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ESTIMATION OF EXPORT DEMAND FUNCTION FOR SWAZI SUGAR: A PANEL DATA ANALYSIS

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ABSTRACT

Export demand estimates are important for meaningful export forecasts, planning, and policy formulation that can help improve the performance of the sugar subsector in Swaziland. This study estimated the determinants of export demand for Swazi sugar and measured the impact of the EU reform on Swazi sugar export demand. The study used panel data approach by using annual time series data between the periods 1997 and 2012. An LSDV fixed effects model was employed. Export price, Importer GDP and the EU reform were found to be significant in explaining export demand for Swazi sugar. These variables had coefficients -121.069, and -2.682, respectively, whose signs were against the priori expectation except for export price. The EU reform was found to have an overall positive impact to Swazi sugar export demand with coefficient of 120 816. The study also measured elasticities of the explanatory variables to the export demand of Swazi sugar. Export price, foreign income, producer prices and real exchange rate were found to be inelastic with elasticities of 0.35289, 0.00168, 0.04256 and 0.28572, respectively, for all the markets (SACU, EU, USA and COMESA) pooled together. Explanatory variables in the individual markets were found to be highly elastic. The study, therefore, recommended that Swaziland needs to take advantage of the EU reform and invest more on sugar production as it was not negatively affected. Swaziland also needs to negotiate for the quotas abandoned by those countries heavily affected by the EU reform.

Keywords: Export demand, Export destinations, Panel data model, Sugar industry, Swazi sugar, Swaziland, Swaziland sugar association.

Contribution/ Originality

This study contributes in the existing literature by using demand function on the Swaziland Sugar Industry. This is the only study to be undertaken in Swaziland in relation to the Sugar Industry. Hence the study is original.

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1. INTRODUCTION

1.1. Background

The sugar industry is of critical importance to Swaziland's development, and plays a multifaceted role in the economy. It contributes about 18% to GDP and over 35% of the workforce in the agricultural sector is employed in the sugar industry (Govenment of Swaziland, 2006). Swaziland is an export led economy and the basis for further expansion can be attributable to the preferential markets that have been provided by developed countries (particularly in Europe and the USA). The European markets absorbs about 150000 tonnes of the total sugar production of Swaziland, while representing over 30% of the industry revenue due to the higher prices attainable in EU (GoS, 2006). Swaziland's sugar industry has consistently been ranked among the top 10 most efficient producers of sugar in the world (Swaziland Sugar Association, 2013). The industry is expected to expand as the country has recently invested in irrigation projects such as the Komati Downstream Development Project (KDDP) and the Lower Usuthu Smallholder Irrigation Project (LUSIP). These irrigation projects are expected to increase sugar cane production in the country.

The sugar industry can be traced back to the establishment of the Big Bend sugar mill in 1959. Since then, the sugar industry has shown enormous expansion in production. Figure 1 shows an increasing trend in sugar production in Swaziland from 1969 to 2013.

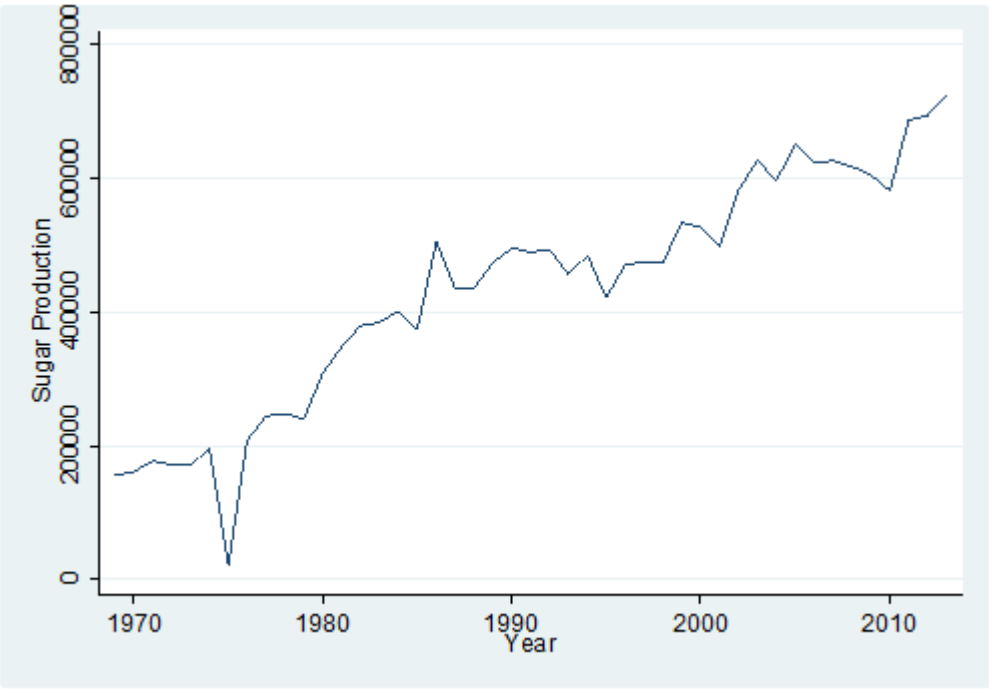
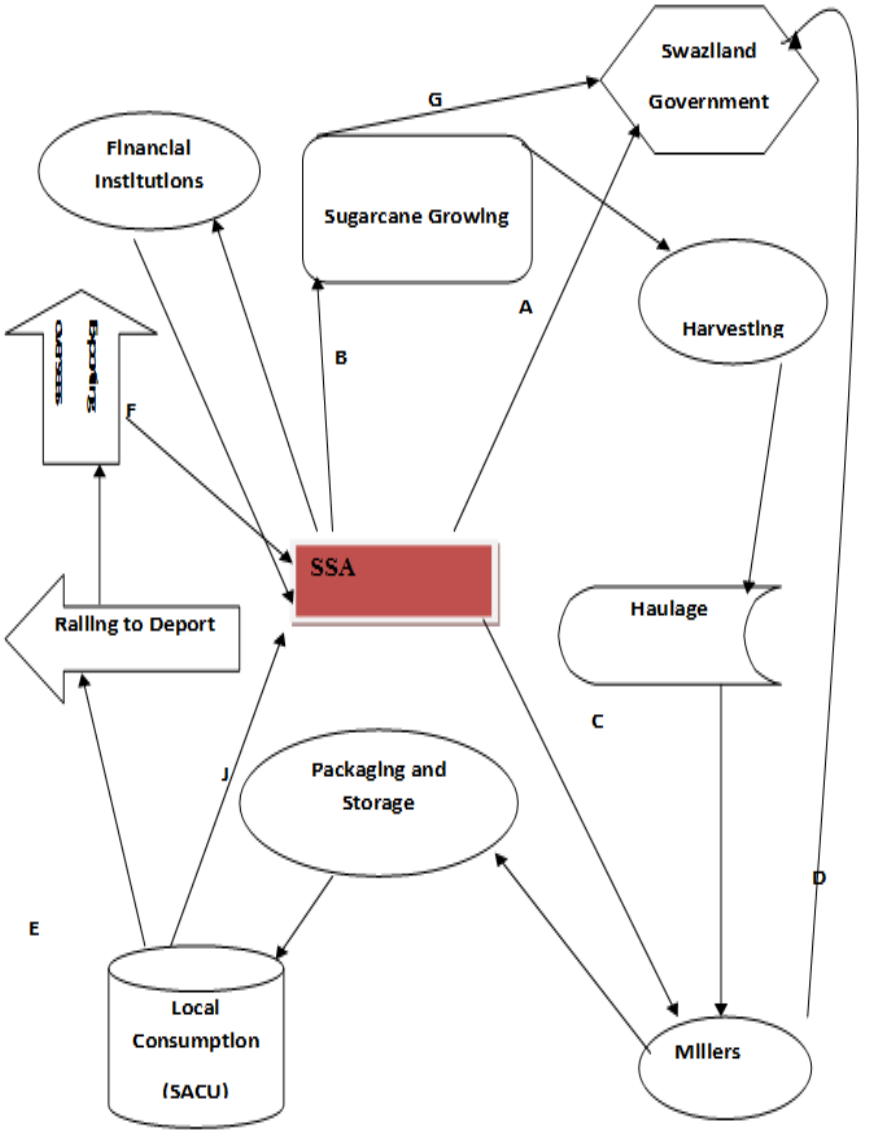


