The Effect of Tariffs on Import

The case of Norway and agricultural goods

Oda Melina Sæthren Joramo

Master in Philosophy in Economics

Department of Economics

University of Oslo

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Oda Melina Sæthren Joramo

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Abstract

To what degree do changes in tariff affect imports? In the literature, estimates of the substitution between home and foreign goods differ substantially, depending on the data used to measure changes in import price. The purpose of this thesis is to examine the relationship between tariff and import, using Norwegian annual tariffs data, and annual import data from 15 EU countries. I estimate how changes in price, through changes in tariff, affect the optimal demand for imported or foreign goods, hence estimating the Armington elasticity. With this I present a study solely dedicated to examining how tariffs affect imports, using data for a specific group of goods. Never before has the examination of import effects due to changes in tariff been done using data from a small and open economy, like Norway.

In this thesis, the estimation of trade elasticities is done using fixed effects ordinary least-square method on panel data, for the period 2003 - 2013. The results from this analysis provide clear rejections of the notion that tariffs strongly affect the import of agricultural goods. First and foremost, tariffs do not have any independent effect on the import of these goods in Norway. These results are valid even after several robustness checks. The most conceivable explanations for this is that consumers are inelastic and do not react to price changes or secondly that market power prevents prices from adjusting properly.

Contents

1 Introduction

In a global economy, countries produce and trade different goods that are to some extent easily substitutable for each other. The elasticity of substitution between home and foreign produced goods, often referred to as the Armington elasticity, is the critical parameter for determining how trade flows react to changes in international prices. A classical economic answer to how a country's import is affected by reduced import prices would be as follows: Lower prices on goods lead to higher demand amongst consumers, which again increase the import. The *size* of this increase in demand, however, depends on the Armington elasticity.

There are several ways to measure import price. One way is to evaluate changes in tariff , or another way is to evaluate exchange rate fluctuations. Studies of the Armington elasticity reveal that the size of the elasticity depends on the data being used to measure import price changes. Studies using trade liberalization data (see Clausing, 2001; Head and Ries, 2001; Romalis, 2007), and trade cost data (see Hummels, 1999; Baier and Bergstrand, 2001) find substantially higher estimates of the Armington elasticity than studies using fluctuations in the exchange rates to measure the same elasticity (see Reinert and Roland-Holst, 1992; Blonigen and Wilson, 1999; Shiells and Reinert, 1993). These divergent findings are often referred to as the "International Elasticity Puzzle", a phenomenon examined by researchers in recent years. However, the reasons for these contrasting results has not been identified. Previous research estimating import effects using tariff data, has for the most part examined the effects of changes in trade in the United States and Canada (see Clausing, 2001; Romalis, 2007; Head and Ries, 2001), and the effects of The North American Free Trade Agreement (NAFTA).[1]

In this thesis I set out to estimate how changes in price, through changes in tariff, affect the optimal demand for imported or foreign goods. By exclusively examining the agricultural sector in Norway, I intend to make a contribution to the economic literature on price elasticities, in particular how tariffs relate to import. Hence, I present a

[1] With the exception of Romalis, who also include effects of the Canada - Ukraine trade agreement (CUFTA)

study solely dedicated to examining how tariffs affect imports, using data for a specific group of goods. An examination of import effects due to changes in trade liberalizations, using data from a small and open economy like Norway, has never been done before. Carrying out this examination, this study explores whether the high estimates found using tariff data is valid for a specific sector in a small, open economy.

1.1 Research question

With this as a backdrop, this research project seeks to systematically examine the relationship between tariff and import, by conducting an analysis with Norwegian tariff data covering import data from 15 European countries in the time period from 2003 to 2013. The research question to guide this thesis is:

To what degree do changes in tariff affect imports?

The Armington elasticity

As well as being a critical parameter for determining trade flows, the elasticity of substitution plays a significant role in evaluating gains from trade. According to Arkolakis, Costinot and Rodriguez-Clare (2009), the welfare prediction of important trade models depend on two figures. The first being the share of expenditure used on domestic goods, λ. The second, the elasticity of imports regarding variable trade costs, ϵ. Using this knowledge, the authors offer a simple way of calculating the changes in real income $\hat{W}$, depending only on the change in the share of domestic expenditure, $\hat{\lambda}$, and the trade elasticity, ϵ.[2] The relationship is given by the following equation:

$$\hat{W} = \hat{\lambda}^{\frac{1}{\epsilon}} \tag{1}$$

The reason why estimates of trade elasticities are of special interest is because it gives valuable information about trade flow reactions to different changes in trade costs.

[2] $\hat{W} = \frac{W'}{W}$ and $\hat{\lambda} = \frac{\lambda'}{\lambda}$.

Besides, correct estimates of the trade elasticity are of great importance for research calculating welfare gains from trade.

Tariffs

The significant growth in world trade throughout the last century has by researchers (see Yi, 2003; Feenstra, Mandel, Reinsdorf and Slaughter, 2009) been accredited tariff reductions. Because lower tariffs reduce the price of foreign products relative to domestic products, this increases both import and export.

A tariff is a tax imposed by the government on imported commodities. In general, a country imposes tariffs for two reasons: to increase government revenue or to reduce the import of specific goods. Tariffs measure trade cost and price on imports, as well as being an indicator of a country's openness. For this reason, tariffs are often used to measure the effects of trade liberalization.

Small and open economies, such as the Norwegian, are highly dependent on trade to provide a wide selection of consumer goods. However, harsh climate and challenging production conditions for farming increases the cost of Norwegian agriculture and makes it uncompetitive on the world market. Therefore, the Norwegian government imposes tariffs on imports of agricultural goods to protect Norwegian agriculture and reduce import of specific products (NorskLandbrukssamvirke, 2016).

During the last decades, the protection of the agricultural sector has been an important element in Norwegian politics. Solidarity with Norwegian farmers and fishermen were an important causes for why a majority of the Norwegian people and politicians voted against membership in the European Communities (EC) and the European Union (EU) in 1972 and 1994. The EC opponents of 1972 in particular emphasized the belief that farmers and fishermen would go bust due to world market competition if Norway entered EC (Kristoffersen, 2015*a*). These views were still present in 1994, but the economic situation had changed due to the Norwegian oil production. In 1992 Norway signed The European Economic Area (EEA) agreement, which meant that Norway had to adopt many of the same EU regulations (Kristoffersen, 2015*b*).

Through the EEA agreement, Norway secured free-trade on all goods between Norway and its biggest trading partner, EU, except trade with agricultural goods (Rolsdorph and Austnes, 2006).

The tariff-based import regulation is a central instrument to secure production and turnover of agricultural and refined groceries in Norway. It is an important premise for the realization of the national agricultural politics, which seeks to secure sales of Norwegian products to the target price set by the Agricultural Agreement[3] (Nordlund, N.d., p. 61).

1.2 Empirical findings

The results from my analysis provide a clear rejection of the notion that tariffs strongly affect the import of agricultural goods. First and foremost, tariffs do not seem to have any independent effect on the imports of these goods in Norway for the period 2003 - 2013. By estimating the trade elasticitt using fixed effects ordinary least-square method on panel data[4] I find no evidence that tariffs affect the trade flows of the agricultural goods used in this analysis. These findings thus reject recent empirical inquiries about the size of the elasticity, and suggest that tariff reductions do not correspond with massive growth in trade, in this analysis. The results are still valid and non-significant after a series of robustness checks.

The results point out characteristics of consumer behavior and potential market failure. Hence, the results imply that consumers are inelastic to price change. Alternatively, that chain stores have gained market power preventing prices from adjusting to changes in tariffs. Low elasticities, small budget shares used on groceries and habits explain why consumers are inelastic. Features of the Norwegian geography, market structure, and consumer behavior can potentially give supermarkets or groceries the ability to exercise market power.

[3] Agreement between the government and the Norwegian farmers union(*Store Norske Leksikon*, 2016).
[4] SoftwarePackag: StataSE 14.1.

Descriptive contribution

This thesis is the first of its kind to present a descriptive systemization of the Norwegian Custom Tariffs data. The magnitude of these types of data makes it challenging to get a proper overview of the degree of trade barrier due to Norwegian tariffs. Presenting tables with ad valorem tariffs data, according to goods category, I offer a perception of what type of goods are mostly protected, and the ad valorem[5] tariffs development in the period 2003 to 2013.[6]

Structure

The content this thesis is divided into 6 sections. In section 2, I present the tariff and import data used in the analysis in the time period from 2003 to 2013. This section gives an insight into the work of systemizing the Norwegian tariff data and present the ad valorem tariffs of relevance. In section 3 of this thesis, I review relevant literature of trade flow reactions to change in terms of trade. Additionally, I introduce a theoretical model that serves as the foundation for the estimations carried out in this thesis. This section is hence meant to give an understanding of the effects I am estimating, and a brief portrayal of previous findings on the area. Section 4, the methodology section, describes the ordinary least-square methods used to estimate the import elasticities. A detailed description of the method used, and the result of this analysis will be presented in the beginning of this section. Concerns regarding reverse causality and robustness checks will be discussed in the end of this section. In section 5 I address possible reasons for the result in this analysis. The main mechanism I present is the possibility of inelastic consumers and market power leading to higher margins and no price change. Section 6 is the conclusion where I wrap up the thesis and point out some paths for further research.

