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Analysing substitutional patterns on demand for poultry meat in South Africa

– An Armington trade model approach

Angelica Jörnling

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Angelica Jörnling

Supervisor:	Yves Surry, Swedish University of Agricultural Sciences, Department of Economics
Assistant Supervisor:	Assem Abouhatab, Swedish University of Agricultural Sciences, Department of Economics
Examiner:	Rob Hart, Swedish University of Agricultural Sciences, Department of Economics

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Abstract

In recent years, large quantities of poultry meat have been dumped in the South African market by suppliers in other countries, such as Brazil, USA and the EU, at prices way below the domestic cost of production, threatening local producers and jobs. Therefore, South Africa has imposed countervailing anti-dumping duties on these foreign suppliers in order to protect its domestic poultry sector. In order to develop better understanding of demand relationships among domestic and foreign poultry suppliers to the South African market, this study has empirically estimated the elasticity of substitution between imported and domestically produced poultry meat. The results reveal that the elasticity of substitution ranges between 6.49 and 6.63, indicating that an increase in the prices of the domestically produced poultry meat would lead to a reduce in demand for domestic poultry meat and curtail the expenditure on the product. Hence, domestically produced and imported poultry meat are considered to be similar to the South African households, which indicates that the products can be substituted and are therefore also sensitive to price changes. The elasticity of substitution can be seen as a key parameter to analyse the impacts of these imposed anti-dumping duties.

Sammanfattning

Under de senaste åren har leverantörer från bland annat Brasilien, USA och EU dumpat stora mängder kycklingkött på den Sydafrikanska marknaden. Detta hotar Sydafrikanska producenter och Sydafrikanska jobb, eftersom priserna på den importerade kycklingen är lägre än produktionskostnaderna för inhemskt producerade kycklingen. I syfte att skydda den inhemska kycklingproduktionen har Sydafrika infört anti-dumpningstariffer gentemot dessa utländska producenter. Denna studie syftar till att skapa en bättre förståelse för förhållandet mellan efterfrågan på importerad respektive inhemsk kyckling genom att empiriskt uppskatta substitutionselasticiteten på den Sydafrikanska marknaden mellan de båda produkterna. Resultaten avslöjar att substitutions elasticiteten sträcker sig mellan 6.49 och 6.63, vilket indikerar att en prisökning på den inhemskt producerade kycklingen skulle leda till minskad efterfrågan och begränsa utgifterna på produkten. Härav följer att inhemsk och importerad kyckling synes vara liknande produkter för Sydafrikanska hushåll, detta innebär att de båda produkterna kan substitueras och är därför även känsliga för prisförändringar. Vid analyserande av anti-dumpningstariffernas effekter kan substitutionselasticiteten betraktas som en nyckelparameter.

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1. Introduction

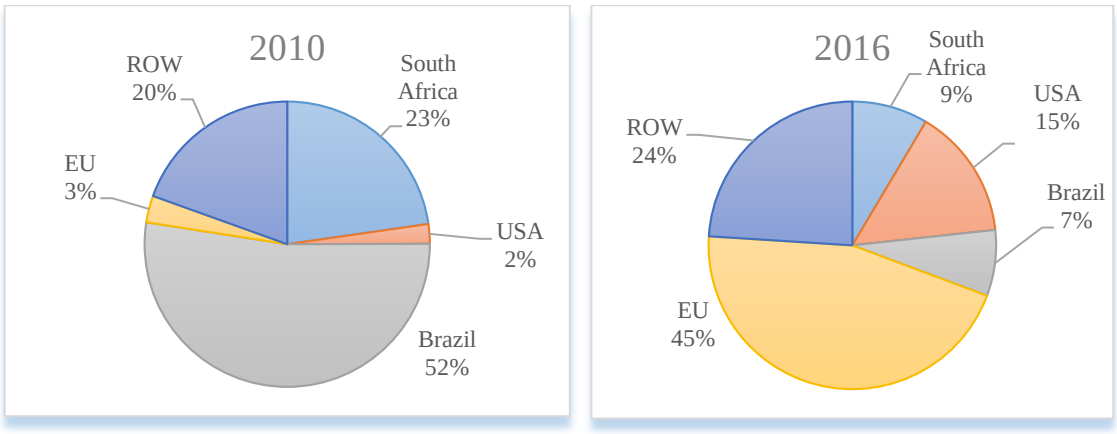
This chapter provides a background description of the chosen subject and highlights the research problem. It also outlines the objective, research question and hypothesis of this study. Next limitations for the study are defined, followed by information on how the study is structured.