Figure-1. Swaziland Sugar Production (1969 – 2013)

SSA derives its structure from the Sugar Act of 1967. Figure 2 shows that the SSA's purpose is to regulates, promotes and fosters the sugar industry in Swaziland and purchases, sells or otherwise deals in sugar and by-products. It is responsible for providing the services necessary for

the general development of the industry and the marketing of SSA products with a view to ensuring optimum returns for producers. The roles of SSA are summarized in Figure 2 which shows Swazi sugar value chain.



A – Taxes to Government; **B** – Payments to Extension Services and to Growers;

C – Payments to millers; **D** – Taxes; **E** – Income from SACU; **F** – Income from Exports;

G – Taxes to Government from; **H** – Financing; **I** – Interest Cost; **J** – Local consumption (SACU)

Figure-2. Swazi sugar value chain

Swazi sugar is sold into four main markets, namely: the EU, the US, Southern African Customs Union (SACU) and the regional/world market. The most important market is the EU

market. The market is accessed through duty-free, quota free terms under the Market Access Regulation. Exports to the USA are governed by the US Sugar Program (under which Swaziland has a specified tariff rate quota of about 16000 tonnes). Exports to the rest of the export markets are on a residual basis (Southern African Development Community Sugar Digest, 2014). Figure 3 shows the trends in sale of sugar (metric tonnes/annum) to the different markets.

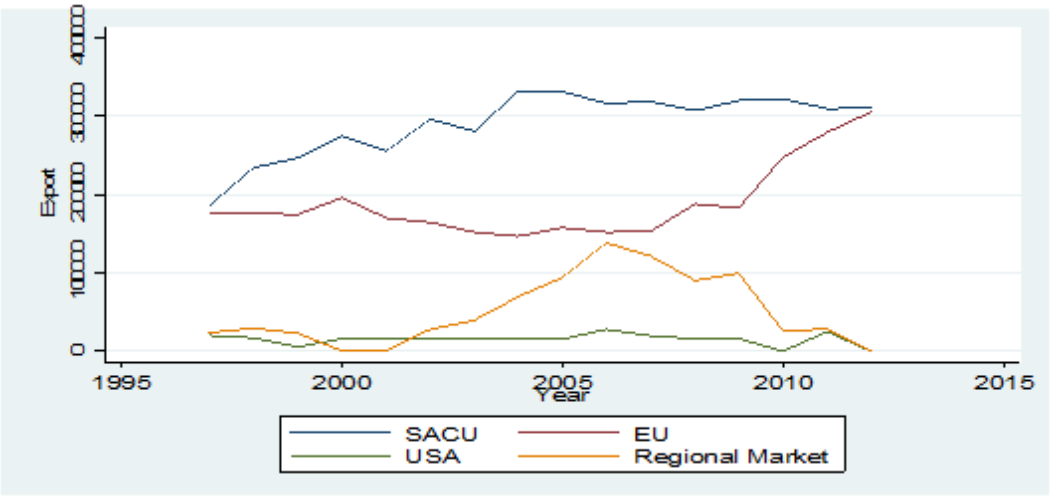


Figure-3. Sales of Swazi Sugar to the Various Markets

In 2006 the European Union (EU) reformed its sugar regime, reducing the reference price for sugar by 36% to € 404.40 per tonne. This affected not just European sugar beet producers, but also sugarcane producers in the eighteen African, Caribbean and Pacific (ACP) countries which had preferential access to the EU. As a significant sugar exporter and highly dependent on the sugar industry economically, Swaziland was expected to be hit particularly hard by the sugar reform (Richardson, 2012).