[5]Percentage of the value

[6]A detailed description of particular tariffs can be found at `http://www.toll.no`.

2 Data

In addition to the results presented in my analysis. Another contribution of this thesis is a systemic organizing of the Norwegian tariff data. In order to make this contribution clearer, I offer a description of the work done to make the tariff data useable in this analysis. The average ad valorem tariffs are presented in Table 3 to give an overview of the degree of protection in the Norwegian tariff data. Also, I introduce the import data used in this analysis.

2.1 Tariff data

For the purpose of this thesis, I have systemized Norwegian Customs Tariff data from 2003 to 2013, about imports on goods from European Union member countries[7](A total of 15 countries, see Table 4, section 2.2). The Norwegian tariffs data is arranged according to the Harmonized System (HS classification), but with two extra digits. The HS classification is a 6-digit classification, where each individual figure refers to a specific good. This makes up thousands of different goods specifications that can be divided into 97 good categories. Each category is given by the first two HS digits. The two extra digits in the Norwegian tariff data enable greater products specifications than the HS-system of Norwegian tariff data. When it comes to imports from the EU only agricultural goods[8] that are also produced in Norway are subject to tariffs. This means that 20 out of 97 categories are subject to tariffs when imported to Norway. Table 1 lists the categories of goods that are subject to tariffs, and the number of products affected by tariffs, can be seen in Table 2.

The tariff is normally given in percentage of the value (ad valorem) and in NOK per kilo of import. Where NOK per kilo is the most common tariff on agricultural goods, but sometimes tariffs are given in ad valorem, NOK per liter or NOK per piece as well (Toll.no, 2016). Some agricultural tariffs are subject to an extra commodity custom set

[7]Some of the countries joined the European Union during this time period.
[8]With the exception of category 38. Other chemicals.

Table 1: Categories[1] of goods subject totariffs[2]

Group 1. Living animals and animal products
1. Living Animals
2. Meat and edible trimmings
4. Milk and dairy products
5. Other products from animals
Group 2. Vegetable products
6. Living trees and other plants
7. Vegetables and edible roots
8. Edible fruits and nuts
10. Corn
11. Mill products
12. Oil-containing seeds and fruits
Group 3. Animal and vegetable oils and fats
15. Animal and vegetable oils and fats
Group 4. Prepared nutrients
16. Products of meat, fat, fish, crustacean and mollucs
17. Sugar and sugar goods
19. Corn products
20. Vegetable products
21. Different types of prepared nutrients
22. Beverage, ethanol and vinegar
23. Other vegetable products
Group 5. Products from chemical or related industries
35. Proteins
38. Other chemicals

[1] Categories given by the first two digits of the Harmonized System

[2] For all other goods tariffs are equal to zero

by the Norwegian Agricultural Directorate[9]. These customs differ, and is calculated on the basis of the products commodity content. When importing goods affected by this commodity custom, the importer must apply to the Agricultural Directorate for each separate product (Landbruksdirektoratet, 2016*b*). This makes product affected by this commodity custom difficult to use in an analysis and they have been left out of this dataset.

To match the tariff data with the import data, it was necessary to reduce the Norwegian

[9]This commodity custom is only given to products that is categorized as prepared nutrients and affects around 43 to 45 products each year in my dataset.

Table 2: **Numbers of products subject to tariff.**[1] **2007 - 2013**

Year	Count
2007	758
2008	761
2009	762
2010	123
2011	113
2012	117
2013	118

Source: The Norwegian Customs Tariff

[1]Import from EU-countries

tariffs to the 6-digit HS classification. I left out the extra digits by taking the simple average of the 6-digit HS numbers observed several times. Additionally, I only make use of the specific tariff, NOK per kilo, and ad valorem tariffs in this analysis (the average specific tariffs are listed in Table 10 in the Appendix A.1).

According to the World Trade Organization (WTO) agreement, Norway can freely choose between tariffs given in NOK (specific tariffs) or tariffs in percent (ad valorem tariffs). Most tariffs on agricultural goods are, however, specific tariffs, meaning that they are given in NOK per kilo, per liter or per piece.[10] Specific tariffs have been favored because they offer most stability in domestic prices, while ad valorem tariffs vary in accordance to price changes in the international market (NorskLandbrukssamvirke, 2016). However, tariffs as a percentage of the value may give a clearer picture of how extensive tariffs really are. Therefore, the specific tariffs have been converted to ad valorem tariffs[11]. In Table 3 the average ad valorem tariffs in 2003, 2010 and 2013 are presented.

Table 3: **Average[1] ad valorem tariffs, by category**

Category	2003	2010	2013
2. Meat and edible trimmings	134.1%	0	0
4. Milk and dairy products	71.2%	47.0%	36.5%
5. Other products from animals	25.7%	0	0
6. Living trees and other plants	0.9%	0.3%	0.2%
7. Vegetables and edible roots	28.5%	17.7%	7.6%
8. Edible fruits and nuts	10.5%	0.7%	0.3%
10. Corn	78.1%	2.3%	1.7%
11. Mill products	45.8%	0	0
12. Oil-containing seeds and fruits	50.8%	77.4%	49.9%
15. Animal and vegetable oils and fats	19.6%	0	0
16. Products of meat, fat, fish, crustacean and mollucs	74.1%	0	0
17. Sugar and sugar goods	26.6%	0.7%	0.3%
19. Corn products	11.9%	7.9%	8.6%
20. Vegetable products	49.5%	15.1%	9.8%
21. Different types of prepared nutrients	2.2%	2.8%	2.5%
22. Beverage, ethanol and vinegar	3.4%	0.3%	0.3%
23. Other	168.9%	167.6%	177.1%
35. Proteins	8.5%	14.4%	12.4%
38. Other chemicals	0.6%	0	0
Total average	42.8%	18.6%	16.1%

Source: The Norwegian Customs Tariff 2003, 2010 and 2013

[1] Unweighted average

Description of tariff data

From 2003 to 2009 there are close to zero change in the tariffs. In 2004 [12] and 2007 [13] new countries joined the European union, but this did not affect tariffs on import from these countries (see Table 9 in Appendix A. 2 for a comparison of tariffs). Contrarily, in 2010 we see reductions in import tariffs, see Table 3. In 2012 tariffs were even further reduced. In a few cases there is an increase in tariffs during the same time period, but the total average of ad valorem tariffs is reduced from 42.8% in 2003 to 18.6% in 2010, and to 16.1% in 2013.

The specific reason for these tariff reductions starting in 2010 and onwards has not

[10] Only tariffs on 15 products are given in ad valorem rom 2007 to 2013.

[11] See Appendix A.3 for details about converting specific tariffs to ad valorem tariffs.

[12] Poland, Estonia, Latvia, Lithuania, Czech Republic, Slovakia ,Hungary, Slovenia Cyprus and Malta.

[13] Romania and Bulgaria.

clearly been explained anywhere, but events around this time period is worth mentioning. A new round with article 19 negotiations between Norway and EU started in May of 2006, an agreement was met in 2009, and both parties signed the agreement in January 2010. Article 19. states that the "Contracting Parties undertake to continue their efforts to achieve progressive liberalization of agricultural trade". On two-yearly intervals they should review the conditions of agricultural products. Within the framework of this agreement and their respective agricultural politics the Contracting Parties should further reduce the trade barriers (europalov, 2016). The reduced tariffs in this time period may be explained by, or should at least be seen in light of, the corresponding agreement on this article.

