The determinants of beef imports in Sweden

De avgörande faktorerna för import av nötkött i Sverige

Felicia Östby Andersson

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Abstract

This paper investigates the determinants of Swedish beef imports using a Vector Autoregression and a Vector Error Correction model. By examining which variables responsible for the volume demanded on imported beef, one can understand how domestic beef production can compete and regain market shares from imported beef. A market relocation has been seen in recent years where country of origin, animal welfare, and environmental issues has been highlighted. Swedish authorities suggest that Swedish beef has an advantage concerning these aspects. The literature records a growing demand for added value at beef production and local beef. Price is crucial when it comes to choices of beef to purchase according to economic theory which somewhat contradicts the literature recordings. Therefore, this paper investigates if added value is of importance when choosing between Swedish or imported beef. The results are comprehended for both the short and long run. The results show that beef import is significantly positively influenced by factors such as Gross National Income export and its price. This corresponds to economic theory in which the demand is dependent on the consumer budget whereas an increase in income, which in this study is measured by Gross National Income, will increase demand for all normal goods. Export and its price are indirect variables for the budget since export increases revenue and thereafter the budget. Local beef has less elasticity than other beef. Therefore, the assumption of Swedish beef having an advantage in the local origin aspects. It is also assumed that Sweden has a less negative effect of added value, which is supported by the findings. Irrespective of the lag length, domestic production, import price, and added value is the variables with negative impact on import in both models. This confirms earlier literature about consumers preferring added value beef with Swedish origin. On the other hand, imported beef has a greater advantage in the lower price for which domestic beef does not have a larger market share. The origin and the higher added value that Swedish beef involves seeming to be the filling between the price gap in between import and domestic beef as the market shares are on a fifty percent level between the two. In the short-run model, the variables had more impact on imported beef. This is interpreted as the importance of the allocation in consumer preference not being recorded long enough for addressing as a trend in the long-run model. Omitted variables can also be influencing a long-run result.

Sammanfattning

Denna studie undersöker faktorerna för svensk nötköttsimport med hjälp av en kort- och en långsiktig regressionsmodell. Genom att undersöka vilka variabler som påverkar volymen importerat nötkött kan man förstå hur inhemsk produktion kan konkurrera och återfå marknadsandelar från importerat nötkött. En omfördelning i marknadsandelar har rapporterats de senaste åren där ursprungsland, djurskydd och miljöfrågor har diskuterats som potentiella orsaker. Svenska myndigheter föreslår att svenskt nötkött har en fördel när det gäller dessa aspekter. Litteraturen bekräftar en växande efterfråga av lokal nötköttsproduktion med större mervärde. Priset är dock alltid avgörande i det slutgiltiga valet av kött enligt ekonomisk teori vilket motsäger litteraturen angående mervärde. Därför undersöker denna uppsats om mervärde är en avgörande faktor i valet mellan svensk eller importerat nötkött. Resultaten för modellerna påvisar att nötköttsimport påverkas positivt av variablerna Bruttonationalinkomst, export och dess pris. Efterfrågan är beroende av konsumentens budget, därför innebär en ökning av inkomster, som i denna studie mäts med Bruttonationalinkomst, till en ökad efterfråga på alla normala varor. Export och dess pris är en indirekt variabel för inkomst eftersom exporten ökar intäkterna i landet och därefter budgeten. Lokalt nötkött har mindre elasticitet än annat nötkött. Därför antas svenskt nötkött ha en större fördel i ursprungsaspekten. Enligt litteraturen så har även Sverige ett högre mervärde, vilket också stöds av resultaten. Inhemsk produktion, importpris och mervärde är de variabler som har en negativ påverkan på importen i båda modellerna. Detta bekräftar den litteratur som föreslår att konsumenter föredrar nötkött med svenskt ursprung. Å andra sidan har importerat nötkött en stor fördel i dess lägre pris vilket enligt ekonomisk teori innebär att inhemskt nötkött inte har en större marknadsandel. Ursprunget och det högre mervärdet hos svenskt nötkött tycks fylla prisskillnaden mellan import och inhemskt nötkött eftersom marknadsandelarna för respektive produkter är 50 procent. På kort sikt har variablerna större påverkan på importerat nötkött. Detta tolkas som att betydelsen hos konsumenternas preferenser inte avspeglas tillräckligt under tidsperioden för att kunna tolkas som en trend i den långsiktiga modellen. Utelämnade variabler kan också påverka resultatet i den långsiktiga modellen.

Abbreviations

CPI - The index measures the average price trend for the entire private domestic consumption, the prices the consumer pays. The CPI is the usual measure of compensation and inflation calculations in Sweden.

GNI - Gross national income is a measure consisting of the sum of the gross domestic product and net factor income from abroad.

ISIC - International Standard Industrial Classification

Normal good - Any good for which demand increases when income increases, i.e. with a positive income elasticity of demand.

Time series - A time series is a series of data points that are observed over a given time.

VAR – Vector Autoregression Model is a stochastic process model used to capture the linear interdependencies among multiple time series.

VAT - Value Added Tax or Sales Tax, are consumption taxes that are ultimately paid in connection with purchases for consumption.

VECM - Vector Error Correction Model is a restricted VAR model designed for use with nonstationary series that are known to be cointegrated in the long run

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1 Introduction

This section will introduce a fundamental understanding of the subject and an idea on why the paper is contributing to further knowledge.

1.1 Background

Beef is the most consumed meat product in Sweden. Consumption of beef has increased after Sweden joined the European Union in 1995 because of the low prices and increased revenues as well as new product variants and packaging, which is an effect of increased competition. The markets share throughout the years confirms that the EU entry was of crucial effects for the Swedish beef market. In 1985, the Swedish share of consumption was 120 percent (Swedish Board of Agriculture 2019), in 1995 the share was 89 percent, and in 2013, 50 percent.

The import of beef has been increasing since the EU entry until 2015. However, from 2016, the import of beef has been decreasing. An increase in demand for Swedish beef has been observed since 2016 and in 2019 the Swedish share of consumption was more than 50 percent (Swedish Board of Agriculture 2019). In 2017 and 2018, beef production in Sweden increased, while the consumption of imported meat decreased. The share of Swedish beef from consumption increased for the second year in a row. Earlier notches in ***Error! Reference source not found.*** can be explained by the mad cow disease and foot-and-mouth disease in 2001 and the economic crisis in 2009 (ibid.).