SSA (2013) attributed the volume of sugar exports to a number of factors. The report indicated that output of sugar influences the amount of sugar exported through the Maputo sugar terminal, while export returns are highly influenced by movements in foreign exchange rates as well as prices in foreign markets. On another note, half of the sugar sales are destined for the EU and other markets outside the Common Monetary Area (CMA), in which the contracts entered to are in foreign currency of these markets. Currencies fluctuations have a huge impact on SSA revenues, whether positively or negatively. Swaziland is experiencing appreciation of the local currency which has led to the reduction of export earnings by the country and thus reduction of the industry revenues (SSA, 2014). In 2006 the EU introduced a reform on its sugar market regime which affected both the EU sugar producers and ACP sugar producers. Before the EU sugar reform was introduced, the industry relied on preferential prices on its sugar. The reduction in prices has been projected to reduce the industry's revenue earnings. It is, therefore, the interest of this study to quantify the factors that affect export demand for sugar to the various

world markets. This will be important for meaningful export forecasts, planning, and policy formulation.

1.2. Objectives of the Study

The main objective of this study was to analyse the factors influencing export demand for Swazi sugar during 1997 – 2012 period using panel data approach. The specific objectives of the study were to:

1) Determine the impact of the EU sugar sector reform on Swazi sugar exports demand to the various Swazi sugar markets; and

2) Measure the response of Swazi sugar export demand with respect to its determinants.

1.3 Hypotheses

Hypothesis 1:

H_0: There is no relationship between Swazi sugar export demand and export price, trading partner GDP, trading partner's producer price and real exchange rate.

H_1: There exist a relationship between Swazi sugar export demand in Swaziland and export price, trading partner GDP, trading partner's producer price and real exchange rate.

Hypothesis 2:

H_0: The European Union sugar sector reform has no effect on Swazi sugar export demand.

H_1: The European Union sugar sector reform has an effect to Swazi sugar exports demand.

2. THEORETICAL FRAMEWORK

Several studies have been carried out in most countries more especially in developed countries (i.e. USA, Ecuador, Croatia, Australia etc) to estimate the export demand functions for several commodities. Some of the studies employed panel data methods while others used time series methods to estimate export demand functions.

Imperfect substitutes model developed by Goldstein and Khan (1985) which assumes that neither imports nor exports are perfect substitutes for domestic goods, was adopted in the study because the imperfect substitutes model is the standard approach in the literature for specifying and estimating foreign trade equations for both developed and developing countries. The framework is separated into two: export demand and export supply. Since estimation of export demand for Swazi sugar is an export demand approach, the study adopted the model of export demand. Goldstein and Khan (1985) export demand was modelled as:

$$X_f = (GDP^*, P_i^*, PEx_i, ER,)$$

Where: $X_f$is export demand; GDP^* is world income; P_i^* is price, of foreign goods in the world market; $PE_x$is export price;and ER is exchange rate.

Following the specification of Olofin and Babatunde (2007) it is assumed that the exporting country (Swaziland) has only one trading partner (the rest of the world). Hence, Swazi sugar's export demand (xt) will be the same as the import demand of the rest of the world (qt*). The

model assumes the existence of a representative agent in the rest of the world, who lives forever and maximizes his utility by choosing how much to consume of his domestic endowment (st*) and of the imported good (qt*). In addition, the model assumes that there is no production sector, because production often involves the combination of intermediate inputs by using factors of production and therefore makes no distinction between intermediate and final products.

Saghaian *et al.* (2014) estimated the export demand function for US corn and soybeans to three major destinations (China, Japan & EU) for 1980-2011 periods. The study employed a panel data analysis approach in a log-linear equation. The logarithm estimates showed that China had more elastic demand (2.5), while income elasticity of Japan was close to 1. The parameter estimates for price of soybean as a cross price was significant for China and EU and parameter estimates for price of corn as a cross price was only significant for Japan. The positive sign obtained revealed soybeans and corn could be substitutes in those countries.

Saghaian and Soltani (2012) estimated the export demand function for US raisins for the period for 1992 – 2008. The study investigated the export demand for five importer countries (Australia, Canada, Germany, Japan and United Kingdom). The study used a panel data analysis approach in a double log format to determine own-price, cross-price, and income elasticities for the US raisins. The results were not significant for Iran and Turkey price. For Canada only price for Iran was not significant. The cross price for elasticity for Iran was unusual. All variables for Germany and UK were significant except for exchange rate.

Zeng *et al.* (2012) identified the major factors affecting export demand for U.S. pistachios. The impacts of market conditions and the effects of food safety shocks were investigated. The study used a panel data analysis approach. The results from their study indicated that U.S. pistachio producers should take advantage of their advanced technology and reputation for higher food safety standards to enhance international market share.

Sultan (2014) estimated Saudi Arabia's export demand function using bound test approach to cointergration which was developed by Pesaran *et al.* (2001). The results showed that there is a long run equilibrium relationship between demand for export, world income and real effective exchange rate. The demand for Saudi's export with respect to world income and real effective exchange rate were found to be elastic both in the short run and long run. The exports were found to be more elastic in the short run than in the long run with respect to both variables.

Thaver and Bova (2014) estimated Ecuador's demand function with the US and employed the bounds testing approach to cointegration to estimate Ecuador's export demand function with the US between 1965 and 2011 with special emphasis on dollarization's impact on exports. They developed two different export demand models based on previous empirical studies of the nature of their study. Results confirmed a unique cointegration relationship between exports and its regressors. In the long run, in both models, GDP was positive and elastic, while volatility was positive and inelastic. Relative prices in Model I and real exchange rate in Model II were not statistically significant. Both models revealed that dollarization has had a significant, but negative and inelastic long-run and short run impact on Ecuador's exports to the US.

Abbas (2012) investigated empirically the critical parameters of merchandise export demand function for Egypt by using annual time series-cross section data from 1990-2008 and by applying fixed effect model. The empirical results revealed a significant relationship among the real value of merchandise exports for Egypt and trade panther's income, relative exports price, trade panther's real exchange rates. All variables showed positive relationships as expected and negative relationship for real price as pre assumed. The elasticities of real income, relative price and real exchange rates were found to be smaller than unity.