1.1 Background, Research Question and Hypothesis

The World Trade Organisation (WTO) was founded in 1995 and essentially replaced the General Agreement on Tariffs and Trade (GATT) which had been in force since 1948. The WTO is an international organisation managing international trade among its 164 member countries (WTO, 2017). One of the basic principles of the WTO is to work for and open up for free trade, i.e. by helping importers and exporters to conduct their business (WTO, 2017). However, WTO also creates boundaries, for example by Article VI of GATT 1994, also known as the Anti-Dumping Agreement (WTO, 2017). The Anti-Dumping Agreement is a policy which aims to ensure that the members of the organisation do not apply dumping of products in foreign countries (WTO, 2017). If a member of the organisation causes or threatens to cause injury to a foreign domestic market, an anti-dumping duty could be used as a measure to reduce the problem. However, the Anti-Dumping Agreement does not *prohibit* dumping, its focus is instead to look at how governments can or can't react on dumping (WTO, 2017). South Africa is one of 164 member countries of the WTO as well as a country that has suffered from dumping. The products affected are for instance garlic, chips and poultry (The South African Revenue Service, 2017). The latter product, poultry meat, is the focus of this study.

Poultry meat has become one of the most important protein sources in the diet of the South African consumer (Burgin, 2015). The South African per capita consumption of poultry meat has increased from 21.5 kg to 38.5 kg between the year 2000 and 2014 (GAIN, 2015). In 2015 the gross value of animal products was 48.8 % of the total gross value of the South African agricultural production, whereat the poultry meat industry was the biggest industry of 16.6 % (Department of Agriculture Forestry and Fisheries Republic of South Africa, 2015). Although the domestic production of poultry meat is relatively large, South Africa is a large importer of the product as well.

Figure 1: The South African supply of bone-in frozen poultry (0207.1490) 2010 and 2016.



Source: Data analysis by Angelica Jörnling

The largest exporters of poultry meat to South Africa are among others Brazil, USA and a few EU countries; the UK, Germany and the Netherlands (CTA, 2014). Table 1 above presents the percentage share of the supply of poultry meat (HS code 0207.1490) in South Africa, and from 2010 to 2016 the domestically produced poultry meat have decreased from 23 % to 9 %, this shows the increasing importance of imported poultry meat in South Africa. Brazil's and USA's market share have also decreased in favour of imports from the EU. The demand for poultry meat has increased and at the same time the South African suppliers has lost market shares. To protect the domestic producers in South Africa, countervailing anti-dumping duties have been imposed, since the import prices are set way below the South African cost of production of poultry meat. The dumping affects the domestic producers negatively and causes job losses in the sector (Brinkhuis, Pitman and Masemola, 2017). Dumping of poultry meat can partly be explained by the consumers' demand for specific pieces of poultry meat in developed countries. In developed countries, like the EU countries, the consumers tend to buy and eat the breast part of the poultry, rather than the cut pieces. The companies active within the poultry meat production industry are therefore overbalanced with cut pieces, that are hard to sell at their domestic markets. Therefore, the frozen cut pieces are the most common pieces exported from the EU countries (Hermelin, 2004).

To prevent the dumping of poultry meat, different kinds of anti-dumping measures can be imposed and the most common measures are ad valorem and specific duties (European Commission, 2017). In the beginning of the year 2000 a specific anti-dumping duty of 6.96 Rand/kg was imposed on bone-in poultry (HS Code 0207.1490) from USA. This duty was later on, in 2012, extended for additional five years and was increased to 9.4 Rand/kg (Viljoen, 2015). In February 2012 South Africa imposed a provisional anti-dumping duty of 62.93 % on all Brazilian frozen whole birds (HS Code 0207.1412) which lasted until august of the same year (GAIN, 2013).

In the same year, 2013, an agreement on full liberalization of trade took affect between the EU and South Africa, resulting in an increase of imported poultry meat from the EU countries (USDA, 2016). The consequence of the increase in market share led South Africa to impose anti-dumping duties on the three EU countries in July 2014, which will last until February 2020 (European Commission, 2017). The UK was imposed with an anti-dumping duty of 22 %, Germany 73.3 % and the Netherlands 22.8 % on the commodity code 0207.1490 (CTA, 2014).

Table 1: Anti-dumping duties recently imposed on specific poultry product's suppliers

Country	**HS Code**	**Anti-Dumping Duty**	**Time Period**
Brazil[1]	0207.1412	62.93 %	Feb 2012 - Aug 2012
USA[2]	0207.1490	6.96 R/kg 9.40 R/kg	2000 - 2012 2013 - 2018
EU (the UK, Germany & the Netherlands)[3]	0207.1490	22 %, 73.3 %, 22.8%	2014 - 2020

Sources: 1: (GAIN, 2013), 2: (Viljoen, 2015), 3: (CTA, 2014)

Against this background, it is of interest to analyse the impact of these countervailing anti-dumping duties on the consumption of poultry meat in South Africa, along with its welfare impacts. To this end, the study will use an econometric model to capture these impacts by taking into account the substantiality pattern in terms of consumption between domestically produced, South African, and imported poultry meat. The objective of this study is to estimate the elasticity of substitution between imported and domestically produced poultry meat, to determine the substitutional pattern in demand for poultry meat in South Africa. The research question of this study is;

What is the elasticity of substitution between domestically produced, South African, and imported poultry meat from Brazil, USA, the EU and ROW[1]?