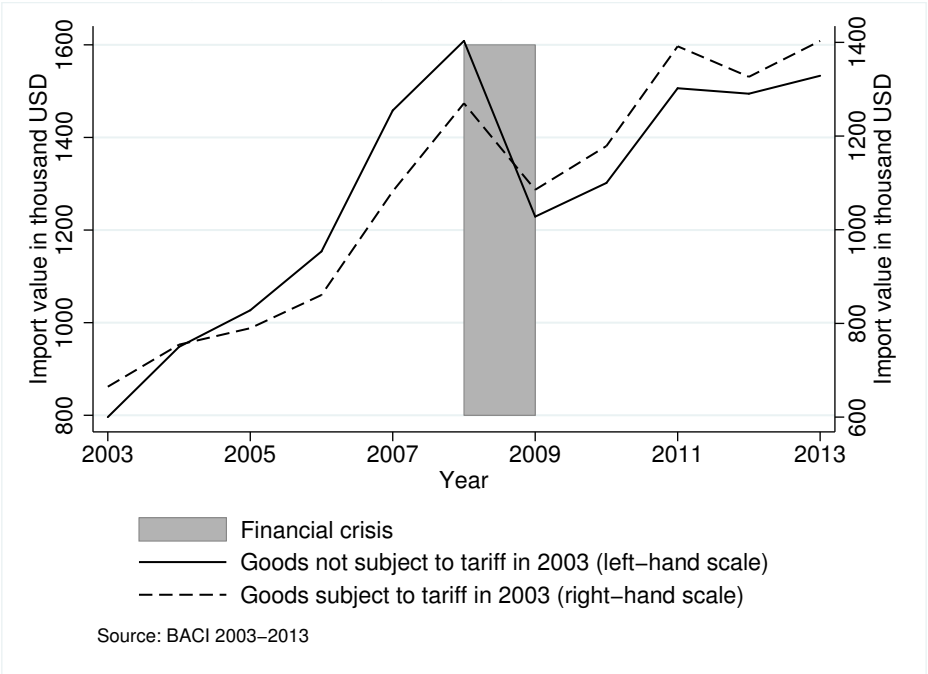
2.2 Import Data

Table 4: Countries in the dataset

1	BGR	Bulgaria
2	CZE	Czech Republic
3	DNK	Denmark
4	EST	Estonia
5	FRA	France
6	DEU	Germany
7	LVA	Latvia
8	LTU	Lithuania
9	NLD	Netherlands
10	POL	Poland
11	ROU	Romania
12	SVK	Slovakia
13	SVN	Slovenie
14	GBR	United Kingdom
15	SWE	Sweden

Import data for the 15 countries in the dataset, Table 4, are given by BACI, the world trade database developed by CEPII. The import data is arranged according to the HS-classification of 1996, which is used by all countries as the basis for their tariff line. The HS-classification has undergone revisions in 2002 and 2007. These revisions have been corrected for in the import data. The data is divided into import value and import

Figure 1: Average aggregated import value

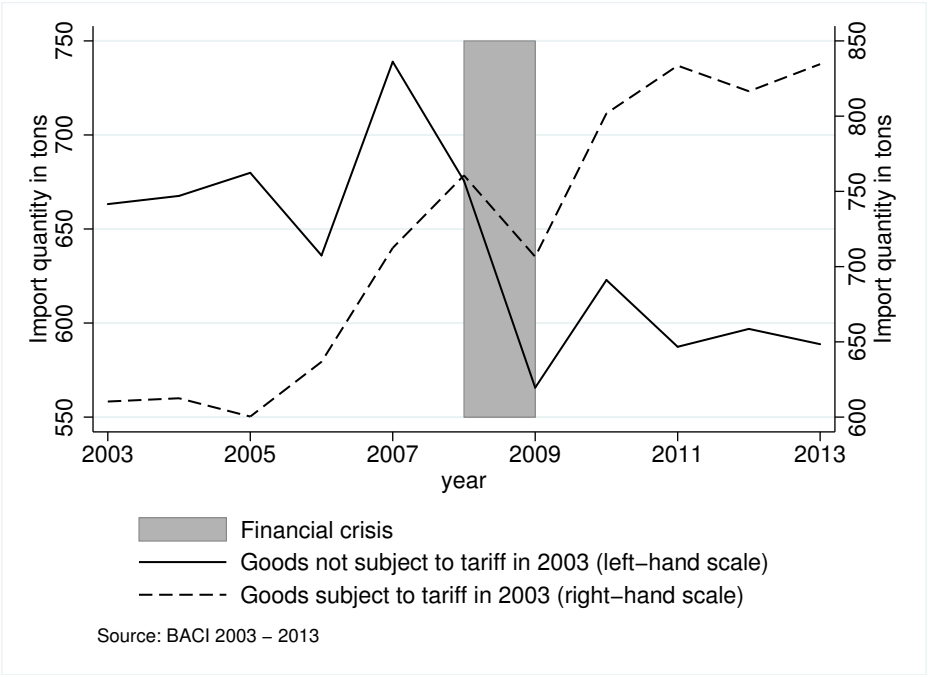


quantity. Import values are reported CIF (cost, insurance and freight), where the CIF costs are estimated and removed from the import value to compute FOB (Free ion Board) import values (*CEPII*, 2016). The FOB import value signifies cost of movement. In practice, the importer and exporter decide on a price of the good that includes shipping and buying of the good. Other costs the importer meet, such as tariffs or cost due to devaluation of the currency, will not be included in this price. The import value is in thousands US dollars while the quantity is given in tons.

Figure 1 illustrates that the import value[14] of agricultural goods subject to tariff steadily increased from 2003 to 2013. The same trend is apparent for goods that are not subject to tariff in 2003, and on average the import value on these goods are higher. Also, the import quantity of goods that are subject to tariff steadily increased during this time period, see Figure 2. The quantity of imported goods not subject to tariff appears to be more stationary. The reduction in imports during the financial crisis is smaller for the goods subject to tariff, than the goods not subject to tariff. Due to of this bump in im-

[14]The import value has not been corrected for inflation, but according to Statistics Norway the inflation from 2003 to 2013 has been 19%. Meaning that 1000 NOK in 2003 is the same as 1189,72 NOK in 2013.

Figure 2: Average aggregated import quantity



ports, during the financial crisis, it is not evident if the increased imports afterwards is a results of reduced tariffs or optimism in the economy. What is evident is that import has increased in the period of tariff reductions.[15]

2.3 Dataset

To sum up, my dataset consists of ad valorem tariffs and import value given in thousands of USD and import quantity given in tons, organized according to the Harmonized system at a 6-digit level. It consists of annual data with one destination country, Norway, and 15 source countries (see Table 4) in the period from 2003 to 2013. The tariffs have been converted from specific to ad valorem tariffs (see Appendix A.3 for details). From 2003 to 2009 the tariffs are basically unchanged, but in 2010 these tariffs are reduced. Further reductions are seen in 2012 (see Table 3 ad valorem tariffs, and Appendix A.1, Table 10, for developments in specific tariffs). From Figure 1 and Figure 2 it is evident that the import of goods subject to tariff has steadily increased throughout the time period.[16]

[15]For a detailed overview of the import quantity development see Figure 3 in the Appendix A.2.
[16]Ignoring the reductions that appeared during the financial crisis of 2008/2009.

3 Literature and model

In the literature, estimates of the substitution between home and foreign goods differ substantially, depending on the data used to measure changes import price. This phenomenon is better known as the International Elasticity Puzzle, (Henceforth IEP). The origin of this puzzle has not been identified. In this section I will review the main findings in the literature on the Armington elasticity, as well as recent attempts to solve the puzzle. I will also present a model that serves as the theoretical foundation for the estimations carried out in this thesis.

3.1 Literature

Research shows that estimates of the Armington elasticity are substantially higher when trade liberalization (see Clausing, 2001; Head and Ries, 2001; **?**) and trade cost data (see Hummels, 1999; Baier and Bergstrand, 2001) are used to measure price changes[17], rather than exchange rate fluctuations[18] (see Reinert and Roland-Holst, 1992; Blonigen and Wilson, 1999; Shiells and Reinert, 1993).

Another feature of the IEP is that different economic models use different estimates of the Armington elasticity, depending on what they seek to study. Static applied general equilibrium models need high elasticity estimates to match the growth in trade following trade liberalization[19] (see Yi, 2003). Contrarily, typical international business cycle models on the other hand, use low elasticity estimates to match fluctuations in trade balances[20] (see Backus, Kehoe and Kydland, 1994; Heathcote and Perri, 2002).

In one of the recent attempts to solve the IEP, Ruhl (2008) suggest that the puzzle is due to the fact that agents react more to permanent changes than temporary changes. Exporters will change their status from non-exporters to exporters as a result of reduced tariffs, but this same reaction will not happen as response to changes in real exchange

[17] Estimates ranging from 4 to 13
[18] Estimates ranging from 0.02 to 3.52.
[19] Estimates around 12 and 13.
[20] Estimates ranging from 0.5 to 2.0.

rates. Because of these different participation responses, aggregate export reacts more to tariffs than to real exchange rates (Ruhl, 2008, 4).

Fitzgerald and Haller (2014) find that tariffs only have modest effect on aggregate export for a country, meaning that reduction in tariffs will not trigger more firms to export. However, conditional on export participation, the revenue of the firm is strongly affected by tariffs, and not at all affected by the volatility in the exchange rates. The key to the puzzle lies in how export revenue conditional on export participation responds to different shocks, and a potential explanation for this is the menu cost of changing prices (Fitzgerald and Haller, 2014, 27).

Other robust findings in the literature indicate that the long-run estimates are greater than the short-run estimates of the trade elasticities[21]. Study shows that long-run estimates are approximately two times larger than the short-run estimates, where long-run estimates are more appropriate for most trade-policy and hence trade liberalization analysis (see Gallaway, McDaniel and Rivera, 2003).

Feenstra, Luck, Obstfeld and Russ (2014) on the other hand emphasize the difference between macro- and micro elasticities as a factor affecting the size of the estimate. Whereas the macro elasticity is the substitution between home and foreign goods, the micro elasticity is the substitution between varieties of foreign goods. The macro elasticity is the prime determinant of the aggregate import response to changes in terms of trade. The export response to changes in terms of trade depend upon both the micro- and macro elasticity. The micro elasticity appears to be greater than the macro elasticity (Feenstra et al., 2014, 39-49).

