002:08. This is the only period we could use due to the unavailability of SA retail price data for any other periods, including the within-sample period, from published sources. Table 5 below reports the results. As seen therein, method 1 NPRs stood at 130, 119 and 109 under the assumptions that transfer costs amount to zero, five and ten percent of SA prices, respectively. Under method 2, the respective NPRs stood at 126, 115 and 105. Therefore, the potato model-generated NPR of 118 falls within the range of these estimates, under each method, implying that it is reasonably accurate. Thus, we infer from these results that the orange model is equally realistic.

Table 5: Verification of Nominal Protection Rates for Potatoes

Computation of NPR	Model Generated	Based on Retail Prices†	
		Method 1	Method 2
Model-Generated	118		
TCs are Zero		130	126
TCs are 5 Percent of SA Retail Price		119	115
TCs are 10 Percent of SA Retail Price		109	105

†: Method 1 is based on the simple average of monthly NPRs and method 2 on the econometric estimation of NPR. TC= Transfer Cost.

4. Conclusions

The purpose of this study was to quantify the welfare impacts of import controls on Botswana's horticulture. Simulations from the econometric models indicate that orange and potato imports fell by 30 and 20 percent, respectively, during the 1986-98 period, as a result of the trade policy regime. This has yielded NPRs of 55 and 118 percent for oranges and potatoes, respectively. The consumer loss from protection has significantly risen over time, for both commodities. While the producer gain from protection has declined over time in the case of oranges, it has risen, albeit marginally, in the case of potatoes. Since the driving reason for protection has been to support producers, it can thus be concluded that the policy is not very effective in enhancing producer welfare over time.

The net loss in social welfare has also risen over time, implying that import controls have become increasingly burdensome over time. One of the most important distributional consequences of the policy regime emanates from the fact that quota rents, accruing to importing firms, surpass producer surplus gains from protection. This is caused by the smallness in domestic production, relative to imports.

When treating the current policy regime as the base scenario, the complete elimination of import controls would lead to an expansion of about 43 and 25 percent in orange and potato imports, respectively. The welfare effects would be reversed. That is, consumers would gain, producers would lose, and quota rent would no longer exist. Such action (removal of import controls) would yield net social welfare gain to Botswana, compared to the current situation where import controls are in place.

As noted earlier, quantitative import restrictions are to be removed as per the renegotiated SACU agreement and the SADC protocol on trade. However, no guidelines have been set on how such trade restrictions are to be removed. For example, it is not stipulated whether member states will adopt an abrupt or step-wise removal process.

If a gradual removal is adopted, levying a*d valorem* tariffs not exceeding 55 and 118 percent for oranges and potatoes, respectively, and gradually reducing the tariff to zero percent (or to an agreed minimum level) over an agreed period of time, would be the most feasible action. However, such high rates of protection, being now more transparent than the current quantitative import restrictions, would appear difficult, if not impossible, to argue for under a free trade area (SACU for example). An alternative action would be to adopt a tariff-rate quota system and to gradually move to a free trade regime over an agreed time period. However, the administration of tariff-rate quota regimes may be more burdensome, compared to simple *ad valorem* tariff systems.

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6. Appendix

Table A.1 Definition of Variables

Variable	Definition
Imports	
m_0	Pre-policy level of imports (mt)
m_1	Policy induced level of imports
Δm	Policy induced change in imports
Demand	
q^0	Pre-policy quantity demanded
q^1	Quantity demanded with policy in place
Δq	Policy-induced change in quantity demanded
Supply	
q^0	Pre-policy quantity supplied
q^1	Quantity supplied with policy in place
Δq	Policy-induced change in quantity supplied
Prices	
P_B	Border price
P_D	Domestic price
NPR	Nominal Protection Rate
Parameters	
θ	Domestic supply shift parameter (Cobb-Douglas)
ϕ	Import demand shift parameter (Cobb-Douglas)
ε	Domestic supply elasticity.
η	Domestic demand elasticity
β	Import demand elasticity
Welfare Changes	
ΔCS	Policy-induced change in consumer surplus
ΔPS	Policy-induced change in producer surplus
QR	Quota rent
ΔSW	Policy-induced net change in social welfare

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