The Hypothesis stated is;
H_0: $\sigma=1$
H_1: $\sigma > 1$

The null hypothesis explains that the estimated elasticity of substitution equals one. When the elasticity of substitution approaches one the function approaches the Cobb-Douglas function (The Economics Network, 2002). The alternative hypothesis is that the elasticity of substitution is larger than one, meaning that the elasticity of substitution approaches to infinity i.e. the products are perfect substitutes. If the null hypothesis is rejected, it indicates that poultry meat is a relatively sensitive product and that a price increase in domestically produced poultry meat will lead to an increase of imported poultry meat to South Africa. If instead the elasticity of substitution approaches zero, the function approaches the Leontief utility function i.e. the products are perfect complements (The Economics Network, 2002).

1.2 Limitations

The study is limited to look at domestically produced poultry meat in South Africa and imported poultry meat from Brazil, USA and the EU (the UK, Germany and the Netherlands). All these countries are large exporters of poultry meat to South Africa and they have all been under investigation and/or imposed with anti-dumping duties during the beginning of the 21st century. Poultry meat imported from the rest of the world will also be considered, in order to determine the substitutional pattern in demand for poultry meat in South Africa.

Time series data covering the period 2009-2016 on South Africa's domestic production and imports of poultry meat were used in the econometric estimation, the initial idea was to use a larger dataset, from 2000 to 2016, since the first duty was imposed on USA in the beginning of the year 2000 (Viljoen, 2015). Unfortunately, the only data available for domestically produced poultry meat was from 2009 to 2016, the range therefore needed to be narrowed down. The estimation was done using the ordinary least square (OLS) method.

There are a lot of different parts and cuts of a poultry, which can be either chilled or frozen. This study has been limited to only look at a commodity code that has been imposed with an anti-dumping duty for almost all of the selected countries. The commodity chosen is Bone-in frozen parts except wings with the commodity code 0207.1490. Bone-in means breasts, front, legs, thighs, drums and backs (New Zealand Foreign Affairs & Trade, 2017). The only country not imposed with a duty on this specific commodity is Brazil (GAIN, 2013).

[1] The rest of the world.

1.3 Structure of the Study

The study starts with an introductory chapter that contains a background and research problem description, followed by the stated objective, research question, hypothesis and limitations. The second chapter presents the theoretical framework of the study. Chapter three discusses the Armington trade model and overviews the relevant literature. The third chapter presents the methodology and starts with a description of the data and then the model specification. The fourth chapter then presents and discusses the results, brings up the limitations and discusses further research. Finally, chapter five summarizes the thesis and provides concluding remarks.

2. Theoretical Framework

The second chapter contains a brief explanation and argumentation of different trade theories that could be applicable. Followed by an illustration of the chosen method, the Armington trade model and a literature review.

2.1 Trade Theories

Both the Heckscher-Ohlin and Ricardian model are two standard models of international trade which assumes that there are two countries producing two products and trade them with each other. The Heckscher-Ohlin model is a model that comparative advantage derives from differences in relative factor endowments, labour and capital, across countries. The model also shows differences in relative factor intensities, for example land when it comes to agriculture, across industries (Parson, 2007). The output is assumed to be homogeneous across all firms. This means that products are identical in their characteristics so that a consumer finds products from different firms hard to distinguish. This means that products from different firms are perfect substitutes for all consumers (Koo and Lynn, 2005). The Ricardian model on the other hand assumes that there is only one factor of production, labour. The model has been developed on a general equilibrium framework which imply a perfect competition in all markets. The produced goods are assumed to be homogeneous across countries and firms within an industry (Koo and Lynn, 2005).

The Armington trade model differs from both the Heckscher-Ohlin and the Ricardian model in terms of assumptions. The Armington trade model presumes that each trading country produces its own goods, which are differentiated from the products produced in other countries, thus not homogeneous (Sarker and Surry, 2006).

In this study poultry meat is not assumed to be a homogeneous product. The reason for this is that agricultural products are often perceived differently by consumers due to factor contents, quality attributes and marketing features (Sarker and Surry, 2006). Therefore, there is an imperfect substitution between domestic and imported poultry meat (Zhang, 2006). The Heckscher-Ohlin and Ricardian model are hence less suitable than the Armington trade model for the purpose of this study. Consequently, The Armington trade model will be used in this study and a more detailed description of the model follows below.