Arkolakis, Eaton and Kortum (2012) introduce dynamic adjustments of the consumers, to capture the low elasticity estimates in the short run (needed in international business cycle models), and at the same time capture the high estimates in the long run (needed in general equilibrium models). They introduce a model where customers can shift relative demand slowly in response to relative prices. This model can be used to explain why there is a difference between long and short run responses to the

[21] Estimates of the lon-run elasticity range from 0.53 to 4.83.

same variable.

3.2 The model

The theoretical foundation for the estimations executed in this thesis is inspired by the model of Blonigen and Wilson (1999) and Armington (1969).

A consumer can at any point in time, t, choose between a variety of foreign- or domestically produced product, j. The utility that the consumer derives from these nationally differentiated goods is represented by the following constant elasticity of substitution function:

$$\mathbf{U_t} = \left[\omega \sum_{j=1}^{n} {C_{h,t}^{j}}^{\rho} + (1-\omega) \sum_{j=1}^{n} {C_{f,t}^{j}}^{\rho} \right]^{\frac{1}{\rho}} \tag{2}$$

Here, $C_{h,t}^{j}$ equals the home consumption of a good, j, at time t, and $C_{f,t}^{j}$ represents the consumption of a foreign produced good. $C_{f,t}^{j} = \sum_{i=1}^{m} C_{i,t}^{j}$ signifies that the foreign good can be produced from a number of m different countries, given the subscript i. The ω represents a home bias parameter - a parameter that captures the fact that consumers have a higher preference for goods produced in the home country. Maximizing this utility function subject to the standard budget constraint yields the following optimal demand for foreign goods.

$$\tilde{C}_{i,t}^{j} = \left[\frac{P_{h,t}^{j}(1-\omega)}{P_{i,t}^{j}\omega} \right]^{\sigma} \cdot \tilde{C}_{h,t}^{j} \tag{3}$$

The $\tilde{C}$ represents the optimal demand for the two goods, home and foreign, while $P_{h,t}^{j}$ and $P_{i,t}^{j}$ are the prices of the good produced at home and abroad respectively. Equation (3) specifies that relative prices is the main determinant of the optimal demand of a foreign good. How the changes in these prices affect the optimal demand is in turn decided by the $\sigma = \frac{1}{1-\rho}$, the elasticity of substitution between the goods, referred to as the *Armington* elasticity in this thesis.

In this thesis I aim to estimate how changes in prices, through changes in tariffs, affect the optimal demand for imported or foreign goods. The effect tariffs have on trade is not apparent from equation (3). For a proper understanding of these effects it is necessary with a decomposed version of the price $P_{i,t}^{j}$:

$$P_{i,t}^{j} = d_i \left(1 + \tau_{i,t}^{j}\right) \left(\frac{p_{i,t}^{j}}{E_{i,t}}\right) \tag{4}$$

The price of equation (4) can be separated into three parts. The first is d_i, the gross trade cost or the "ice-berg" cost i.e. the physical amount of the good that must be shipped in order for one unit to arrive. The second part, $(1 + \tau_{i,t}^{j})$, is the gross ad valorem tariffs the importer faces when importing a specific product. The third and last part is the nominal exchange rate, $(p_{i,t}^{j}/E_{i,t})$, where $p_{i,t}^{j}$ is the price of a specific foreign good, and $E_{i,t}$ is the exchange rate when buying foreign goods. Together these components add up to the price of import goods from different countries at different points in time. Including the full price expression into the optimal demand function for foreign goods generates the following expression:

$$\tilde{C}_{i,t}^{j} = \left[\frac{P_{h,t}^{j}(1-\omega)}{d_i \left(1 + \tau_{i,t}^{j}\right) \left(\frac{p_{i,t}^{j}}{E_{i,t}}\right) \omega}\right]^{\sigma} \cdot \tilde{C}_{h,t}^{j} \tag{5}$$

The optimal demand function, equation (5), demonstrates that tariffs only affect the demand of foreign goods through the relative prices. Also evident from this equation is that increased tariffs lead to lower demand[22] and the magnitude of this effects is determined by σ. Taking log and some rewriting[23] of equation (5) yields the following estimation equation:

$$log(\tilde{C}_{i,t}^{j}) = \alpha_i + \lambda_t + \gamma_j + \sigma log(1 + \tau_{it}^{j}) + u_{it}^{j} \tag{6}$$

[22]Not shown here, the first derivative with respect to tariffs is negative.
[23]See (Blonigen and Wilson, 1999, 6) for the steps of the rewriting.

Equation (6) constitutes the basis of the estimation of the import elasticity. Parameters, α_i, λ_t and γ_j, represent changes in other factors that will influence the optimal demand for foreign goods than tariffs. These other effects will typically vary over time, across country and across goods. The model presented here will use import data as the observed trade flows to predict consequences of trade policy. Calculating the elasticity this way assumes that tariffs are the only change in relative price.

3.3 Summary

Previous estimates of the trade elasticity are inconclusive, but based on these studies and theory I expect to find that tariff reductions lead to higher Norwegian imports of agricultural goods. The magnitude of this effect, however, is difficult to predict as the literature points in several directions.

Studies of the trade elasticity find that tariffs have a greater effect on trade flows than exchange rate fluctuations. General equilibrium models need high estimates of the Armington elasticity to match the growth in trade following trade liberalization. This give grounds to belive that estimates will be high.

Using annual figures, I estimate the medium run elasticity in this thesis, which indicated that the estimates will lie somewhere between those of long- and short run estimates. Studies also imply that the macro elasticity, the one I am estimating, is lower than the micro elasticity pointing in the same direction.

In addition to this, one of the first systematic studies of import-demand elasticities by Stem, Francis and Schumacher (1976) found that, food and beverages are moderately "import sensitive". This research implies a third alternative that the estimates will be low or moderate.

4 Methodology

The purpose of this thesis is to examine the relationship between tariff and import, using Norwegian annual tariff data, and annual import data from 15 EU countries. In this section I will estimate how changes in price, through changes in tariffs, affect the optimal demand for imported or foreign goods, hence estimating the Armington elasticity.

The results of the estimations will be presented as well as a discussion of the potential for reverse causality problems. In the last part of this section, robustness checks will be executed.

4.1 Estimation through ordinary least-squares (OLS)

The purpose of this section is to give an understanding of how the estimation of the Armington elasticity has been executed, and how I control for omitted variable bias by specifying different types of fixed effects.

I make use of a simple OLS regression method on panel data in this analysis to estimate the import elasticity of agricultural goods. This makes it possible to control for omitted variable bias without observing or including them in the regression (Stock and Watson, 2015). The dependent variable in my regression model is the logarithm (log) of the import quantity or import value. It is expressed in logs to deal with the huge varieties in quantity and value imported across goods and countries.

The independent variable is the ad valorem tariffs that are added when importing specific goods. The tariffs are also measured in logs, as the tariffs range from 0.2% to figures of approximately 177%. The regression function is in this case a nonlinear function, commonly referred to as a log-log model. The interpretation of the β_1 coefficient is the elasticity of tariffs on the imported value or quantity. This means that I am estimating how percentage changes in the independent variable leads to percentage changes in the dependent variable. This will be the case for all the regression functions in this analysis.

The theoretical trade model outlined in section 3.2 states other factors than tariffs affecting the Norwegian demand of foreign goods. These can typically be the price of domestically produced substitutes, nominal exchange rates and the trade costs. These factors will vary over time, across countries and across each product. They can also vary over time and across countries, or across countries and across goods at the same time. Additionally, the theoretical model does not catch all the effects that can affect the Norwegian demand for imported goods. Therefore, I will use different specifications of fixed effects to control for correlation between the error term, $u^j_{i,t}$, and the regressor.

As I am using a fixed effects model, it is the variation in the tariff- and import data from year to year that identifies the estimate of the β_1 coefficient. By controlling for fixed effects, only variations in the tariff data are used to measure the changes in imports and these will be specified further when I present the estimation equations.

The main estimation equation is given by equation (7) below, and is a paraphrasing of equation (6) derived from the theoretical model in Section 3.2:[24]

$$\begin{aligned} logImp^j_{i,t} &= \beta_1 log(1+\tau^j_{i,t}) + \alpha_i + \lambda_t + \gamma_j + u^j_{i,t} \\ i = country, \quad t = year, \quad j = HS.no \end{aligned} \tag{7}$$

The country fixed effects, α_i, are effects that vary across countries, but not over time. Examples of country fixed effects are transportation costs, price level and that some countries trade more with some specific countries due to for example historical relationships. The time fixed effects, λ_t, are the effects that change over time, but not across countries. e.g.: Norwegian productivity, unemployment and inflation, factors that typically will affect the price of the domestically produced goods. The product- or HS[25] fixed effects, γ_j, represents effects that vary across products, but not across countries or over time. An example of HS fixed effects are typically the price difference between specific home- and foreign produced goods.