The Swedish Board of Agriculture (2019) indicated that the decrease in imports is partly due to a change in consumers' attitude towards beef production. Especially, attitude towards the use of antibiotics, animal welfare, and carbon footprints are contributory factors to the decrease in beef import. Consumption is shifted towards domestically produced beef since Sweden has one of the highest standards concerning livestock in comparison to other EU-members (Federation of Swedish Farmers 2016). 1 kilo of Swedish beef has 25 per cent fewer emissions than the EU average (ibid.). These characteristics will be referred to as Added Value in this study.

The greatest exporting countries of cattle to Sweden are in order; Ireland, the Netherlands and Germany (Swedish Board of Agriculture 2019). Although approximately 50 per cent of the beef consumed in Sweden is imported, it constitutes a minor part of the exporting country's production. For example, Swedish beef imports make up 4 per cent of Ireland's beef production (FAOSTAT 2017). These small proportions indicate that the price, production, and environmental effects of Swedish imports are small or negligible in the exporting countries. Thus, production volume and environmental impact in the exporting countries, are determined by the world market, which includes vastly larger volumes than Swedish imports (Kumm & Larsson 2007). Swedish beef consumers' choices, accordingly, have negligible environmental effects in Germany or Ireland, although a significant part of the meat we consume comes from these countries.

Sweden has the capacity to increase its beef supply and begin export beef as an environmentally friendly alternative (Swedish Board of Agriculture 2019). Swedish beef exports increased by 10.8 per cent during the first quarter of 2018 compared to the previous year. 60 per cent of beef originates from milk production (ibid.). As in 2018, domestic production of beef was at 55,6 per cent in Sweden whereas the domestic milk production was at 72 per cent. Many authorities suggest that these differences in market shares, since closely linked, show that domestic beef production has the capacity to increase (Federation of Swedish Farmers 2014; Svenskt Kött 2015; Swedish Board of Agriculture 2019).

There is a lot of work going on in the Swedish government as well as Swedish companies, and organizations to increase exports of beef to different parts of the world. In 2014, the Rural Development Programme funded by the European Union (Swedish Ministry of Enterprise and Innovation 2015) was implemented. The aim was to foster the competitiveness of agriculture, ensure sustainable management of natural resources, and achieve a balanced territorial development of rural economies and communities. The programme applies from 2014 to 2020 where 4,3 billion is set aside in the EU for this purpose.

Another initiative was the Swedish Government's food strategy to encourage increased food production in Sweden (Swedish Ministry of Enterprise and Innovation 2017). The goal of the food strategy was to create a competitive food chain where food production, including beef, increases while reaching relevant national environmental goals. These targets were envisioned to be accomplished by 2030. The government bill implemented in 2017 concerning the food strategy has yet not produced effects but since the bill is a long-going project it is likely that effects will appear in future data. Nevertheless, the strategies are proof that several actors have begun favoured Swedish agriculture.

The reduction of food Value Added Tax (VAT) in 1996 from 21 per cent to 12 per cent also affects consumption and price. A key idea for the proposal was that the reduction of VAT on food would lead to lower prices for food and thus particularly favour the families with children and low-income households. Since then, the VAT rate on food has remained at a reduced level of 12 per cent. Reduced food VAT had a full price impact in the short term which means that the reduction has strengthened the purchasing power of households and has resulted in prices of food being lowered or not raised at the same rate as they would otherwise have done (Swedish National Audit Office 2018).

Studies located in foremost Canada and the U.S have determined which variables responsible for a change in consumer preferences using sensory, quantitative, and conjoint analyses (García-Torres, López-Gajardo & Mesía 2015; Charlebois, McCormick & Juhasz 2016) were added value was one of the common variables of significance.

1.2 Research Question and Hypothesis

According to the economic theory of specific factor model, the product whose relative price goes up is exported and the product which relative price goes down is imported (Feenstra & Taylor 2017). In this context, the product whose relative price is lowered in free trade is beef. Through exporting goods witch higher relative price at a higher price and importing beef at a lower price, Sweden should be better off than it was in the absence of trade. As per economic theory the consumer chooses the product, in this case which beef, dependent on which good giving the highest utility constrained to the consumer's budget (Pindyck & Rubinfeld 2009). Since the amount and choice is constrained to the consumer's budget, price is a of crucial interest. Despite these facts, domestic production has a 50 per cent market share (Swedish Board of Agriculture 2019), although a higher price, which most mean that other factors than pure economic theory influence the consumer behavior.

Some stakeholders attribute the market location to people being more aware of animal welfare and favouring local businesses. Others imply that the weak Swedish Krona has contributed to imports getting unattractive. However, these arguments are not based on scientific evidence. Scientific evidence on factors accounting for the fluctuation in beef imports to Sweden is lacking. Hence, there is a need for a study that examines factors influencing beef imports in Sweden. In addition, most scientific studies have focused on consumer preferences for beef in

other countries, such as beef origin, type of production (i.e. organic or conventional), animal welfare, etc. (Wolf & Tonsor 2017; Jonge & Trijp 2013; Yeboah, Naanwaab & Otchere 2015; Anders & Moeser 2008).

Not much work has been done on what drives imports and domestic production of Swedish beef. Therefore, the research will answer the question: *Which factors are driving import of beef, which in turn affects the share between imported and domestic beef?* The following hypotheses will be tested:

1. Agricultural value-added, import price and domestic production will have a negative impact on beef imports in Sweden.
2. Increase in GNI, the quantity of export, and its price will have a positive impact on beef import in Sweden.

The first hypothesis about agricultural added value having a negative impact on import quantity is based on the statements from authorities suggesting that Swedish consumers prefer higher animal welfare and lower climate impact. In that aspect, Swedes ought to prefer domestic beef rather than the imported beef if Swedish beef has a higher added value. The import price must be negative according to the specific factor model (Feenstra & Taylor 2017). An increase in domestic production indicates that the demand has relocated from import beef to Swedish beef and, therefore, will have a negative impact on the quantity of imported beef.