2.2 The Armington Trade Model

The Armington trade model, developed by Paul S. Armington constructed 1969, is a commonly used model to explain a country's import behaviour. The model rests upon two assumptions: *i*) traded products are not homogeneous and differentiated according to their geographical origin, and *ii*) an imperfect substitution exists between imported and domestically produced products. This imperfect substitution is measured by a constant elasticity of substitution, σ (Armington, 1969). The elasticity of substitution can be defined as the percentage change in relative quantities demanded divided by the percentage change in relative prices (Leamer and Stern, 1976).

$$\sigma = \frac{\delta \log(q_F/q_D)}{\delta \log(p_F/p_D)} \tag{1}$$

The first assumption indicates that the consumer has a global utility function, U, and that the consumer maximizes his or her utility by choosing several different goods. According to the second assumption the consumer's optimisation problem regards choosing between a combination of domestically produced and imported products (Equation 2), whose ratios satisfy the first order condition (Equation 3) (Ogundeji, Jooste and Uchezuba, 2010). The designation q_F denotes the imported quantity from country i, q_D represents the domestically produced quantity of a product and q_1 denotes the aggregated quantity. The p_F and p_D are the prices of the imported and domestically produced products, and σ is the elasticity of substitution between imports and domestic sales.

$$\begin{gathered} MaxU_1 = \alpha\,[\beta_D q_D^{-\rho} + \beta_F q_F^{-\rho}]^{-\frac{1}{\rho}} \\ p_F q_F + p_D q_D = R \end{gathered} \tag{2}$$

Where β is positive and $\rho \geq -1$. The elasticity of substitution is $\frac{1}{\rho+1} = \sigma$.

$$\frac{q_F}{q_D} = \left[\frac{\beta_D p_F}{\beta_F p_D}\right]^{\sigma} \tag{3}$$

By taking the natural logarithm of Equation 3 it can be expressed in the following log-log form as:

$$\log\frac{q_F}{q_D} = \sigma \log\frac{\beta_D p_F}{\beta_F p_D} \tag{4}$$

The variable utility, U_1, can also be viewed as a quantity index q_1. The variable measuring the volume level of the quantity demanded for the product. The aggregated quantity index can be derived and defined because of the linear homogeneity of the utility function. Therefore, the following relationship can be obtained (Armington, 1969).

$$q_1 = U_1 = \alpha\,[\beta_D q_D^{-\rho} + \beta_F q_F^{-\rho}]^{-\frac{1}{\rho}} \tag{5}$$

2.3 Literature Review

The Armington trade model is commonly used within consumer theory and international trade, and is often used to explain trade flows in computable general equilibrium (CGE) models (Sarker and Surry, 2006). According to Armington assumptions, that products are not homogeneous and differentiated by their geographical origin, the model is often used when it comes to agricultural markets (Alston et al., 1990). The model is considered easy to use, flexible and is often able to presents successful results because of likely statistical significance and parameter estimates (Alston et al., 1990). However, there are some problems with the Armington model as well, for example, disaggregated data estimates higher elasticity of substitution and parameter estimates are sensitive to model misspecification (McDaniel and Balistreri, 2003).

There are five studies that have been of great importance when it comes to Armington estimation; Stern, Francis and Schumacher (1976), Shiells, Stern and Deardorff (1986), Reinert and Roland-Holst (1992), and Shiells and Reinert (1993). These studies do, however, not consider the time series properties of the data nor the long-run aspect of the elasticity of substitution. Later Gallaway, McDaniel and Rivera (2003) developed a technique that took care of the time series attributes of the data that separates the short- and long-run elasticities. Regarding estimation of the elasticity of substitution in South Africa, this new technique was mostly ignored. These problems were then mastered in an article by Gibson (2003) by applying the specifications of Gallaway, McDaniel and Rivera (2003) to estimate short- and long-run elasticities of different products in South Africa.

In recent years' estimation of Armington elasticities on agricultural products has become more common. Ogundeji, Jooste and Uchezuba (2010) examined the short and the long run Armington elasticities for agricultural products like meat of bovine animals, meat of swine, maize, wheat, soybeans and sunflower in South Africa. The result from the study is a long run elasticity ranging from 1.91 to 4.5 and short-run elasticities ranging from 0.79 to 3.47. These values suggest that imported and domestic agricultural products are far from perfect substitutes. In the study they recommend the use of Armington elasticities for other agricultural products with a relatively high trade percentage relative to domestic production.

Another article by Murphy et al. (1992) examined the impacts of boarder protection on the global poultry markets. In order to do so the researcher apply the Armington trade model to look at different scenarios of different import tariffs and how they affect the total exports and imports of poultry meat. Although they do not present a detailed explanation on how they calculate the elasticity of substitution for poultry meat, it may still give indications on the elasticity of substitution, in this study it is between 0.09 to 1.9.