[24] See (Stock and Watson, 2015) Chapter. 10 for more details on fixed effect regression models.
[25] See section 2.1 for the meaning of HS.

In the next regression, equation (8), I use another fixed effects specification. Here, the time- and country fixed effects have been grouped together creating a regressor for country-time fixed effects, α_{it}. These are effects that vary from country to country and changes through time, but not across goods. Examples are exchange rates, inflation and productivity in the countries the importer trade with. HS-fixed effects will also be included in this equation.

$$\begin{aligned} logImp^j_{i,t} &= \beta_1 log(1+\tau^j_{i,t}) + \alpha_{it} + \gamma_j + u^j_{i,t} \\ i = country, &\quad t = year, \quad j = HS.no \end{aligned} \tag{8}$$

The third variation of fixed effects specification is given by equation (9). In this equation, α_{ij}, is a new grouped variable, consisting of HS numbers and countries, called HS-country fixed effects. This variable makes it possible to control for fixed effects that change across country and across goods, but do not vary through time. An example is difference in prices due to different costs of production across goods and across countries. In addition, this estimation controls for time fixed effects.

$$\begin{aligned} logImp^j_{i,t} &= \beta_1 log(1+\tau^j_{i,t}) + \alpha_{ij} + \lambda_t + u^j_{i,t} \\ i = country, &\quad t = year, \quad j = HS.no \end{aligned} \tag{9}$$

In the next estimation equation I also use a grouped variabel, λ_{jt}, grouping HS numbers with years, called HS-year fixed effects. This new variable controls for effects that vary across goods and over time. Such as the variation of goods we demand from year to year or changes in technology that leads to cheaper production of some goods. Equation (9) controls for country fixed effects as well.

$$\begin{aligned} logImp^j_{i,t} &= \beta_1 log(1+\tau^j_{i,t}) + \lambda_{jt} + \alpha_i + u^j_{i,t} \\ i = country, &\quad t = year, \quad j = HS.no \end{aligned} \tag{10}$$

The results of these four regressions are presented in the Tables 5 in the next subsection, Results. I separate between the use of import quantity and import value in the regressions, and it will be stated in Table 5 which dependent variable that is of use. The regression procedure will be equal in the two cases. What type of fixed effects specification that is of use will also be stated in Table 5.

I also estimate the Armington elasticity for each category of goods In order to see if different categories of goods react differently to changes in tariffs. Again a variation of the main estimation equation will be used, only this time for each category of goods, see equation (11). The category decided by the first two HS-digits in the tariff data.

$$\begin{aligned} slogImp^k_{i,j,t} &= \beta_1 log(1+\tau^k_{i,j,t}) + \alpha^k_i + \lambda^k_t + \gamma^k_j + u^k_{i,j,t} \\ i = country, \quad t = year, \quad j = HS.no, \quad k &= category \end{aligned} \tag{11}$$

The result of these regressions will be presented in Table 6 under Results.

Results

Non of the results are significantly different from zero, as can bee seen Table 5.[26]This means that the estimate of the Armington elasticity is equal to zero.

In Table 6, the ImportQuantity column, only 3 out of 17 regressions show results that are statistically different from zero. It can be seen that a 10% decrease in tariffs increase the imports of other animal products by 82%. Surprisingly, two out of these significant results imply that a tariff reduction has a negative impact on the quantity of imports. According to these estimates a 10% reduction in tariffs decreases the imports of milk and dairy products by 19% and decrease the import of corn products by 3.6%. Looking at the development in import quantity (see Figure 3 in Appendix A.3), and reductions in ad valorem tariffs (see Table 3 section 3.1), it is evident that the tariff on these goods

[26]See Appendix A.5 for the results of the same regression done for a restricted time period.

has decreased and import has increased. One possible explanation is that this fixed effect model specification is not able to control for all other factors driving the import increase. A detailed look into tariff and import data of the products in these categories would be needed to find the source of the odd results. For now, I have no reason to believe that tariffs reductions actually have a negative impact on the import quantity of these goods.

In Table 6, in the ImportValue column, 4 out of 17 regressions present results that are statistically different from zero. Also here a 10% decrease in tariffs will decrease the import of milk and dairy products by 12%, a possible explanation is that there are factors that this fixed effect model is not able to control for. Hence, giving the impression that a reduction in tariffs has a negative effect on import, which is unlikely to be the case. A 10% decrease in tariffs will increase the import of other animal products, corn and mill products by respectively 56%, 12% and 33%. The result from these estimations indicates that a few of the product categories might react statistically to changes in tariff.

The conclusion from these estimation results is as follows: Aggregated imports do not react statistically to tariff changes. Hence, the estimate of the Armington elasticity equals zero. The overall picture from the estimations of product categories is that they do not react statistically to changes in tariff either. Values of the R^2 further supports the findings that tariffs explain little of the variations in the dependent variable, import. This means that I am not able to reject the notion that tariffs has no effect on Norwegian imports of agricultural goods. According to these estimtes, tariffs do not affect the aggregated imports of agricultural goods in Norway.

Table 5: Ordinary least-square regressions

Import	(1) Quantity	(2) Quantity	(3) Quantity	(4) Quantity	(1) Value	(2) Value	(3) Value	(4) Value
$\log(1+\tau^j_{i,t})$	-0.0455	-0.0385	0.0507	0.791	-0.0296	-0.0260	0.0370	0.234
	(0.0685)	(0.0718)	(0.0756)	(1.636)	(0.0467)	(0.0451)	(0.0604)	(1.397)
Constant	-0.252	2.047	2.848***	2.044	1.012*	3.578**	3.749***	2.043
	(0.536)	(2.265)	(0.187)	(4.019)	(0.427)	(1.369)	(0.150)	(3.464)
HS fixed effects	Yes	Yes	-	-	Yes	Yes	-	-
Time fixed effects	Yes	-	Yes	-	Yes	-	Yes	-
Country fixed effects	Yes	-	-	Yes	Yes	-	-	Yes
HS-country fixed effects	-	-	Yes	-	-	-	Yes	-
HS-year fixed effects	-	-	-	Yes	-	-	-	Yes
Country-time fixed effects	-	Yes	-	-	-	Yes	-	-
N	12607	12607	12607	12607	12607	12607	12607	12607
R^2	0.111	0.129	0.010	0.113	0.137	0.156	0.048	0.135

Source: The Norwegian Customs Tariff and BACI. 2003 - 2013

Standard errors clustered and given in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Ordinary least-square regressions

Category	ImportQuantity $\hat{\beta}_1$	R^2	ImportValue $\hat{\beta}_1$	R^2	N
2. Meat and edible trimmings	0.273	0.262	0.705	0.263	975
	(0.485)		(0.441)		
4. Milk and dairy products	1.894***	0.229	1.188***	0.253	809
	(0.217)		(0.189)		
5. Other products from animals	-8.174**	0.550	-5.620**	0.643	104
	(0.690)		(0.210)		
6. Living trees and other plants	0.544	0.559	0.315	0.665	401
	(0.331)		(0.210)		
7. Vegetables and edible roots	-0.0840	0.200	-0.0801	0.231	1731
	(0.171)		(0.156)		
8. Edible fruits and nuts	-0.114	0.242	-0.305	0.276	810
	(0.294)		(0.220)		
10. Corn	0.128	0.155	-1.206*	0.180	464
	(0.549)		(0.470)		
11. Mill products	-4.078	0.124	-3.332*	0.162	798
	(2.509)		(1.434)		
12. Oil-containing seeds and fruits	-1.630	0.138	-1.450	0.193	930
	(1.161)		0.969)		
15. Animal and vegetable oils and fats	-0.108	0.147	0.0101	0.127	1226
	(0.0570)		(0.0164)		
17. Sugar and sugar goods	-7.787	0.202	-5.916	0.245	506
	(3.886)		(3.191)		
19. Corn products	0.359*	0.499	0.236	0.531	560
	(0.118)		(0.229)		
20. Vegetable products	0.113	0.229	0.0574	0.250	1624
	(0.0685)		(0.0712)		
21. Different types of prepared nutrients	-1.036	0.320	-1.783	0.353	250
	(1.806)		(1.637)		
22. Beverage, ethanol and vinegar	7.092	0.476	4.820	0.626	135
	(1.889)		(1.730)		
23. Other	-0.404	0.293	-0.275	0.355	447
	(0.280)		(0.198)		
35. Proteins	-0.109	0.384	0.0852	0.430	187
	(0.365)		(0.380)		

Source: The Norwegian Customs Tariff and BACI. 2003 - 2013

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Standard errors are clustered

4.2 Reverse Causality

The problem of endogeneity due to omitted variable bias has been controlled for by specifying different types of fixed effects. Endogeneity due to reverse causality however, is a more challenging to problem. Reverse causality means that the causality runs from the dependent variable (import) to the regressor (tariff). If this is the case, an OLS regression picks up both effects, and the OLS estimator is biased and inconsistent. If there is a high probability for import causing tariffs to change, then the result from this analysis is not valid.