Bobic (2009) estimated income and price elasticities of imports and exports, as well as to quantify the effect of other potential trade determinants in Croatia. The estimated model was based on the imperfect substitutes model developed by Goldstein and Khan (1985). Dynamic panel data methods were applied to disaggregate data and. The Arellano-Bond method was used to estimate the model in first differences. The estimated income and price elasticity coefficients, both in the import and in the export model, had the expected signs - increase in income positively affected exports and imports, while increase in prices lower them.

3. METHODOLOGY

3.1. Research Design

The study used panel data approach for the period 1997 - 2012 to estimate the determinants of export demand for sugar in Swaziland. Panel data approach was chosen because it has many advantages over the other conventional methods such as cross sectional data and time series data. Panel data approach:

1. gives the researcher a large number of data points thus increasing the degrees of freedom and reducing the collinearity among explanatory variables hence improving the efficiency of econometric estimates.
2. allows the researcher to analyze a number of important economic questions that cannot be addressed using cross-sectional or time-series data sets.
3. provides means of resolving the magnitude of econometric problems that often arises in empirical studies, namely the often heard assertion that the real reason one finds (or does not find) certain effects is the presence of omitted (mismeasured or unobserved) variables that are correlated with explanatory variables. That is to say panel data allows controlling for omitted (unobserved or mismeasured) variables.
4. involves two dimensions: a cross-sectional dimension N, and a time-series dimension T. We would expect that the computation of panel data estimators would be more complicated than the analysis of cross-section data alone (where T = 1) or time series data alone (where N = 1). However, in certain cases the availability of panel data can actually simplify the computation and inference.

3.2. Data Sources

Secondary data were collected from various sources. Data for export volumes and sugar export price to the major destination markets were collected from SSA, real exchange rates for the Emalangeni/US Dollar and Emalangeni/Euro were obtained from the Central Bank of Swaziland. The GDP for the trading partners (SACU, EU, COMESA and USA) were sourced from the World Bank data base. Trading partner, producer prices were be obtained from the FAO websites.

3.3. Model Specification

The main objective of this study was to estimate the determinants of the export demand function for sugar in Swaziland. There are three main variables used in export demand functions (Coşar, 2002; Abbas, 2012; Saghaian *et al.*, 2014). First, it is the product price which is the main explanatory variable; second is foreign income, which represents the purchasing power of the trading partner; and the third is the exchange rates which is a relative price that is crucial in affecting imports. Producer prices of sugar in the market destinations are also used as price substitute to Swazi sugar. The study followed Zeng *et al.* (2012) where fixed effects model regression was used for the estimation of export demand for US pastachios and Mindaye (2012) who employed fixed effects and (least square dummy variables) LSDV approach in his study to estimate the role of COMESA growth and development of Ethiopia. The export demand function for sugar in Swaziland was estimated using a multiple linear regression approach based on the fixed effect model methodology. The model is specified as follows:

$$Export_{it} = \beta_1 + \beta_2 XPrice_{it} + \beta_3 MGDP_{it} + \beta_4 TPP_{it} + \beta_5 RER_t + \beta_6 D_t + \varepsilon_t$$

Table-1. Variables description

Variable	Description	Coefficient	a *priori* expectation
$Export_{it}$	quantity of sugar exports (metric tons) to the major destination at time t		
$XPrice_{it}$	export price of sugar to the destination of interest in (E/ton) at time t	β_2	Negative
$MGDP_{it}$	gross domestic product of the importer country at time t	β_3	Positive
TPP_{it}	Trading partners' producer price at time t	β_4	Positive
RER_t	real exchange rate at time t	β_5	Positive
D_t	dummy variable (D= 0 before EU reform and D = 1 at and after EU reform)	β_6	Positive
ε_t	error term		
I	i^{th} importer		

3.4. Analytical Technique

3.4.1. Fixed Effects and Random Effects Models

In panel data the most commonly estimated models are the fixed (FE) effects and random effects (RE) models. The crucial distinction between fixed and random effects is whether the

unobserved individual effect embodies elements that are correlated with the regressors in the model or not.

Fixed Effects explore the relationship between predictor and outcome variables within an entity (country, person, company, etc.). FE models control for, or partial out, the effects of time-invariant variables with time-invariant effects. Fixed-effects model should be used whenever one is interested in analyzing the impact of variables that vary over time (Reyna-Torres, 2007).
The equation for the fixed effects model becomes:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it} \quad \text{.....(eq. 1)}$$

Where

α_i (i=1….n) is the unknown intercept for each entity (n entity-specific intercepts); Y_{it} is the dependent variable (DV) where i= cross section entity and t = time; X_{it} represents one independent variable (IV); β_1 is the coefficient for that independent variable; and – u_{it} is the error term

Fixed effects may be used with time dummies to control for time effects whenever unexpected variation or special events my affect the outcome variable. So the equation for the fixed effects model becomes:

$$Y_{it} = \beta_o + \beta_1 X_{1,it} + \ldots + \beta_k X_{k,it} + \gamma_2 E_2 + \ldots + \gamma_n E_n + u_{it} \quad \text{.....(eq. 2)}$$

Where

–Y_{it} is the dependent variable (DV) where i = cross section entity and t = time; $X_{k,it}$ represents independent variables (IV); β_k is the coefficient for the IVs; u_{it} is the error term; E_n is the entity n. Since they are binary (dummies) you have n-1 entities included in the model; and $\gamma 2$ is the coefficient for the binary repressors (entities)

Fixed effects may also be analysed with LSDV in which by adding the dummy for each market (panel) we are estimating the pure effect of each independent variable (by controlling for the unobserved heterogeneity).Each dummy is absorbing the effects particular to each market. The fixed effects equation becomes:

$$Y_{it} = \beta_o + \beta_1 X_{1,it} + \ldots + \beta_k X_{k,it} + \gamma_2 E_2 + \ldots + \gamma_n E_n + \delta_2 T_2 + \ldots + \delta_t T_t + u_{it} \quad \text{.....(eq.3)}$$

Where

Y_{it} is the dependent variable (DV) where i = cross sectionentity and t = time; $X_{k,it}$ represents independent variables (IV); β_k is the coefficient for the independent variable; u_{it} is the error term; E_n is the entity n. Since they are binary (dummies) you have n-1 entities included in the model; γ_2 is the coefficient for the binary regressors (entities); T_t is time as binary variable (dummy), so we have t-1 time periods; and δ_t is the coefficient for the binary time regressors. The rationale behind RE model is that, unlike the FE model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. If you have reason to believe that differences across entities have some influence on your dependent variable then you should use random effects. The equation for random effects becomes:

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it} \quad \text{.....(eq.4).}$$

To decide between fixed or random effects you can run a Hausman test where the null hypothesis is that the preferred model is RE versus the alternative the FE (Reyna-Torres, 2007). It basically tests whether the unique errors (u_i) are correlated with the regressors, the null hypothesis is they are not.