The second hypothesis is based on economic theory, a higher income will increase demand on all normal goods, which beef is assumed to be (Pindyck & Rubinfeld 2009). Therefore, a rise in Gross National Income, which is the variable representing the Swedes budget, should be positive. Export and its price increase Swedish revenue and hence the budget and demand.

1.3 Aim

Some of the reasons to promote this trend of choosing Swedish beef is that Sweden has healthy and good breeding for beef production (Federation of Swedish Farmers 2016). All heifers and cows go out to pasture during the summer which gives open landscapes and a rich biodiversity. Sweden is world-leading in preventive animal health that contributes to less use of antibiotics. Swedish beef production creates jobs in rural areas, not only in breeding but also in processing and tourism (ibid.).

Swedish beef production has environmental benefits over meat production in countries with large meat exports to Sweden (Kumm & Larsson 2007). Therefore, it would be good from a global environmental standpoint if Swedish beef production could regain market shares. A hypothesis from the Environmental Protection Agency report (2007) is that a more cost-effective Swedish meat production would gain market shares from import meat and that this, in turn, would lead to greater environmental benefits than environmental disadvantages in Sweden and the world. The aim of this thesis is, therefore, to investigate which variables affecting the demanded quantity of imported beef, and thus the Swedish beef production.

1.4 Structure

The thesis is structured as follows: The first section presented the introduction which gives a background to the study, the research problem, question, and hypothesis as well as the aim and objectives of the study. Section two presents a review of relevant literature on added value, price determinant and exchange rates. Section three discusses the methods used in the study. This includes data description, theoretical framework, and the economic model. The fourth section will present the empirical result. Tests for unit root and cointegration is used as well as

one short- and one long-run model. The discussion part will then, by combining the literature review and result, introduce an interpretation of the paper with suggestions of further work on the subject. In the conclusion, a short compilation of the discussion's key points will be presented.

2 Literature review

In this section earlier studies and data contributing to an understanding on the subject will be summarized.

2.1 Added values

The marginal benefit-cost ratios for increasing domestic beef demand were tested on eight different expenditure categories in Cattlemen's Beef Promotion in the U.S (Kaiser 2013). Of these eight expenditure categories, the highest marginal benefit-cost ratios were for product enhancement research, nutritional research, industry information and beef safety research in 2013 (ibid.). This implements that the consumer foremost chooses its beef depending on how the producer works for improving the production process. Consumers want better products, more nutrients, better animal welfare and transparency from the beef industries. Change in consumer preference concerning the animal health, quality and food safety can be traced back to the mid-70s where the U.S farmers experienced a 66 per cent decrease in retail beef demand (Marsh 2003).

In later years, this phenomenon is called; **added value.** Swedes and the rest of the world have begun considering the animal welfare, the agricultural enterprise, and environmental aspects. Information about food such as its origin, quality and animal welfare has become more important for the consumer (García-Torres, López-Gajardo & Mesía 2015). Also, if the food approach does not contribute to environmental contamination or misuse synthetic or chemicals possibly risking health seem to be of more importance. Organic labelling implicit animal welfare and environmental care which creates an added value to the quality and animal origin. Therefore, an organic label provides safety to the consumer.

The consumer preference was tested comparing organic grazing beef, organic intensive beef, and conventional beef. This was made by García-Torres et al (2015) through using both sensory analysis and conjoint analyses which examines both the purchase decisions and attributes. The importance of the different attributes in the conjoint analyses was in order, the colour, origin, price, and production system. When only using conjoint analyses organic grazing beef was most favourable. According to economic theory, the consumer chooses the good which gives the highest utility which, when the attributes including taste is calculated altogether, shows for organic intensive beef (ibid.). Organic intensive beef was expected to be in between the prices of the conventional product and the organic grazing beef hence satisfy both prices- and added value- preferences. The consumer is willing to pay 40 per cent more of the conventional price for organic intensive beef (ibid.).

Price seems to be rather elastic for all types of beef although organic and/or locally produced beef price is more inelastic (Ridley, Devadoss & Shook 2014). Local farmers seem to have an advantage in the market because of the added values (better quality, environmental benefits, healthier, price premiums) consumers associate with their production. Since 2000, it is mandatory to indicate the *origin of beef* according to European Parliament and Council Regulation (EG) nr 1760/2000. This branding facilitates for the consumer to get information and thereafter choose the wanted beef since it is significant differences in pollution and animal care in beef production in different countries. In 2015 it must be stated where the animal is raised and slaughtered. Sweden has its own branding; if "origin Sweden" or "Swedish meat" this means that the cattle must be born, raised, and slaughtered in Sweden (Svenst kött 2015).

2.2 Exchange rate

Secondly, the **exchange rate** or **inflation** has a big importance for the trade of Sweden. A weak Swedish krona makes imports more expensive while exports are favoured and vice versa (Riksbanken 2019). Many different factors affect the exchange rate. Some of these are of a structural nature and therefore affect the exchange rate for a long time. For example, a trend in faster productivity growth in Sweden relative to the outside world contributes to a long-term stronger exchange rate (ibid.).

Effects of exchange rates and its pass-through in import prices were tested for Japan which is a traditional net importer for meat products (Miljkovic & Zhuang 2011). Alike Sweden, Japan has a few importing countries which make Japan sensitive to changes in bilateral exchange rates. Different meat differed substantially where beef indicates partial exchange rate pass-through whilst pork has zero exchange rate pass-through. This could be a result of more competitiveness amongst beef importing firms (ibid.).

The effects of changing exchange rates were tested for trade between the U.S and Sweden (Bahmani-Oskooee & Hajilee 2011). Earlier studies were mentioned where the volatile exchange rate had no significant effect on Sweden's trade flow (Bahmani-Oskooee & Hegerty 2007). This was arguable because of the different degree of risk aversion international traders had on profit maximization. However, the study by Bahmani- Oskooee et al (2011), when using disaggregated data, measures that a depreciation of the SEK would be favourable for trade balance in Sweden in relation to the U.S. Whereas the short-run effect of an appreciation would negatively affect two-thirds of the production. In the long-term, this effect only would imply in one-third of these industries.