The elasticity of substitution is a key parameter to analyse the impacts of an imposed anti-dumping duty. An article by Hansen, Meinen and Nielsen (2014) examined the role of the elasticity of substitution for the outcome of anti-dumping investigations and show that the result from the article is that the dumping margin varies inversely with the elasticity of substitution. Accordingly, the elasticity of substitution is an important determinant of the outcome of anti-dumping petitions for countries that commit themselves strongly to rules that mechanically describes how the anti-dumping duty should be determined, by use of observable variables.

Another article with poultry meat in focus is Alston and Scobie (1987) who examined the consequences of the EC policy by using two approaches, firstly, poultry meat seen as a homogeneous product and in the second, poultry meat is treated as being differentiated by region of origin.

In this case, the second approach is of more interest. Alston and Scobie (1987) use an elasticity of substitution ranging from 3 to 36, which is a quite large span. This is taken from Johnson (1971,1984) where they used this range for different agricultural products. In the conclusion of the article Alston and Scobie (1987) also mention that the Armington trade model requires more detailed specification of parameters.

As far as I have found, previous research has not focused on estimating the elasticity of substitution for poultry meat. Even less have previous studies examined the substitutional pattern between imported and domestically produced poultry meat with respect to anti-dumping issues. This study aims to fill this gap by estimating an elasticity of substation for a commodity code which is being dumped in the South African poultry market.

3. Methodology

The first section in this chapter will give a model specification for this study by presenting two models. The second section will then describe the data, data sources and clarify how the dependent and independent variables were computed.

3.1 Model Specification

To estimate the elasticity of substitution between imported and domestically produced poultry meat this study has been using time series data, from 2009 to 2016. To analyse the data an ordinary least squares analysis of time series has been used. To do this two separate approaches, time series data and cross sectional data, were combined. The new regression equation (6) is obtained by pooling data cross sections for the different time periods. This regression tells that the elasticity of substitution will vary between countries but be constant over time (Leamer and Stern, 1976).

$$\log\left(\frac{q_i}{q_1}\right)_{i,t} = \alpha_1 + \alpha_2 D_2 + \alpha_3 D_3 + \alpha_4 D_4 + \alpha_5 D_5 + \alpha_6 D_6 + \alpha_7 D_7 + \sigma_1 \log\left(\frac{p_i}{P_D}\right)_{i,t} \quad (6)$$

In Equation 6, α_1 is the intercept, followed by dummy variables. The largest importers of poultry meat to South Africa are Brazil, USA and the EU (the UK, Germany and the Netherlands). Therefore, dummy variables for each country, counting the three EU countries as one, were constructed. A dummy was also constructed for the domestic production in South Africa and for the rest of the world. There is also a dummy variable constructed for the year 2013 when South Africa imported 0 from USA. The denotation $\log\left(\frac{p_i}{P_D}\right)$ is the ratio between the aggregated import prices and the total aggregated price of poultry meat.

In order to determine the elasticity of substitution two different models, Model 1 and Model 2 were constructed, containing three different ordinary least square regressions. In the first model the South African consumer choses between purchasing poultry meat from South Africa, Brazil, USA, USA2013, the EU and the "rest of the world" (Equation 7). The second model is divided into two stages. At the first stage the South African consumer choses between purchasing South African and imported poultry meat (Equation 8). If the South African consumer choses imported poultry meat the next stage will be to choose if he/she wants to purchase poultry meat from Brazil, USA, USA2013, the EU and the "rest of the world" (Equation 9). The Appendix brings a more illustrative explanation of the two models.

Model 1;

$$\log\left(\frac{q_i}{q_1}\right) = \alpha_1 + \alpha_2 South\ Africa + \alpha_3 Brazil + \alpha_4 USA + \alpha_5 EU + \alpha_6 ROW + \alpha_7 USA2013 + \sigma_1 \log\left(\frac{p_i}{P_D}\right) \quad (7)$$

Model 2;

$$\log\left(\frac{q_i}{q_D}\right) = \alpha_1 + \sigma_1 \log\left(\frac{p_i}{P_D}\right) \quad (8)$$

$$\log\left(\frac{q_i}{q_1}\right) = \alpha_1 + \alpha_2 Brazil + \alpha_3 USA + \alpha_4 EU + \alpha_5 ROW + \alpha_6 USA2013 + \sigma_1 \log\left(\frac{p_i}{P_D}\right) \quad (9)$$

A problem with these equations is that they do not provide long-run values. This is because there is no long run relationship between poultry meat as a product and the price ratio series. Capturing both the short- and long-run elasticity estimates requires the use of a geometric lag model which is able to capture the dynamic relationship between quantity and price (Ogundeji, Jooste and Uchezuba, 2010). This type of model will not be used due to time and the extent of the study.