3.4.2. Diagnostic Tests

The study used four tests to test for the robustness of export demand model for Swazi sugar. These diagnostic tests include: testing for cross-sectional dependency (to test whether the residuals are correlated across entities); testing heteroscedasticity (to test whether the disturbances have the same variance); testing for serial correlation (to test whether the residuals are correlated across entities); and testing for time-fixed effects (a test conducted to see if time fixed effects are needed when running the FE model).

4. RESULTS AND DISCUSSION

4.1. Trend Analysis of the Sugar Exports to the Various Destinations

The trend of sugar export volumes (tonnes per year) to the various destinations was analysed graphically. Sugar export trends for the period 1997 – 2012 to SACU, EU, USA and Regional Market were graphically plotted in their logarithm form against the time period. Each panel was then closely analysed for the stated period of time. Figure 4 shows a graph panel of SSA sugar exports plotted against time. Sugar exports to SACU show a steady trend over the period under consideration. From the period 1997 to 2005 there was a slight increase in sugar sales to this market. The increase was as result of the proposed EU sugar sector reform in 2006 which threatened sugar sales to the EU, which forced countries to focus their sales to other markets. Over the period of 2005 onwards, the exports to SACU exhibit a constant trend over time.

The trend of sugar sales to the EU also exhibits a generally steady trend over the period of 1997 - 2012. Slight increase of export volumes of sugar to this market are noted from the period of 2007 onwards. This was a result of the introduction of the duty-free and quota-free arrangement which allowed ACP countries to sell more sugar to the EU at market based prices after the EU reform. The export of sugar to the USA slightly shows a steady trend over time. However, some drops and increases of sales are noted at some periods. From 1997 towards 2000 sugar sales started steadily and then showed a sharp decline. After the year 2000 sugar sales to the USA became steady and then increased again. The US market is not a main market for the Swazi sugar industry and therefore, SSA sugar is sold on residual basis to the US. When SSA sales shifted to the EU and SACU market in 2005, sales to the US were reduced.

Sales to COMESA represent the major regional market for SSA. Exports to this market have never exhibit a steady trend in overall. There are a lot of observable fluctuations in exports to this market. SSA sales to Regional markets are on residual basis because of the lower prices offered in this market. As sales to other preferential markets outside COMESA become attractive SSA

sugar sales to COMESA decline. This is evident in the year 2000 to 2003 and 2009 onwards after the introduction of the Duty-free Quota-free arrangement of ACP sugar producers and the EU.

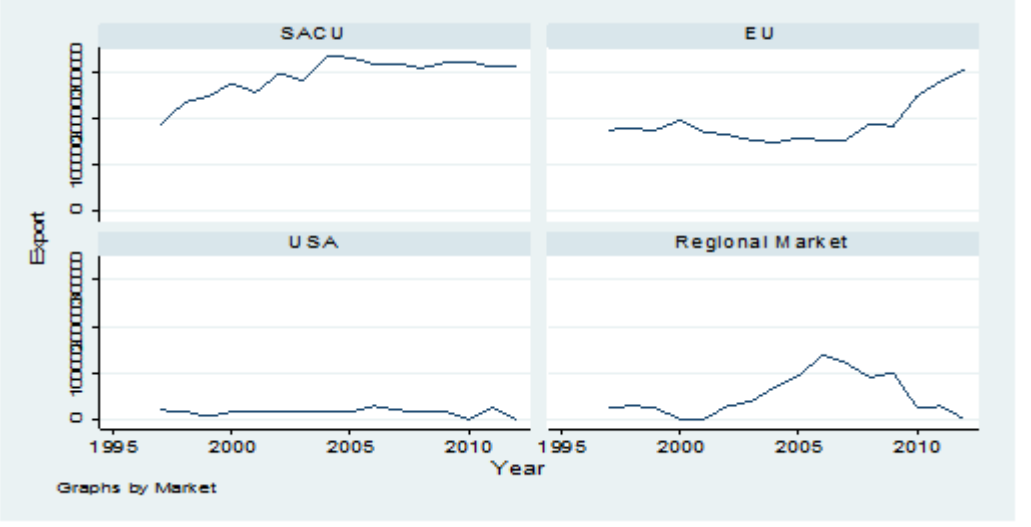


Figure-4. Sugar exports to SACU, EU, USA and Regional Market (1997 – 2012)

4.2. Estimation Results

The study estimated the fixed effects model and the random effects model which were both significant. To choose which model to use, the Hausman test was conducted. The test was significant with p = 0.0000, which implied that the FE model is better than RE model. The FE model was estimated with time dummies to absorb the effect of time difference with the data. Table 2 shows some results of the time fixed effects model. The long run regression presented in Table 2 reveals that importer real GDP (MGDP), trading partner's producer price (TPP), real exchange rate (RER) and EU Reform are significant in determining sugar export demand with coefficients -2.68249, -69.9953, -11376.6, and 120.816 respectively. These variables were varyingly significant at 10 percent, 5 percent and 1 percent level of significance.