Looking back in time, SEK has since 1995 mostly been strong which has favoured import. In *Figure 2* the exchange rates for Euro and US dollars is demonstrated in Swedish kronor. The highest notches of Euro were in 2010, after the financial crisis, and today (2020) for both Euro and USD. The relationship between market shares (import vs export) and the exchange rate is also identified through comparing ***Error! Reference source not found.*** and *Figure 2.*

2.3 Price determinants

Thirdly, price is not the only determinant of inflation but also the beef markets itself. Earlier mentioned mad cow disease changed the buying pattern in the world beef market where Japan for example banned import from both Canada and the U.S (Miljkovic & Zhuang 2011). Another example is how the summer drought that hit Sweden 2018 affected prices for the producer (Swedish Board of Agriculture 2019). The strong demand in the years before 2018 for Swedish beef left a high price on life calves but after the summer drought, calf buyers had a shortage of feed and therefore reduced their demand for calves so that calf prices instead decreased (ibid.).

Consumers purchasing behavior when sudden retail prices increase was tested in Canada using a quantitative analysis of primary data obtained from a survey (Charlebois, McCormick & Juhasz 2016). The result showed that 37,9 per cent of the sample reduced or stopped beef consumption because of a higher price. Besides the price, sustainability, food safety and health were also significant factors for decreasing the beef consumption.

U.S beef producers have worried that imported beef will lower the market price and outcompete the domestic production (Tonsor & Mitchell 2017). Dhoubhadel, Azzem and Stockton (2015) investigated the claim using a translog processing cost function. They conclude that the two

goods are substitutes. Therefore, if Sweden begins to import more beef it would replace the domestic beef and vice versa. On the other hand, Tonsor and Mitchell tried the same method (2017) but with considering seasons and time trends. This cost function gave less degree of substitution suggesting that the effects never existed or potentially has decreased in recent years.

Dhoubhadel and Stockton (2010) investigated the question of how import affected meat prices in the U.S with the conclusion that the imported beef did not have any influence on domestic price. However, it is plausible that the U.S import of beef has no significance because of the small import share. The violations in the prices at the time of the EU entry in Figure 3 indicates that the European Union membership was one of the variables affecting food prices the most. For South Korea, the substitution effects were more evident, but a decrease in South Korean price would potentially not implicate a greater market demand for domestic beef (Lee & Kennedy 2009). Different types of beef seem to have varied results, some evidence claimed that domestic and imported beef are substitutes in production. Although a rather high degree of substitution in inputs, or production, it is not evidence for imports harming domestic livestock or meat prices (Tonsor & Mitchell 2017).

3 Method

This section discusses the methodological approaches used in this study. This first section under the methods is the data description, which indicates the type of data, sources, and types of variables used. The next section discusses the theoretical framework which outlines the theory behind the empirical analysis. The third section discusses the econometric model used in this study.

3.1 Data Description

The data used are time series collected for 23 years (1995-2018). The quantity of beef imports is the dependent variable whereas the import price, Gross National Income, the quantity of domestic beef production, agriculture added value, quantity, and price of export beef are the independent variables. The data is collected from FAOSTAT.

- The quantity of imports represents the size of consumers' demand for foreign beef.
- Quantity of production is the demand for domestic or exported beef. An increase in domestic production implies that the demand has shifted from beef import towards domestic production. This is likely to be because of price changes or new valuation of other influencing variables. Therefore, the quantity of beef for both import and domestic production reflects the demand, which is determent by varying variables, some of which are used in this study.
- The import values and export values divided with the quantity equals the unit price for the goods. Values are based on the price paid by the buyer to the seller in trade. These values are included in the model for determining the importance of price. The economic theory claims that the price is crucial and will, therefore, be tested in this model.
- For the same reason as for the values, Gross National Income is used in the model to determine how the economy shifts affect demand. Increased income is expected to increase demand for all goods as well.
- Agriculture added value corresponds to ISIC for which covers the exploitation of vegetal and animal natural resources (FAO 2020). It is the net output of agriculture including depletion and degradation of natural resources. This measurement will work as the variable on how much consumers evaluate added value. As mentioned, it corresponds to real exploitation and not consumer perception, therefore it is a causal variable.
- Export value and export quantity are included as a variable reflecting the Swedish beef production activity and course of action. Also, export and its price indicate income to Sweden and will boost the economy.

Error! Reference source not found.shows the descriptive statistics of variables included in the model for the period of 1995 to 2018. In terms of import of beef, the average quantity of imports exceeds the quantity of exports by 51564 tonnes. This implies that Sweden is a net importer of beef. The export quantity represents 1,1 per cent of the total domestic production. Import price is 16 per cent lower than the export price also indicates that Sweden is a net importer. The great gap between minimum and maximum import quantity shows for great changes in market shares. The results show that the average agricultural value added is 1580 (USD million) with a maximum of 3246 (USD million). GNI's minimum and maximum indicate shifts in consumers' purchasing power during the period.

Table 1 Descriptive statistics of variables

Variable	Units	Mean	Minimum	Maximum
Quantity of import	Tonnes	53106.25	13527	79694

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Quantity of domestic production	Tonnes	137275.4	120944	151700
Quantity of export	Tonnes	1541.75	513	3036
Price for import	USD thousand	5.02	2.72	6.83
Price for export	USD thousand	5.96	2.34	13.37
Gross National Income	USD million	422044.4	241203.2	597817.6
Agriculture value-added	USD million	2322.6	1579.7	3246.4

3.2 Theoretical Framework

The study follows a simple demand theory which is built on the assumption that the consumer chooses its quantity consumed depending on the given price (Pindyck & Rubinfeld 2009). The function will describe the most feasible quantity for achieving the highest consumer utility constrained for their budget. The equation will describe the limit of quantity considering the most feasible combination of variables. The demand function can be fixed for a short run or long run. Short run suggests effects that can immediately be made, for example, change in income, for which shifts in allocation can transform the market only so much (ibid.). In the long run, more changes can be made when firms enter and exit. Therefore, the market in the long run will adjust to the new demand and preferences. In the short run, the market will be unbalanced whilst in the long run, the market will be in equilibrium.