3.2 Data Description

The dataset used in this study consists of observations on quantities, measured in tons, of poultry meat (0207.1490) domestically produced in South Africa as well as imports from Brazil, USA, the EU (the UK, Germany and the Netherlands) and the rest of the world. The import prices, measured in thousand Rand, is Free on Board (FOB) prices and the domestically produced poultry is in retail prices. Since the import prices was FOB prices, both the transportation costs and the duties imposed on the three countries, have been added in order to calculate the retail prices. The transportation costs were calculated using data from the Comtrade database.

The data are annual and cover the period 2009-2016 and the source of the data is the South Africa Poultry Association (SAPA). It is a broiler organisation that represents broiler producers with the intention to serve the interest of the broiler industry on a national level (SAPA, 2017). The producer prices were gathered from a monthly survey of approximately 50-70 % of the total South African poultry production (Bradford, 2017). In this study, a time series data of 40, 32 and 8 observations have been used. This data has then been run in an ordinary least square (OLS) regression in Gretl to estimate the elasticity of substitution.

The data from SAPA, regarding domestically produced poultry meat, were organized into different kinds of poultry cuts instead of commodity codes. It was therefore necessary to do an aggregation of the different poultry cuts so that they matched the commodity code 0207.1490. The result of the aggregation was eight different frozen cuts; Thigh (IQF), Drum (IQF), Filleted Breast (IQF), Breast (IQF), Thigh, Drums, Drum/Thighs and Sundry. Where IQF stands for individually quick frozen. The following step was then to aggregate total expenditure and price for the domestically produced poultry meat (0207.1490).

When the primary data were prepared, the expenditure for each importing country was computed. However, since the three EU countries are seen as one, an aggregation of the total expenditure and price was calculated for these three EU countries. This was followed by an aggregation of the total expenditure and price, for all countries. The aggregated prices are calculated by the stone price index with the base year 2012. The total aggregated quantity was then calculated by taking the ratio between total expenditure and total aggregated price.

The dependent variable was constructed by taking the log of the aggregated quantity, for each country, divided by the total aggregated quantity. To construct the independent variable log of the aggregated price, for a specific country, was divided by the total aggregated price. Dummy variables were then constructed to reflect the characteristics of each country.

4. Results and Discussion

This chapter starts with a presentation of the empirical results from the estimation, that is presented separately in three tables, followed by a comparison between this study's and previous research elasticity of substitution. Then an interpretation, discussion of the results, limitations and suggestions for further research will be presented.

4.1 Empirical Results

Table 2 to 4 summarize the econometric results of the two estimated models. The results from the first model, is presented in Table 2 below. Thereafter, the second model econometric results are presented, which is split into two OLS regressions, in Table 2 and Table 3.

Table 2: Results for Model 1 (Eq. 7) with Log (q_i/q_D) as the dependent variable

Variable	Coefficient	Standard error	P-value	Significance
Constant	-0.722	0.239	0.0049	***
Log (p_i/P)	-6.499	0.979	1.51e-07	***
South Africa	-0.065	0.338	0.848	
Brazil	-0.411	0.342	0.238	
USA	-2.002	0.357	3.12e-06	***
EU (UK, Germany, Netherlands)	0.0373	0.338	0.913	
USA 2013	5.254	2.449	0.039	**

****, ** and * denote significance at 1%, 5% and 10% levels*

R^2=0,929 Adjusted R^2=0,916 Observations=40

Table 3: Result of model 2 (Eq. 8) with Log (q_i/q_D) as the dependent variable

Variable	Coefficient	Standard error	P-value	Significance
Constant	0.660	0.010	0.0008	***
Log (p_i/P)	-5.250	3.170	0.1488	

****, ** and * denote significance at 1%, 5% and 10% levels*

R^2=0,313 Adjusted R^2=0,199 Observations=8

Table 4: Result of model 2 (Eq. 9) with Log (q_i/q_D) as the dependent variable

Variable	Coefficient	Standard error	P-value	Significance
Constant	-0.564	0.255	0.035	**
Log (p_i/P)	-6.636	1.024	7.21e-07	***
Brazil	-0.418	0.364	0.261	
USA	-1.984	0.380	1.93e-05	***
EU	-0.026	0.360	0.941	
USA 2013	5.512	2.556	0.040	**

****, ** and * denote significance at 1%, 5% and 10% levels*

R^2=0,935 Adjusted R^2=0,923 Observations=32

Most of the standard errors in these three tables are relatively small indicating that the estimates are precise. The R^2 for Model 1 (Table 2) and the second stage in Model 2 (Table 4) is high, which indicates that these two OLS regressions fits the data and explains approximately 90 % of the variance of the dependent variable. However, the R^2 of the OLS regression in Table 3 is smaller, that indicates a need for more observations and explanting variables to explain the dependent variable. The variable rest of the world is omitted from the regressions due to exact collinearity.