Importer GDP was used as a proxy for the income for the foreign markets. MGDP has a p-value of <0.00006 which means it is significant at 1 percent level of significance. The results imply that a one unit increase (one million US$) in MGDP will decrease Swazi sugar exports by 2.68249 metric tonnes per year in the long run. This is against the *a priori* expectation which forecasted a positive coefficient as per the economic theory that an increase in income increases purchasing power. TPP was found to have a p-value of 0.0961 thus significant at 10 percent and a coefficient of -69.9953. The results imply that a one US dollar increase per metric tonne in TPP will decrease Swazi sugar exports by 69.9953 metric tonnes per year long run. This was against the *a priori* expectation of a positive sign. RER was found to be significant at 1 percent level of significance. The variable had a coefficient of -11376.6 which is also against the *a priori* expectation. The coefficient value meant that one unit increase in the value of foreign currency to lilangeni currency will decrease Swazi sugar export by 11376.6 metric tonnes per year. This is

against the economic theory which states that an increase in exchange rate make Swazi goods cheaper including sugar in this case. Noteworthy, the coefficient of export price of Swazi sugar -23.4002 was found to be insignificant, with a p-value of 0.5174, in explaining Swazi sugar export demand although it has the expected sign.

The study also estimated the impact of the EU sugar sector reform to the export demand for Swazi sugar to the EU. The results showed that the reform is statistically significant at 1 percent level of significance with p-value of <0.000001 in explaining the export demand. The coefficient of the EU reform was 120816 and not a negative as expected. The reform was expected to reduce sugar exports to the EU, but the results showed that the reform, increased sugar exports by 120816 metric tonnes per year. The results may have been caused by support initiatives such as funding to cushion the effects of the reform.

Table-2. Fixed Effect Model with Time Trend Dummies

	Coefficient	**Std. Error**	**t-ratio**	**p-value**
Const	322144***	41009.6	7.8553	<0.00001
XPrice	-23.4002	35.8271	-0.6531	0.5174
MGDP	-2.68249***	0.59858	-4.4814	0.00006
TPP	-69.9953*	41.0722	-1.7042	0.0961
RER	-11376.6*	5955.25	-1.9104	0.06328
EU Reform	120816***	23609.6	5.1172	<0.00001
dt_2	23444	20047.6	1.1694	0.24916
dt_3	24760.9	20719	1.1951	0.23909
dt_4	30273.7	21940.2	1.3798	0.1753
dt_5	30890.4	25715.4	1.2012	0.23672
dt_6	68441.8**	31625.1	2.1642	0.03648
dt_7	65661.2***	23295.3	2.8187	0.00746
dt_8	80928.1***	21495.7	3.7649	0.00054
dt_9	92932***	21406.5	4.3413	0.00009
dt_10	111646***	22279.1	5.0113	0.00001
dt_11	95980.3***	22247.3	4.3143	0.0001
dt_12	117800***	25919	4.5449	0.00005
dt_13	106279***	25461.8	4.174	0.00016
dt_14	87252.6***	22666.6	3.8494	0.00042
dt_15	110005***	23631.7	4.655	0.00004
dt_16	100180***	24509.2	4.0874	0.0002

Mean dependent var	136255.0	S.D. dependent var	117070.1
Sum squared resid	3.08e+10	S.E. of regression	27770.91
R-squared	0.964272	Adjusted R-squared	0.943729
F(23, 40)	46.93800	P-value(F)	4.06e-22
Log-likelihood	-730.6036	Akaike criterion	1509.207
Schwarz criterion	1561.020	Hannan-Quinn	1529.619
Rho	0.393463	Durbin-Watson	1.091638

*, **, and *** indicate statistically significant at 10 percent, 5 percent and 1 percent level of significance respectively.

4.3. Fixed Effects using Least Square Dummy Variables (LSDV)

The LSDV provides a good way to understand fixed effects. The effect of an explanatory variable (e.g. export price, importer GDP etc.) is mediated by the differences across entities (panels). By adding the dummy for each entity we are estimating the pure effect of the explanatory variable (by controlling for the unobserved heterogeneity).Each dummy is absorbing

the effects particular to each entity. This requires that the entities be divided into given codes. Time dummies were included to absorb the effects of time over the period.

Table-3. Codes of the market groups

SACU	Market 1
EU	Market 2
USA	Market 3
Regional (COMESA)	Market 4

The LSDV with time trend dummies was estimated for each of the variables, namely; sugar exports against export price, importer GDP, trading partner producer price, real exchange rate and EU reform. The results were summarised in Table 4.

The LSDV fixed effects regression showed an overall significant relationship at 10 percent (p-value =0.07) between SSA sugar exports and export prices. In overall, when sugar export prices of SSA increase by US$1 per tonne, total exports by Swaziland to the various markets decrease by 121.0688 tonnes per year. The SACU market shows a positive relationship between SSA sugar export and export prices to SACU. That is an increase in sugar export prices by US$1 increases sugar exports by 301354.58 tonnes per year. The other markets (EU, USA and Regional markets) showed a negative relationship between SSA exports and export prices to the various markets. That is an increase of US$1 of sugar per tonne reduces exports by to the various destinations. All markets are significant at 0.01, 0.05 and 0.1 level of significance.

The LSDV fixed effects regression showed an overall significant relationship at 5 percent (p-value =0.035) between SSA sugar exports and MGDP. In overall, when GDP in the various markets increase by US$1 million, total exports by Swaziland to the various markets decrease by 1.247 tonnes per year. The SACU and the EU market show a positive relationship between SSA sugar export and foreign income in SACU and EU. That is an increase in SACU and EU GDP by US$ 1 million increases sugar exports by 246003.8 and 78773.55 tonnes per year respectively. The other markets (USA and Regional markets) showed a negative relationship between SSA exports and export prices to the various markets. Increase in USA and Regional market GDP by US$1 million reduces sugar exports to US and Regional markets by 101340.7 and 239870.3 tonnes per year respectively.

The LSDV fixed effects regression showed an overall insignificant relationship between SSA sugar exports with TPP (p-value = 0.14) over time. This implies that the prices at which producers in the various markets produce sugar does not affect how much sugar is sent by Swaziland to these markets. On a snapshot though, the overall relationship between SSA sugar exports reduces by 74.36 tonnes per year if the producer prices in the various markets increase by US$1. The SACU market showed a positive relationship between SSA sugar export and SACU producer prices. That is an increase in sugar producer prices in SACU by US$1 increases sugar exports by 254312.9 tonnes per year. The other markets (EU, USA and Regional markets) showed a negative relationship between SSA exports and export prices to the various markets.