In this study, most variables are indirect for which preference- and market-based changes are exposed in long term relations. Because of the variables chosen for this paper, a long-run model will be evitable. Change in consumer preferences, effects of price changes are all long-term influences for which a short-run model will not notice any shocks. From the Literature Review foremost three variables are examined; added value, price, and exchange rate. Added value is measured through the causal variable agricultural added value (Agriculture value-added) since the full consumer preference cannot be measured without any data collection concerning purchasing decisions. Price is obtained through including both export and import price (Import price, Export price). The exchange rate on the other hand is not included, partly because there was some uncertainty concerning the relevance. But as well because GNI (Gross National Income) indirectly represents the economic tendency including the exchange rate.

Horton and Wilkinson (1989) used this demand theory and cointegration to estimate the demand model for import into Australia. Cointegration is when two or more series of data has a common stochastic, or random, trend (Watson & Stock 2015). Time series is often non-stationary with varying variances and means over time but through testing for cointegration, it is possible to estimate the long-run parameters or equilibrium in stochastic or unit root variable systems. This theory and model are employed in this study to analyze and answer the research objectives.

3.3 Econometric Model

The equation using the demand function is specified empirically as:

$$IQ_t = C + IP_t X_j + EP_n X_n + GNI X_m + DMP X_n + AAV X_o + \varepsilon \qquad (1)$$

Were IQ_t is the dependent variable import quantity in tonnes. C is the constant, IP_j is the import price, and EP_n is the export price expressed in 1000 US. *GNI* is the Gross National Income (US million), *DMP* is the domestic production in tonnes and *AAV* is the agricultural added value (US million).

When dealing with time series there is a great potential of errors in the variable. First, a stationary test is needed to detect a non-stationary time series. The regression must be analyzed with de-trended stationary data. Otherwise, since the series is consistently increasing over time, the mean and variance will also grow. A conversion of the non-stationary data to stationary data will be made through removing crucial trends. The Rural Development Programme (2014) and the Swedish Government's food strategy (2017) were tested as dummy variables in the model but were not included because of a lack of variation. The VAT decrease (1996) was also tested as a dummy, but did not, like the strategies, show for any variation and was therefore excluded.

A unit root test is used to determine if the time series contains trends, thus, non-stationary. To stabilize the variance and mean it is possible to differentiate the variables trough using logarithms which degree is shown in the unit root test. This will eliminate or reduce the trends and seasonality of this study's series and present results in elasticities. The order of integration tells which differences that can transform the non-stationary variables to stationarity (Watson & Stock 2015).

Through testing for cointegration, it is possible to estimate the long-run parameters or equilibrium in stochastic, or unit root variable, systems. If the data is cointegrated both a short- and a long-run estimation are required. Cointegrations means that they exhibit a long-run relationship and can be combined in a linear fashion (Watson & Stock 2015). This means that shocks in the short run in one of the series converges in the long run.

The estimation will require the use of a short-term Vector Autoregression (VAR) and a long run Vector Error Correction Model (VECM). VAR is differenced to obtain the VECM and therefore, a lag is lost in the long-run model. Autoregression is when the presence of lagged values is in the dependent variable. The vector means that the system contains two or more variables. All variables are endogenous, in other words, is correlated or has covariance with the random error term (ε). The error term is called impulses or shocks. The dependent variables are a function of its lagged values and the lagged values of other variables in the model which all have equal lags. Therefore, the optimal level of lags is determined for the model and not the individual variable. It is of importance to choose the right lag length since too many lags create statistical insignificance, multicollinearity, and losses of the degree of freedom whilst too few lags create specification errors. VAR must be specified in levels. The model is estimated by Ordinary Least Square (OLS). The result of VAR and VECM will be, since OLS, of paribus ceteris or "all other holds constant"-effect.

Short run equation:
$$lnIQ_t = C + \sum_{i=1}^{k} B_i lnIQ_{t-1} + \sum_{j=1}^{k} \beta_j lnIP_{j-1} + \sum_{n=1}^{k} \delta_n lnEP_n + .. + \varepsilon_{1t} \qquad (2)$$

Long run equation:

$$\Delta lnIQ_t = C + \sum_{i=1}^{k-1} B_i \Delta lnIQ_{t-1} + \sum_{j=1}^{k-1} \beta_j \Delta lnIP_{j-1} + \sum_{n=1}^{k-1} \delta_n \Delta lnEP_n + .. + \lambda_1 ECT_{t-1} + \varepsilon_{1t}$$
(3)

The long-run equation will have a different operator (Δ) as the independent variable. The $\lambda_1 ECT_{t-1}$ is the Error Correction Term which is the adjustment parameter for VECM.

4 Result

This section will present the result from the tests mentioned in the headline Econometric Model. These will be displayed and discussed. The tests are augmented Dickey-Fuller test for unit root, Johansen test for cointegration. After those tests being interpreted the results from the VAR- and VECM models will be revealed and later discussed in the 5 Discussion section.

4.1 Empirical Results

4.1.1 Test for Unit Root
In Table 2 Augmented Dickey-Fuller test for unit root the Dickey-Fuller test is used for testing unit root with trends. The absolute value is smaller than the 1, 5, and 10 per cent critical value which indeed means that it is not possible to reject the null hypothesis. The time-series is non-stationary. The series is integrated in order 1.

Table 2 Augmented Dickey-Fuller test for unit root

	Test Statistics	**Interpolated Dickey-Fuller**		
		1% Critical value	5% Critical value	10% Critical Value
Z(t)	-1.46	-4.38	-3.60	-3.24

4.1.2 Test for Cointegration
The Johansen cointegration test indicated that the null hypothesis of no cointegration is rejected as shown by the trace statistics for ranks zero. The null hypothesis is rejected if Trace statistics is greater than the 5 per cent critical value. Johansen Cointegration test is used for this cause, shown in Table 3 Johansen tests for cointegration. Since the time series is stationary after the first difference it is necessary to establish that a long-term relationship exists between or among the variables. Even though the series is drifting apart and/or trending either upward or downward an assumption of a long-term relationship is made. Therefore, in this model, we have a maximum of 6 cointegrated equations.