The import value has been estimated to be FOB, denoting that changes in tariffs and exchange rates are not included in the regressor. This does not imply that import cannot affect tariffs in other ways. To address this problem, a thorough understanding of how tariffs are imposed in Norway is necessary. Therefore, I will present how the tariffs in Norway are decided, and use this to evaluate it the problem of reverse causality is likely in this case.

In Norway, the tariffs are decided for one year at the time by Stortinget. Stortinget acquires advise from the Committee of Finance, and the Committee of Finance get a proposal from the Ministry of Finance. In addition, trade with agricultural goods are regulated by bilateral trade agreements and through international regulations.

Norwegian tariffs are approved by the WTO. This means that the upper limit for tariff and import quotas are regulated on the grounds of a common framework. Through the EEA agreement, Norway and the EU have decided on a mutual way to calculate tariffs on prepared agricultural goods. The system is meant to harmonize commodity prices and equalize the conditions of competition (Pettersborg, 2011). Article 19 of the agreement states that "The Contracting Parties undertake to continue their efforts with a view to achieving progressive liberalization of agricultural trade" (europalov, 2016). Trade agreements reduce the Norwegian government's ability to set tariffs freely and in particular higher than upper limits.

The Norwegian Agricultural Directorate has the authority to reduce tariffs on agri-

cultural goods regulated by contract target price[27]. The new tariff level will be valid for all trading partners. The tariff can be reduced when the price the producer meets stay higher than what is agreed upon in the Agricultural Agreement (Landbruksdirektoratet, 2016*a*). This means in practice that if we experience devaluation of NOK, tariffs can be reduced to compensate for the price change. Tariffs on seasonal products will be reduced in periods when the Norwegian production is low.

What I have not discussed is to what degree import patterns through lobbyism can cause changes in tariff. The answer to this question is beyond the scope of this thesis. Keeping this in mind, my conclusion about the problem of reverse causality is as follows: With tariffs decided on a yearly basis and special criterion for tariffs reductions, in addition to upper limits decided by trade agreement, the import patterns' ability to affect tariffs is restricted. This implies that reverse causality most likely do not affect the results in this analysis.

4.3 Robustness check

Addressing classical measurement error

The tariff figures in the dataset represent the highest possible tariffs the importer will meet in the course of a year. In practice, several of the tariffs will for periods of time be lower than the tariffs given in this dataset.

In periods where the Norwegian production is off season, import tariffs on these goods will be reduced by the Agricultural directorate. Also, in periods of devaluation, tariff on specific products will be reduced. These reductions are referred to as reductions in general tariffs and from 2010 to 2013, 291 products were affected by these reductions.[28] In addition, importers can apply for tariff reductions independently on more goods on the basis of their commodity content (Landbruksdirektoratet, 2016*a*).

Lower applied tariffs for several goods than those in the dataset lead to a risk of clas-

[27] The maximum price the farmer can achieve as a yearly average.

[28] In 2010 these general reduction was applied on 71 products, in 2011 on 73 products, in 2012 on 72 products and in 2013 applied on 75 products.

sical measurement error in this analysis. As the measurement error appears in the independent variable it leads to an estimator of β_1 that is inconsistent and biased towards zero. The size of this measurement error depends on the use of both general- and independent tariff reductions in the time period from 2003 to 2013. To what extent this affects the result of the analysis alters on the magnitude of the measurement error, and will not disappear even in a huge dataset. Figuring out the extent of this measurement error is outside the scope of this analysis, but it is worth keeping in mind that classical measurement can lead to underestimation of the β_1.

Classical measurement error in the dependent variable leads to an estimator that is inconsistent and biased towards zero, this is a possible explanation of low estimates of the Armington elasticity. This denotes that it is appropriate to test whether or not substituting the top percentages of the tariffs data will affect the estimates.

By replacing the upper 1% and 5% of the figures with values equal to the 99th- and 95th percentile, I am able to remove some of the highest and most unlikely values present in the tariff data. This makes it possible to test if these high values affect the outcome of the previous estimates. For the purpose of this robustness check I use the regression equation (7) to estimate β_1, the effect tariffs has on import, and the results are given in Table 7.

One of four estimates appears to be significantly different from zero at a 5% significance level, indicating that tariffs might have an effect on import quantity, though a modest one. A 10% increase in tariffs will according to this estimate reduce the import quantity by 1.7%. The result of the regressions using modified data supports the previous estimates that for the most part I cannot ignore the possibility that the estimates are not significantly different from zero.

By replacing the top percentage of the tariffs data with values given by lower percentiles I have attempted to address the issue of measurement error in this analysis. The result presented in Table 7 supports the previous finding that we cannot leave out the possibility that tariffs have no effect on imports.

Table 7: OLS[1] robustness check

Modification	Upper 1% ImportQuantity	Upper 1% ImportValue	Upper 5% ImportQuantity	Upper 5% ImportValue
$\log\tau^j_{i,t}$	-0.0415	-0.0272	-0.173*	-0.0556
	(0.0703)	(0.0461)	(0.0831)	(0.0449)
Constant	-0.246	1.015*	-0.981	0.814
	(0.540)	(0.427)	(0.660)	(0.485)
N	12607	12607	12607	12607
R^2	0.111	0.137	0.111	0.137

Source: The Norwegian Customs Tariff and BACI. 2003 - 2013
Standard errors are clustered and given in parentheses
[1] Controlling for time-, country- and HS fixed effects
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Investigating lagged correlation

It is also worth examining if imports have a lagged reaction to change in tariffs, meaning that reductions in tariffs at a specific point in time affect the import periods after the tariff reduction appeared. To leave out the possibility that lagged reactions are the reason for the results of my first analysis I introduce a lagged independent variable to my estimation model. By doing so I am able to investigate if the tariffs at time $(t - T)$ have an effect on imports at time t. The estimation equation is as follows:

$$\begin{gathered} logImp^j_{i,t} = \beta_1 log\tau^j_{i,t-T} + \alpha_i + \lambda_t + \gamma_j + u^j_{i,t} \\ i = country, \quad t = year, \quad j = HS.no \quad T = \{1, 2\} \end{gathered} \tag{12}$$

In addition to examining the lagged effects I will run the regression first for the whole time period of my data, and then restrict the regressions to take place from 2010 to 2013. By doing this, the estimation is exclusively concentrated around the time period when the reduction in tariffs takes place. The results of this estimation is presented in Table 8.

The results are still not significantly different from zero, suggesting that there are no

Table 8: OLS-estimation using lagged independent variable

Time period	2003 - 2013		2010-2013	
	ImportQuantity	ImportValue	ImportQuantity	ImportValue
$\log\tau^j_{i,t-1}$	0.00995	0.0384	0.334	0.0679
	(0.0540)	(0.0431)	(0.199)	(0.209)
Constant	-0.317	1.069*	1.798	1.875
	(0.648)	(0.531)	(1.311)	(1.247)
N	12606	12606	1220	1220
R^2	0.108	0.133	0.241	0.287

Time period	2003 - 2013		2010-2013	
	ImportQuantity	ImportValue	ImportQuantity	ImportValue
$\log\tau^j_{i,t-2}$	-0.0405	0.0243	-0.254	-0.474
	(0.0401)	(0.0304)	(0.506)	(0.458)
Constant	-0.947	0.655	-6.453**	-3.880*
	(0.673)	(0.557)	(1.896)	(1.650)
N	12605	12605	1232	1232
R^2	0.114	0.139	0.269	0.308

Source: The Norwegian Customs Tariff and BACI. 2003 - 2013
Standard errors are clustered and given in parentheses
[1] Controlling for time-, country- and HS fixed effects
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

lagged import effect for the time period of this analysis. In sum, this robustness check supports the results from my main analysis that reductions in tariffs have no significant effect in imports.

4.4 Summary

In this section I have studied the effect tariffs have on import using a panel dataset with Norwegian ad valorem import tariffs and import quantity and import values from 15 European countries in the period 2003 - 2013 . The estimations have been carried out using ordinary least-square method controlling for various fixed effects. In Table 5 these results are presented, which fixed effect specification is used also stated

in this table. Non of the result of the regressions carried out on neither import value or import quantity are statistically different from zero. In addition to this I examined how different categories of goods react to change in tariffs, controlling for time-, year- and product fixed effects. The results are presented in Table 6. The overall picture from these regressions is that tariffs have no statistically significant effect on neither import value nor import quantity. Addressing the problem of classical measurement error and the possibility of lagged import effects further supports the finding that tariffs have small or no effect on imports.

To sum up, the conclusion of the analysis is that I cannot disregard the possibility that tariffs have no effect on neither import value nor import quantity of the goods used in this analysis, and the estimate of the Armington elasticity is set to zero. The strong effect on trade due to changes in tariffs seen in various previous research (see Clausing, 2001; Head and Ries, 2001; Romalis, 2007), is not evident in this study. For the rest of this thesis I will discuss possible mechanisms leading to these results.