Increase of producer prices by US$1 per tonne reduces sugar exports by 100056.3, 274309.3 and 225988.8 respectively.

The LSDV fixed effects regression showed an overall insignificant relationship between SSA sugar exports with RER (p-value = 0.258) over time. This implies that the RER between lilangeni with the various currencies in the various markets does not affect how much sugar is sent by Swaziland to these markets. On a snapshot though, the overall relationship between SSA sugar exports reduces by 6431.999 tonnes per year if foreign exchange increases by one unit. The individual markets showed a mixed relationship between SSA export and real exchange rate and were significant at 0.01, 0.05 and 0.1 level of significance. When the value of lilangeni reduces by one unit, SSA sugar exports to SACU increase by 248040.6 tonnes per year. On the contrary, when the value of lilangeni reduces by one unit, SSA sugar exports to EU, USA and Regional market reduce by 52352.16, 235050.9 and 199417.1 tonnes per year respectively.

The LSDV fixed effects regression showed a significant relationship at 0.1(p-value = 0.061) between SSA sugar exports to various markets with the EU sugar sector reform. The overall relationship states that the introduction of the EU reform increased sugar exports by SSA by 42506.8 tonnes per year. On the individual markets, all entities showed a significant negative relationship over time except for the SACU market. The reform increased SSA sugar exports to SACU by 258965.54 tonnes per year. Exports to EU, USA and Regional markets reduced sugar exports by 117129.9, 274798.2 and 239164.4 respectively.

Table-4. Fixed effects with Least Square Dummy Variables

Variable	Market	Coefficient	Std error	t statistic	p value
XPrice	Overall	-121.0688	65.21907	-1.86	0.070
	Market 1	301354.58	32175.58	9.37	0.000
	Market 2	-86593.53	15328.51	-5.65	0.000
	Market 3	-274183.7	13162.34	-20.83	0.000
	Market 4	-251371.2	14709.78	-17.09	0.000
MGDP	Overall	-1.246978	0.573076	-2.18	0.035
	Market 1	246003.8	20429.07	12.04	0.000
	Market 2	67872.39	78773.55	0.86	0.394
	Market 3	-101340.7	80766.6	-1.25	0.216
	Market 4	-239870.3	12987.09	-18.47	0.000
TPP	Overall	-74.35964	49.53033	-1.50	0.140
	Market 1	254312.9	20542.58	12.38	0.000
	Market 2	-100056.3	13348.03	-7.50	0.000
	Market 3	-274309.3	13330.64	-20.58	0.000
	Market 4	-225988.8	15956.84	-14.16	0.000
RER	Overall	-6431.999	5617.591	-1.14	0.258
	Market 1	248040	21617.44	11.47	0.000
	Market 2	-52352.16	44728.65	-1.17	0.248
	Market 3	-235050.9	37234.39	-6.31	0.000
	Market 4	-199417.1	37234.39	-5.36	0.000
EU Reform	Overall	42506.8	22135.63	1.92	0.061
	Market 1	258965.54	20332.88	12.74	0.000
	Market 2	-117129.9	15529.49	-7.54	0.000
	Market 3	-274798.2	13124.82	-20.94	0.000
	Market 4	-239164.4	13124.82	-18.22	0.000

4.4. Estimation Results of Elasticities

To estimate the response of export demand for Swazi sugar, elasticities of the variables of sugar export demand in Swaziland were computed. The study used the LSDV coefficients of the variables and means of the variables to calculate the elasticities of sugar export demand with respect to its determinants. The results are presented in Table 5. Export price elasticity was found to be inelastic with the overall fixed effects analysis with an elasticity of 0.35. This means 1 percent increase of export price reduces sugar exports to the various markets by 35 percent. The EU, USA and Regional markets showed elastic negative response of sugar export demand. The SACU market showed a positive elastic export price (509.11) of export demand for Swazi sugar.

The overall foreign income elasticity of Swazi sugar export demand was found to be inelastic (-0.00168) meaning that 1 percent increase in income of the foreign markets reduces Swazi sugar exports by 0.168 percent. The USA and Regional markets were found to be elastic with elasticities of -92899 and -390.109 respectively. The SACU and EU markets exhibited elastic export demand of 689.71 and 48958.66 respectively. The overall producer price elasticity of Swazi sugar export demand was found to be inelastic (-0.04256) and elastic with EU, USA and Regional markets with elasticities of -23.0368, -626.4 and -1104.68 respectively. The SACU market has a producer price elasticity of 31.03.

The overall real exchange rate elasticity of sugar export demand was found to be inelastic with elasticity of -0.28572. The elasticities for EU, USA and Regional markets were found to be also negative but were elastic. The SACU market was found to have an elasticity of 1.14. Therefore, overall the elasticities of the variables in the export demand for Swazi sugar export demand for the overall market analysis were found to be inelastic. On the other hand the variables were found to be elastic for all the individual markets for Swazi sugar export demand

Table-5. Sugar Export Demand Elasticities

Market	Variables	Coefficient	Mean Export	Mean Variables	Elasticity
Overall	XPrice	-121.07	136255.00	397.15	-0.353
	MGDP	-1.25	136255.00	182.88	-0.002
	TPP	-74.36	136255.00	77.99	-0.043
	RER	-6431.99	136255.00	6.05	-0.286
SACU	XPrice	301354.58	231407.25	390.95	509.115
	MGDP	246003.80	231407.25	648.79	689.713
	TPP	254312.90	231407.25	28.24	31.033
	RER	248040.00	231407.25	1.06	1.141
EU	XPrice	-86593.53	188853.31	511.51	-234.538
	MGDP	67872.39	188853.31	136226.31	48958.660
	TPP	-100056.30	188853.31	43.48	-23.037
	RER	-52352.16	188853.31	8.66	-2.399
USA	XPrice	-274183.70	15244.88	396.02	-7122.550
	MGDP	-101340.70	15244.88	139751.13	-928999
	TPP	-274309.30	15244.88	34.81	-626.400
	RER	-235050.00	15244.88	7.24	-111.693
Regional Market	XPrice	-251371.20	50878.69	290.12	-1433.370
	MGDP	-239870.30	50878.69	82.75	-390.109
	TPP	-274309.30	50878.69	205.43	-1107.540
	RER	-199417.1	50878.69	7.2242	-28.298