H0: no cointegration
H1: H0 is not true

Table 3 Johansen tests for cointegration

Maximum rank	**Parms**	**LL**	**Eigenvalue**	**Trace statistics**	**5% Critical value**
0	56	167.89	.	270.82	124.24
1	69	220.55	0.99	165.49	94.15
2	80	250.55	0.93	105.85	68.52
3	89	268.56	0.81	69.47	47.21
4	96	285.53	0.79	35.53	29.68
5	101	295.36	0.59	15.90	15.41
6	105	301.88	0.45	2.86*	3.76

4.1.3 Short-run determinants of imports using the Vector Autoregression (VAR)

The Vector Autogregression establishes the short-run relations between import and the explanatory variables considered in the model. The decided lag length is two. In the short-run

estimates, since the log-log function was used, the estimated coefficients represent elasticities. The interpretation of the VAR result, paribus ceteris, is that the GNI has a positive effect on imports at a 1 per cent level of significance in the short run. The added value of agriculture has a negative effect on a 1 per cent significance level for both lags and this implies that an increase in agricultural value-added significantly reduces the import of beef by the estimated coefficient, all things being equal. In terms of domestic production, it also has a negative impact on the number of imports on a 1 per cent significance level for both lags. Export quantity and export prices have a positive impact on imports. Finally, the import price has a negative impact on import quantity on a 1 per cent significance level, as expected and in line with economic theory. In addition, the results indicate that lagged variables of import affect the current import negatively, all things being equal.

Table 4 Vector Autoregression

Variable	Coefficient	Standard errors	P>|z|
Quantity of import $_{t-1}$	-0.92***	0.21	0.000
Quantity of import $_{t-2}$	-1.44***	0.25	0.000
Quantity of domestic production $_{t-1}$	-1.67***	0.54	0.002
Quantity of domestic production $_{t-2}$	-1.88***	0.50	0.000
Quantity of export $_{t-1}$	0.21***	0.07	0.005
Quantity of export $_{t-2}$	0.66***	0.09	0.000
Price of import $_{t-1}$	-0.84**	0.42	0.048
Price of import $_{t-2}$	-2.37***	0.39	0.000
Price of export $_{t-1}$	0.30***	0.09	0.001
Price of export $_{t-2}$	0.40***	0.75	0.000
Gross National Income $_{t-1}$	2.70***	0.07	0.000
Gross National Income $_{t-2}$	2.57***	0.42	0.000
Agriculture value-added $_{t-1}$	0.87***	0.25	0.001
Agriculture value-added $_{t-2}$	-1.58***	0.25	0.000

***, **, * indicates significance at 1%, 5% and 10% respectively

4.1.4 Long-run determinants of Beef Import using Vector Error Correction Model
In this section, the determinants of beef imports, in the long run, are presented in **Error! Reference source not found.**. All variables were significant on a 1 per cent level in the long run. In the long run, GNI has the most positive impact on the import of beef in Sweden, as shown by the significant coefficient at a 1 per cent level. Export quantity and export price has also had a positive impact on import quantity. Import price has the greatest negative effect, then domestic production, and lastly added value.

Table 5 Vector Error Correction Model

Variable	Coefficient	Standard errors	P>|z|
Quantity of domestic production $_t$	-0.73***	0.06	0.000
Quantity of export $_t$	0.22***	0.01	0.000
Price for import $_t$	-1.09***	0.02	0.000
Price for export $_t$	0.176***	0.01	0.000
Gross National Income $_t$	1.83***	0.03	0.000
Agriculture value-added $_t$	-0.41***	0.03	0.000
Constant	-1.31	.	.

Note: The signs were reversed for VEC results as required (Watson & Stock 2015)

5 Discussion

The study has examined the drivers of beef imports in Sweden. Imported beef competes with domestically produced meet and hence, finding out drivers of import can help understand how to boost domestic production and demand by minimizing imports. Swedish producers can learn which factors to promote and develop whilst, because of apposite marketing, consumers easier can purchase their preferred beef.

All variables of the model had high significance and therefore did determined the import quantity. The significance of the lagged variables suggests that there is a delay in responses in the market. This is expected since the processing of food is a long-term project and is affected by earlier years. For example, the summer drought 2018 in Sweden lowered the price of life calves in 2019 (Swedish Board of Agriculture 2019). The Johansen test shows that the import of beef is dependent on short and long forces between the variables. This cointegration is expected since, for instance, export quantity is a part of the domestic production and the Gross National Income will hint the budget for beef. Therefore, an increase in Gross National Income will increase the demand for all goods including beef. Added value is denoted from the domestic production and the import quantity. Many of the variables are stochastic, random trends, which are assumed in a beef market. The mad-cow disease, the summer drought, shifts in valuating of animal welfare, etc, is all random happenings in random times but affects the whole market's buying patterns.

The first hypothesis was that domestic production, import price, and added value would have a negative impact on demanded import quantity. This was confirmed in both the VAR and the VECM model. Irrespective of the lag length, the variables with the most negative impact on imports were in order; domestic production, import price, and lastly added value in the short-run model. It could be that price changes are a longer process for demand to react whilst a higher domestic demand, therefore, domestic production immediately gives results. To keep in mind is that domestic production increases in relation to quantity demanded which according to economic theory is a consequence of a price decrease (Pindyck & Rubinfeld 2009). Import price has a negative impact which follows demand theory, the consumers strive after the highest utility with respect to quantity and price. Since local beef has a lower elasticity (Ridley, Devadoss & Shook 2014) an increase in import price would benefit Swedish beef, since local, more than imported beef, if Swedish beef prices were to rise. Added value is a long process for opinions and information spreading out through the consumers and will have a smaller effect.

In the long-run model, the variables with negative effects were in order; price, domestic production, and added value. As mentioned, the added value is expected to have a smaller effect as it is a prolonged process. The new distribution of price and domestic production however is more in line with economic theory. Price is the factor influencing the consumers purchasing decisions in terms of their budget (Pindyck & Rubinfeld 2009). The result show for less negative effects for all three variables than in the short-run model. This result could possibly be because the vogue of choosing beef depending on its origin (domestic production) welfare and climate attributes (added value) is a rather new preference which importance is not fully reflected in the data observed.