The elasticity of substitution is the coefficient of the price ratio and is somewhere between 6.49 and 6.63, which is a relatively high value. This calculated elasticity of substitution differs from earlier used elasticities in pervious researches, for example Murphy et al. (1992) uses an elasticity of substitution ranging from 0.09 to 1.9. The sign of the estimated elasticity of substitution is negative in the tables and that is because there is a negative relationship between the quantity of imports and the price of imports.

4.2 Result Discussion

In both Table 2 and Table 4 the elasticity of substitution is highly significant to 1 %. The elasticity of substitution measures the percentage change in the ratio of imported and domestically produced poultry meat in response to a percentage change in price. When the elasticity of substitution is larger than one, like the result in this study shows, that indicates that an increase in the prices of the domestically produced poultry meat would lead to a reduce in demand for domestic poultry meat and curtail the expenditure on the product. This implies, that when the domestic price of poultry meat (0207.1490) increases the quantity of imported poultry meat to South Africa will increase. Hence, domestically produced and imported poultry meat are considered to be similar to the South African households, implying that the products can be substituted and are therefore also sensitive to price changes.

In contrast, the elasticity of substitution in Table 3, on the other hand, is statistically insignificant (σ=0,1488). The reason for that may be that the sample size is not large enough, since there are only 8 observations in the OLS regression. The variable USA is also statistically significant to 1 % and the variable USA2013 is significant to 5 %. These two dummy variables indicate that they are an important factor in determining the demand for poultry products. The other two dummy variables, Brazil and EU, are not significant and therefore not an important factor in determining the demand for poultry meat. This is a quite surprising result since these two countries are great exporters of the product.

4.3 Limitations and Suggestions for Further Research

The first issue to raise in this study is the aggregated domestically produced poultry cuts. There was a need to aggregate the different types of poultry cuts so that they matched with the commodity code 0207.1490, which is bone-in poultry except wings. The problem is that the data do not distinguish if the different poultry cuts are bone-in or deboned. This makes the result less trustworthy for this specific commodity.

Another issue when estimating a regression is omitted variables bias. Although there was a high R^2 in two of three regressions, omitted variables may still occur. One omitted variable could be seasonal dummies. This would however require quarterly data, which could not be found, and other previous research, with this type of seasonal dummies used, have not showed any significance regarding meat production (Ogundeji, Jooste and Uchezuba, 2010).

To further improve the results, it would have been possible to use a geometric lag model to calculate the long run elasticity, since the long run estimates are more suitable for trade-policy analysis. The Long run elasticity often receive approximately two times larger results than the short run elasticity (Gallaway, McDaniel and Rivera, 2003). Few numbers of observations can also be a problem when estimating an OLS regression. In Table 3 only eight observations were available which may have affected the result.

In the past several years the consumption of poultry meat has increased in South Africa, since it is considered to be an affordable source of protein. This in turn means an increase in demand for cheap poultry meat (GAIN, 2015). Large exporters of poultry meat have increased their market share in the South African market with the use of dumping. Since the South African producers of poultry meat, probably, lack a comparative advantage, anti-dumping duties have been imposed on the imported products, in order to protect the domestic producers. The increase in demand and lack of comparative advantage suggests that "dumping" of poultry meat will continue. This field of research is therefore worthy to be studied in more detail.

The WTO suggests that global trade will continue to expand in the future. One main reason for this is that developing countries, like South Africa, will continue to rise, which will drive international trade. Studies show that a dynamic economic and open trade environment should benefit countries like South Africa (WTO, 2013). Still South Africa imposes duties on commodities to protect the domestic producers. Since the South African Government wants to protect their agricultural industry, and at the same time increase welfare, the South African Government should find interest in this study and further research on the topic.

The next step for further research could be to study the impacts on consumer and producer surplus and welfare effects, due to the duties imposed. In order to do so the calculated elasticity of substitution can be used as a key parameter. Poultry meat is a product that is sensitive and therefore also vulnerable to, for example, anti-dumping duties. The sensitivity of poultry meat can also affect domestic producers and make it difficult to maintain a domestic production. The International Trade Administration Commission (ITAC) should be interested in this type of information since they investigate various trade related issues and want to ensure that foreign producers compete fairly with the domestic producers (ITAC, 2017). The increased demand for cheap protein might also affect the demand for other agriculture products. Due to that, this study on poultry meat may be useful for further research on other commodities.