5 Discussion of possible mechanisms

The results of my analysis show that change in tariffs have no significant effect on aggregated imports of agricultural goods. This result is somewhat surprising, all the time previous studies using tariffs have found a significant effect of change in tariffs on import.

Having these results in mind, I will in the following section discuss three potential causes that may explain these results. First, I argue that consumers are inelastic, or slow, in adjusting to price changes. I argue that this might be so because of the nature of agricultural goods that food and beverages are necessary goods. The other possibility is that habits determine consumption patterns. Second, I discuss the possibility that change in tariffs, instead of causing a change in the prices, only increase the margin of the importers and supermarkets.

5.1 Inelastic consumers

When governments choose to reduce tariffs, it implies imposing lower price on imported goods relative to domestic goods. Lower prices normally imply higher demand, which again leads to higher import of the same products and goods. This "causal chain", however, does not correspond with the results of my analysis. One plausible explanation for this may be that consumers do not react to changes in price on agricultural goods. If this is the case it means that the consumers are inelastic.

A large proportion of the agricultural goods subject to analysis in this thesis, are typically food and beverages; 97.7 percent of the import value and 96 percent of the import quantity. Food and beverages are necessity goods. One special feature of necessity goods is that the price elasticity is normally low. In 2012, Norwegian households used 11.8% of their budget on food, compared to 20% in 1982 (Strand, 2015). This suggests that Norwegian households pay little, or no attention, to price changes since the share Norwegian consumers use on food takes up such a small amount of the total budget anyway.

Another point that supports the notion of inelastic consumers is the effect habits and taste have on consumption. Atkin (2010) emphasizes the importance of adding habits into trade models as the taste within a household favor the good you consumed as a child. As trade introduces new and better products, consumers seem to stick to their old consumption habits. What this means is that even though prices change, consumer habits determine what the consumer buys and eats.

Lastly, it might be that instead of consumer being inelastic, they are just slow in their adjustments to price change. This can explain a low Armington elasticity.

Arkolakis, Eaton and Kortum (2012) argue that the Armington elasticity becomes small if consumers adjust slowly to price changes. They introduce a model of consumer behavior where the consumer with a probability, λ, switches her source of supply, carefully considers potential suppliers and then choose the one with the lowest cost. With a probability, $1 - \lambda$, the consumer will then buy the goods from the same source, regardless of the price. The authors then set out to simulate change in prices by introducing productivity shocks to the model, and find that the smaller the λ is, the smaller the Armington elasticity becomes. This finding suggests that the slower the consumers are in their reaction to price changes, the lower the elasticity is between home and foreign goods. Bearing this in mind, this has the following implications for my analysis: that Norwegian consumers seem to have a low probability, λ, of evaluating potential suppliers and choose products with the lowest cost.

These explanations solely rest upon the assumption that price on import goods actually change when tariffs change. If this is not the case, the explanation is to be found somewhere else.

5.2 Higher margins

Reduced tariffs imply reduced price. If prices do not change it insinuates that importers sell goods for the same price, but to a lower cost, and thus increase profits. To do this, the price-setter must have gained market power. In the following I discuss the possibility that supermarkets and chain-stores have gained a certain degree of market

power and increase the margin between price and marginal cost, in order to increase their profit.

First, a special feature of the Norwegian market is that the same companies own several of the supermarket-chains. These companies can be referred to as umbrella organizations. According to the report *Food, power and impotence* conducted by the Ministry of Agriculture and Food (2011), in practice four companies controls which good can access the Norwegian grocery market. These four companies each control between 15 and 40 percent of the grocery market. The biggest of these is NorgesGruppen, with a market share of 36 percent in 2010. Moreover they own or cooperates, with 11 different chain-stores (NOU2011:4, 2011, 19, 25). This type of market structure can raise the threshold for lowering prices, in fear of harming other supermarkets owned by the same company, and potentially affect the price setting.

The special characteristic of the Norwegian geography may also affect supermarkets and the umbrella companies' ability to exercise market power. For those parts of the population that is situated in rural areas, choosing between different supermarkets-chains is actually not an option: in 10 percent of the Norwegian municipals only one umbrella organization is represented. The localization of the store seems to be a strong indicator of where people decide to do their grocery shopping (NOU2011:4, 2011, 33,43). This gives the supermarkets and the groceries an opportunity to practice local market power, by setting higher margins between the price and the marginal cost. Moreover, the Norwegian grocery market is highly concentrated and this can weaken the competition in the market and increase the probability of the actors to exercise anti-competitive practices (NOU2011:4, 2011, 13).

On the other hand, in urban areas where people can choose between different supermarkets, the consumers may choose between buying groceries at the nearest shop (to save time) or at a more remotely located and cheaper shop (minimize cost). As previously stated, the household's budget-share used on food is relatively small. Thus, the utility you gain from shopping close to your home might well be higher than the utility you gain from buying cheap groceries from a store further away.[29] By using

[29] Adding uncertainty about the amount of money saved and assuming risk averse consumers would

this variation of rational choice argumentation, I suggest that the price *per se* may not be the prime determinant of peoples shopping habits, this lowers the supermarkets incentives to minimize the prices at all times.

The argument that higher margins might be a plausible explanation for why import do no react to tariff reductions, is supported in a report conducted by Oslo Economics. They examined the development in retail prices and the purchasing prices of Norwegian supermarkets. They found that in the time period, from 2011 to 2014, the difference between the two prices had increased, suggesting that the supermarkets have been increasing their margins (OsloEconomics, 2015).[30]

5.3 Summary

I started this section with two alternative explanations for the lack of effect of tariffs imposed on agricultural products on aggregated import: First, low elasticities and small budget shares used on food and beverage, or consumer habits creates inelastic consumers. Secondly, consumers might be slow in adjusting to price changes due to low probability of switching source of supply. If this is the case, this will lead to low estimates of the Armington elasticity.

Finally, I considered if increased market power by the supermarkets prevent prices from changing when tariffs are reduced. I draw attention to characteristics such as Norwegian geography and market structure that potentially makes it possible for the supermarkets to exercise this type of market power. There is indeed some evidence present that this might be a challenge in the Norwegian market.

even further support this argument.

[30]Nevertheless, there are weaknesses to this analysis which complicates a conclusion that margins actually have increased and that the supermarkets have expanded their market power in this time period. For example, the analysis only looks at the difference in retail and purchasing prices not taking into account that other costs like wages has increased in the same period.

6 Concluding remarks

The guiding research question for this has been: To what degree do changes in tariffs affect imports? Estimates of the Armington elasticity gives valuable information about trade flow reactions to different changes in trade cost, and is one out of two parameters needed to evaluate gains from trade. Previous studies of trade elasticities have found that the size of the elasticity depends on how changes in prices are measured. Studies using trade liberalization data, where changes in price is measured by studying changes in tariffs, find substantially higher estimates of the Armington elasticities than studies using fluctuations in the exchange rates to measure changes in prices.

The main motivation for this thesis has been to examine if the high estimates found using tariff data is valid for a specific sector - the agricultural sector - in a small, open economy, in this case Norway. Previous studies have solely focused on large economies such as Canada and the United States. By narrowing the study of elasticities to exclusively focus on Norwegian import of agricultural goods from its biggest trading partner, the EU, this thesis has endeavored to provide new insight into the literature on price elasticities.

The results of my analysis suggests that there is no effect of tariffs on trade flows, when studying the import of agricultural goods in Norway in the period 2003-2013. This suggests that the positive effect of lower tariffs on imports is not a unanimous phenomenon. De facto, tariffs have no significant effect on the Norwegian import of agricultural goods. The most conceivable explanations for this phenomenon is that inelastic consumers do not react to price changes or that market power prevents prices from adjusting properly.

The empirical findings of this thesis have been that there is no effect of changes in tariffs on imports. In order to get a more comprehensive grasp of the main determinants of changes in price elasticities, I suggest some paths for future research in this topic. First, a natural supplement to this thesis would be to examine the same effects using data for other types of goods than solely agricultural goods, like industrial goods. In

the case of Norway this would imply studying imports from other countries as well, and not only countries from the EU. Second, using data for a longer time-period might be of interest in order to examine if the effects of tariff reductions appear later than the results of this thesis have been able to capture. With such extensions it would be possible to determine whether there are features of the goods being studied or characteristics of the source country that determines trade effects due to changes in tariffs. Lastly, further research would benefit on the examination of the potential for market power and lack of price adjustments, to find evidence for the cause of these results.