The second hypothesis was that Gross National Income, export price, and export quantity would have a positive effect on imports. Gross National Income, which was the variable reflecting income effect, shows for a positive impact on the import demand which is in line with demand theory (Pindyck & Rubinfeld 2009). A greater budget should increase the demand for all goods dependent on its marginal utility. As indicated in the results, Gross National Income had a

smaller impact in the long run which could be read as the long-run model absorbing the change in utility allocation more than the short-run model. Gross National Income had the greatest effect of all variables which also strengthen the assumption that income or the budget is crucial for choosing which beef to purchase (ibid.). Export and export price had both a positive impact of demanded import of beef in both models. This implies that higher export quantity and prices contribute to higher income, which can help a country's capacity to import. The impact on export and export price was, like the other independent variables, less in the long run VECM model.

The results from both the short- and the long-run model agree with earlier literature. The negative impact from added value confirms that consumers prefer environmentally friendly and improved animal welfare (García-Torres, López-Gajardo & Mesía 2015). Price, which is measured through Gross National Income, has the greatest impact (Charlebois, McCormick & Juhasz 2016). Since Sweden is a net importer of beef, as interpreted by the descriptive result, import influences beef's price and operates as a substitution for Swedish beef (Lee & Kennedy 2009). The result indicates that added value is the factor filling the price gap between domestic and imported beef. Namely, the 50 per cent share, although imported beef being cheaper, is because Swedes prefer the added value domestic beef include. This implication can be used for producers in marketing and development. It is also an opportunity for companies, the government, and organizations to fortify the benefits of Swedish beef.

The study is not without limitations. Some of the limitations include omitted variables such as domestic prices of beef, consumers' perception, exchange rate, and so on. The data was obtained from 1995-2018 and thus does not contain data before Sweden joined the EU. Future research should include other important variables that affect imports. Also, future studies should include data on imports before Sweden joined the EU. Similar studies can be conducted for other meat products. Future studies should examine the import and domestic production of beef in the future to compare if the results in this study are robust. In regard to the strategies presented in the Background as the Rural Development Programme (2014) and the Swedish Government's food strategy (2017), the results of those will likely be more evident in future data. It would also be interesting to investigate how much domestic price would have to decrease, or import price increase, for added value to completely fill the price differences, and hence domestic production would have a full market share.

6 Conclusions

The goal of this study was to determine which variables affect the number of beef imports so that Swedish production can evaluate and eventually regain market shares. All variables selected for the model was of influence on import quantity. The chosen lag-length shows for a delay in response in the market from the variable. Except for the influence on the independent variable, the dependent variables also impact each other, for which cointegration is found in the model. Based on the findings using the VAR and the VECM model, the study concludes that the import of beef in Sweden is significantly and negatively dependent on domestic production, import price, and added value. This was shown in both the short- and long-run models which also confirms hypothesis one. This is in line with earlier literature on the subject. Added value has importance for the consumer as well as the local, or in this case Swedish, origin. The price for import will be, according to economic theory, negative if a normal good which is assumed for beef. From this result, it is concluded that consumers consider domestic beef more favourable in the aspect of added value and local origin than imported beef. The Gross National Income has a positive impact on imports in both models. A higher income gives a greater purchasing power on all goods, most likely, domestic beef if treated as the independent variable, would have the same influence by increased Gross National Income. Export and its price had positive effects on imports although very small volumes which are not very cardinal in the regression. This is foremost because export contributes to Swedish income for which performs like an additional budget variable. For all variables, the impact on import quantity was less in the long-run model. This might be because of omitted variables influencing the buying pattern. It may also be because of the limited time series that the impacts cannot be confirmed as longstanding predictors.