5. Conclusion

This chapter will start with a brief review of the topic and the objective of the study. Then the hypothesis will be answered followed by an explanation of the result of this study. In the end of this chapter the importance of further research in this topic is stressed.

5.1 Summary and Concluding Remarks

The focus of this study has been to examine the elasticity of substitution between imported and domestically produced poultry meat in South Africa. The poultry meat in question is imported from Brazil, USA, the EU (the UK, Germany and the Netherlands) and from "the rest of the world". In order to narrow the study, only data for the commodity code 0207.1490 has been considered, which is bone-in frozen poultry except wings. This commodity has been chosen due that it is imported to a large extent from the selected countries and almost all of these countries has been imposed with countervailing anti-dumping duties in respect of this specific commodity.

The objective of this study is to estimate the elasticity of substitution between imported and domestically produced poultry meat, to determine the substitutional pattern in demand for poultry meat in South Africa. The research question to be answered was:

What is the elasticity of substitution between domestically produced, South African, and imported poultry meat from Brazil, USA, the EU and ROW?

To answer the research question three regressions were constructed. These regressions consisted of the log of the price ratio between import price and total aggregated price of poultry meat and dummy variables for each country. The elasticity of substitution is the coefficient of the price ratio between the import price and the total aggregated price. The hypothesis was that the estimated elasticity of substitution for poultry meat was larger than one, the findings show that the hypothesis is correct. The elasticity of substitution was estimated to lie within a range from 6.49 and 6.63, which is relatively high. This indicates that a price increase of the domestically produced poultry meat will lead to an increase of imported poultry meat. One weakness with the estimated regression (Equation 8) is that there are small numbers of observations.

Previous researches have studied the elasticity of substitution for other goods, manufactured as well as agricultural. However, no study has focused on the elasticity of substitution for the cut pieces of the poultry. Still a few papers have been published were the elasticity of substitution for poultry meat has been used in different policy simulations. Neither of them has, however, calculated the elasticity. Instead they have used already existing values. In this study the short run elasticity was estimated. In previous research it is common that authors have calculated both the short and long run elasticities. Long run elasticities are better suited for trade-policy analysis and gives higher estimates than the short run does.

Further research on this topic could be focused on the policy simulation and the impacts on consumer and producer surplus and welfare effects, due to the duties imposed on the different countries. To make this possible, an elasticity of substitution is needed.

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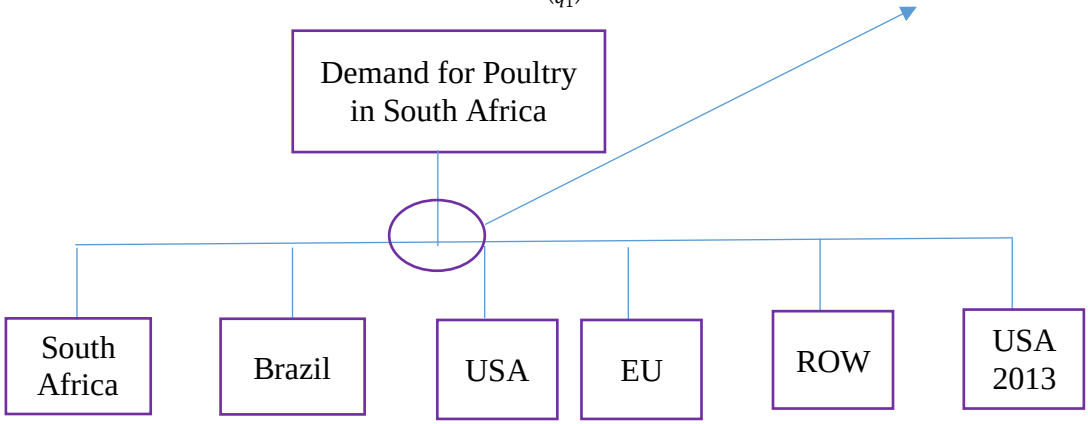
Appendix

Appendix 1.

Model 1:

$$\log\left(\frac{q_i}{q_1}\right) = \alpha_1 + \alpha_2 South\ Africa + \alpha_3 Brazil + \alpha_4 USA + \alpha_5 EU + \alpha_6 ROW + \alpha_7 USA2013 + \sigma_1 \log\left(\frac{p_i}{P_D}\right)$$



Model 2:

$$\log\left(\frac{q_i}{q_D}\right) = \alpha_1 + \sigma_1 \log\left(\frac{p_i}{P_D}\right)$$

$$\log\left(\frac{q_i}{q_1}\right) = \alpha_1 + \alpha_2 Brazil + \alpha_3 USA + \alpha_4 EU + \alpha_5 ROW + \alpha_6 USA2013 + \sigma_1 \log\left(\frac{p_i}{P_D}\right)$$