4.5. Diagnostic Tests

The results for the diagnostic tests performed in the study are presented in Table 6. Testing for cross sectional dependency has a p value of 0.0000 implying presence of cross sectional dependence in the data. The implication is that the standard errors and corresponding t-values could be biased. The heteroscedasticity test has a p-value of 0.0000. This reveals evidence of heteroscedasticity in the variables. Therefore, the standard errors for coefficients and the corresponding t-values are likely to be biased but the fixed effects OLS estimation still remains unbiased. The test for serial correlation has a p value significant at 5 percent (p = 0.0260). This implies that there exists serial correlation in the residuals. This results, therefore, implies biasness of the standard errors and the results are highly likely to be less efficient. However, problems of cross-sectional dependency, serial correlation and heteroscedasticity apply to macro panels (with 20-30 years), they are therefore will not be a problem here since the time period is 16 years. Lastly, time fixed effects test had a p value of 0.000, implying that time dummies are appropriate for use in estimating the FE model.

Table-6. Results of the diagnostic tests

	Cross sectional dependency	Heteroskedasticity	Serial Correlation	Time fixed effects
Prob value	0.0000			
Prob >χ^2		0.0000		
Prob > F			0.026	
Prob > F				0.000

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The major aim of the study was to estimate the export demand function for Swazi sugar to the major destinations for the period 1997 – 2012 using a panel data approach. The FE model and LSDV FE model revealed that a long run relationship between the explanatory variables and the Swazi sugar export demand, export price, foreign income, importer producer prices, real exchange rate and EU reform were significant in explaining export demand for Swazi sugar. These variables had coefficients -121.0688, -2.682, -69.995, -11376.6 and 120816 respectively, whose signs were against the *a priori* expectations except for export price.

Export demand determinants are important for meaningful export forecast, planning and policy formulation. As the sugar sector is a largest agricultural sector in Swaziland and playsa multifaceted role in socio-economic development of the country, determinants of export demand functions are essential for the growth of the sugar sector.

5.2. Recommendations

In view of the findings of the study the following policy recommendations are suggested:

i) Since the Swazi sugar industry did not negatively suffer the effects of the EU reform, the country should invest more on the sugar sector by establishing more irrigation projects to increase sugar production in the country.

ii) Since the EU reform favoured low-cost producers of sugar like Swaziland, the country must negotiate for those quotas which were abandoned by the countries which were hit by the reform.

iii) Since more than half of the Swazi sugar is destined for EU which is outside the Common Monetary Area in which exchange is dominated by foreign currency (Euro or US Dollar), the Swazi government must assist the SSA to negotiate for a have long term policy in reducing the effects currency fluctuation between the Euro and lilangeni to beyond the stipulated one year period.

REFERENCES

Abbas, I.M., 2012. Merchandise export demand function for Egypt: Panel data analysis. Applied Econometrics and International Development, 12(1): 107-116.

Bobic, V., 2009. Income and price elasticities of croatian trade - a panel data approach. Young Economist's Seminar to, 15th Dubrovnik Economic Conference. Central Bank of Croatia, Croatia. pp: 3-25.

Coşar, E.E., 2002. Price and income elasticities of Turkish export demand: A panel data application. Central Bank Review No. 2.

Goldstein, M. and M.S. Khan, 1985. The supply and demand for exports: A simultaneous approach. Review of Economics and Statistics, 60(2): 275–286.

Govenment of Swaziland, 2006. National adaptation strategy in response to the EU reform. Mbabane, Swaziland: Ministry of Economic Planning and Development.

Mindaye, F., 2012. The role of COMESA growth and development of Ethopia. Unpublished Master's Thesis. Addis Ababa University, Ethopia.

Olofin, S. and M.A. Babatunde, 2007. Estimating price and income elasticities of Sub-Saharan African exports. A Paper Presented in the 12th Annual Conference on Econometric Modelling for Africa held from the 4th until the 6th of July 2007, in Cape Town, South Africa.

Pesaran, M.H., Y. Shin and R.J. Smith, 2001. Bound testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3): 289-326.

Reyna-Torres, O., 2007. Panel data analysis: Fixed and random effects using stata. UK: Princeton University.

Richardson, B., 2012. Trade, aid and rural development: EU sugar policy and the experience of Swaziland. UK: European Centre for Aid and Policy Management.

Saghaian, S. and M. Soltani, 2012. Export demand function For U.S. Raisins. Selected Paper Prepared for Presentation at the Southern Agricultural Economics Association Annual Meeting, Birmingham, AL, February 4-7, 2012.

Saghaian, Y., M. Reed and S. Saghaian, 2014. Export demand estimation for U.S. corn and soybeans to major destinations. Selected Paper, the Southern Association of Agricultural Economics (SAEA) Annual Meetings, February 1-4, Dallas, Texas.

Southern African Development Community Sugar Digest, 2014. Annual Report 2014, South Africa.

SSA, 2014. Annual Report 2014. Mbabane, Swaziland.

Sultan, Z.A., 2014. Saudi's export demand function: The ARDL approach. Journal of Economics and Sustainable Development, 5(3): 200-206.

Swaziland Sugar Association, 2013. Annual Report 2013. Mbabane, Swaziland.

Thaver, R.L. and C. Bova, 2014. An estimation of the ecourdo's export demand function with the US. International Journal of Business and Finance Research, 8(1): 89-98.

Zeng, Z., S. Saghaian and M. Reed, 2012. Factors affecting export demand for US pastachios. International Food and Agribusiness Management Review, 15(3): 139-152.