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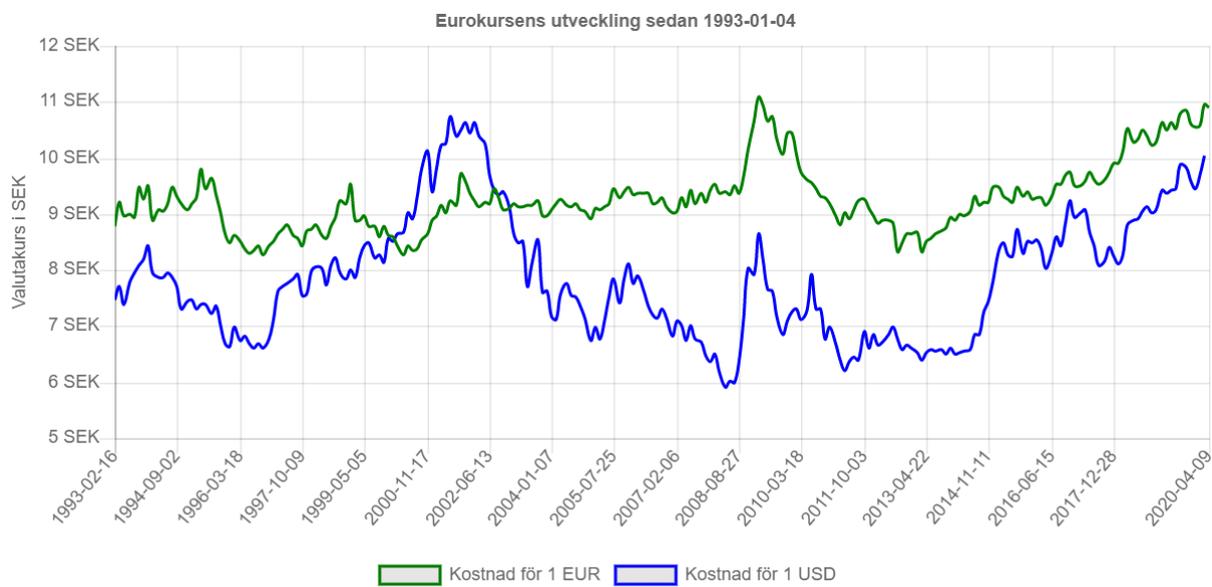Yeboah, O.A., Naanwaab, C.B. & Otchere, R. (2015). Demand for Beef Associated with Country of Origin Labeling., 2015.
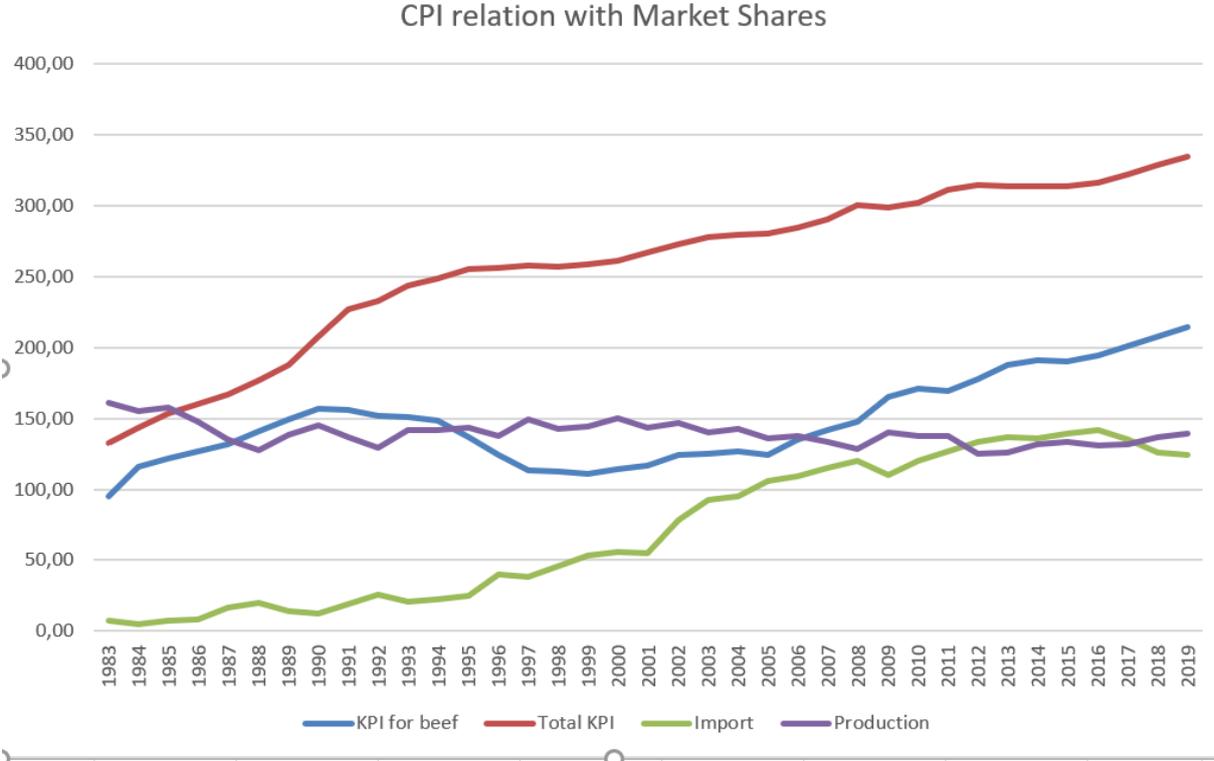
Appendix 1

Figure 1
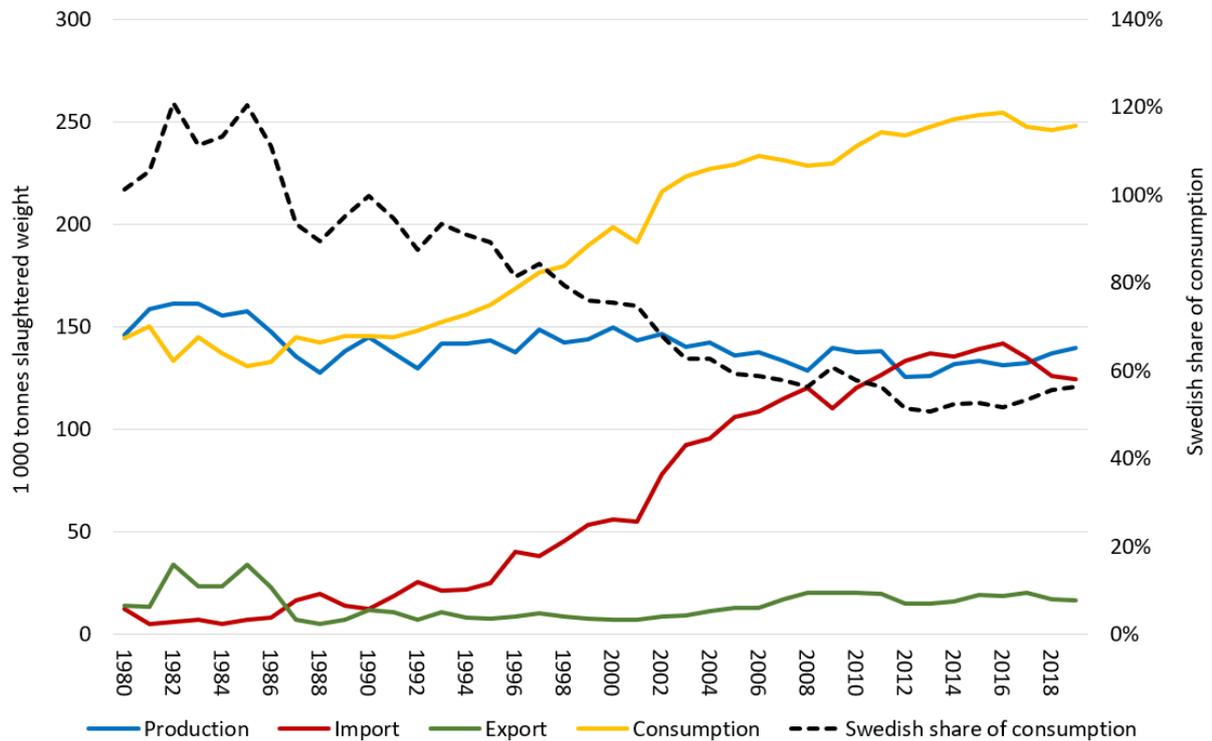
Source: Swedish Board of Agriculture and Sweden Statistics

Figure 2

Source: eurokurs.se

Figure 3

CPI relation with Market Shares

Source: Sweden Statistics