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A Appendix

A.1 Tariff data

2012 HS classification system: http://www.wcoomd.org/en/topics/nomenclature/instrument-and-
hs_nomenclature_2012/hs_nomenclature_table_2012.aspx

Detailed Norwegian tariff data, 8 - digit specification level: http://tolltariffen.
toll.no/templates_TAD/Tolltariffen/Publication.aspx?id=193635&epslanguage=
no

Table 9: Difference in tariffs in NOK per kilo for eu- and non-eu member

Cat.	Not EU 2003	EU 2003	Diff	Not EU 2006	EU 2006	Diff
1.	17.653	17.653	0	17.644	17.644	0
2.	55.736	55.747	-0.01	59.842	59.862	-0.02
4.	28.484	28.495	-0.01	28.398	28.485	-0.096
5.	0.235	0.240	-0.005	0.238	0.251	-0.013
6.	0.212	0.250	-0.248	0.238	0.3124	-0.076
7.	2.367	2.460	-0.093	2.221	2.411	-0.19
8.	1.122	1.170	-0.048	0.897	1.024	-0.127
10.	1.195	1.196	-0.001	1.189	1.193	-0-004
11	3.490	3.432	0.058	3.243	3.394	-0.151
12.	4.691	4.750	-0.059	4.033	4.061	-0.028
15.	1.867	1.872	-0.005	1.887	1.900	-0.013
16.	33.830	33.831	0.001	33.829	33.831	-0.002
17.	1.402	1.394	0.008	1.392	1.394	-0.002
19.	2.556	2.117	0.439	1.802	1.802	0
20.	6.128	6.109	0.019	5.779	5.369	0.21
21.	0.519	0.469	0.05	0.433	0.391	0.042
22.	0.323	0.304	0.019	0.300	0.296	0.004
23.	5.634	5.634	0	5.632	5.632	0
35.	5.509	5.710	-0.201	5.748	6.137	-0.505
38.	0.0816	0.0826	-0.001	0.0815	0.0826	-0.0011

Source: The Norwegian Customs Tariff, 2003 and 2006

Table 10: **Average tariffs in NOK per kilo for imports from EU-countries.**[1]

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1	17.653	17.644	17.644	17.644	16.924	16.924	16.924	0	0	0	0
1*	2606.846	2606.846	2606.846	2606.846	2606.846	2606.846	2606.846	0	0	0	0
2	55.740	59.570	59.570	59.860	60.796	59.816	60.854	0		7	7
4	28.489	28.474	28.471	28.474	28.481	28.464	28.477	4.808	4.743	4.819	4.819
5	0.237	0.234	0.249	0.249	0.279	0.279	0.279	0	0	0	0
6	0.227	0.281	0.303	0.303	0.503	0.503	0.503	0.0332	0.0370	0.208	0.208
7	2.404	2.434	2.423	2.386	2.566	2.567	2.376	2.376	2.427	0.849	0.849
8	1.141	1.147	1.113	1.007	1.005	1.005	1.014	0.100	0.100	0.0572	0.0572
10	1.195	1.193	1.193	1.193	1.193	1 1.193	1.193	0.19	0.19	0.152	0.152
11	3.467	3.393	3.393	3.374	3.304	3.304	3.304	0	0	0	0
12	4.715	4.718	4.057	4.057	4.302	4.302	4.302	11.046	11.046	8.497	8.497
15	1.869	1.871	1.870	1.898	1.888	1.888	1.888	0	0	0	0
16	33.830	33.831	33.831	33.831	33.831	33.831	33.831	0	0	0	0
17	1.399	1.396	1.394	1.394	1.394	1.394	1.394	0.263	0.263	0.099	0.099
19	2.378	2.168	1.802	1.802	1.802	1.850	1.850	1.850	1.850	1.850	1.850
20	6.121	6.092	5.673	5.673	5.509	5.509	5.509	1.280	.280	1.379	1.379
21	0.499	0.447	0.395	0.395	0.381	0.387	0.387	0.711	0.708	0.711	0.711
22	0.316	0.300	0.296	0.296	0.296	0.296	0.296	0.035	0.035	0.035	0.035
23	5.634	5.611	5.647	5.633	5.959	5.917	5.933	39.06	39.06	28.849	28.849
35	5.586	5.678	6.082	6.082	6.137	6.137	6.137	5.641	5.641	5.641	5.641
38	0.082	0.0825	0.0825	0.0825	0.073	0.073	0.073	0	0	0	0

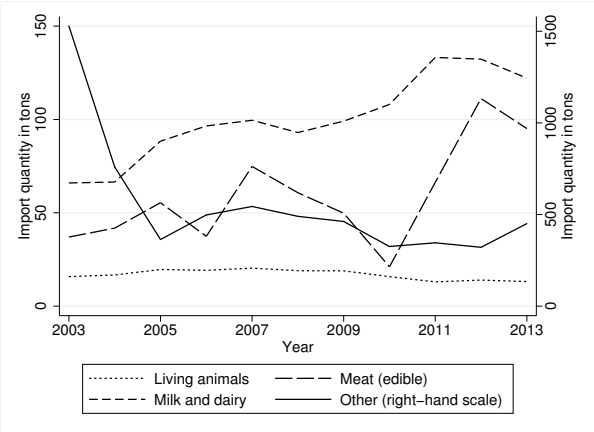
Source: The Norwegian Customs Tariff. 2003 - 2013

[1]The specific tariffs presented here will show figures that deviates from the figures presented in Table 3 as the figures presented here is an average of all tariffs to all possible goods, even though we do dot actually import them during the time period of my data.

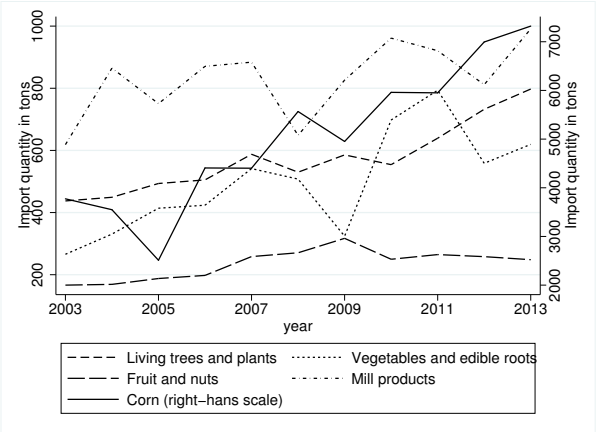
*Tariffs given in NOK per piece

A.2 Import data by BACI. 2003 - 2013

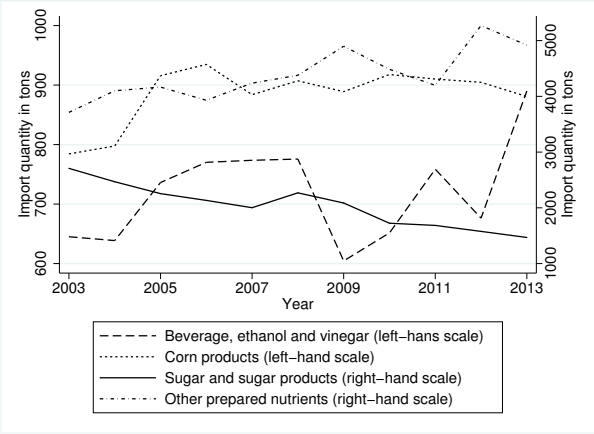
Figure 3: Import quantity for products subject to tariff



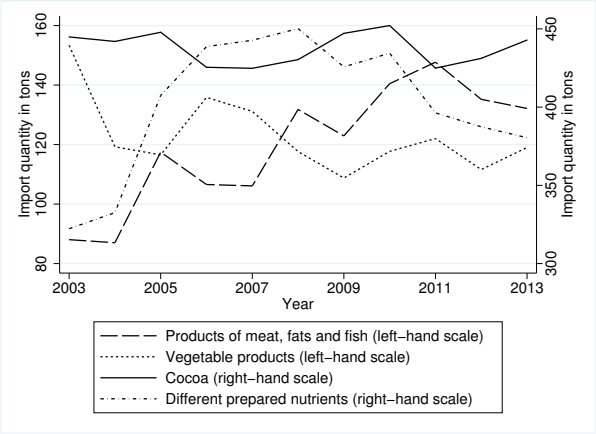
(a) Living animals and animal products



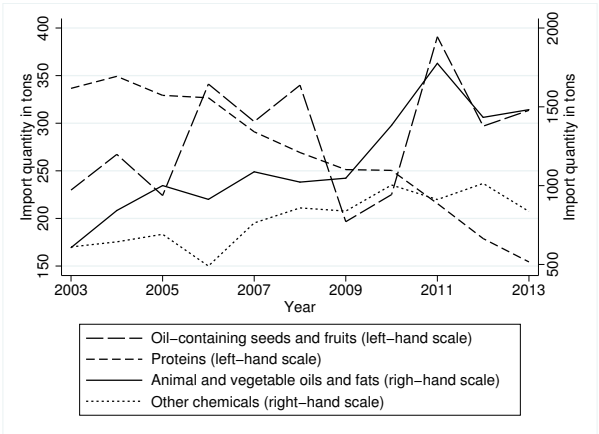
(b) Vegetable products



(c) Prepared nutrients



(d) Prepared nutrients



(e) Other products

A.3 Converting specific tariffs to ad valorem tariffs

To get the price of each good I made us of the import data at hand. The import value is measured in thousand US dollars so dividing the import value by the quantity gives the price per kilo, in US dollars.

For the purpose of describing the tariff data I make use of annual average daily figures of exchange rates (*NorgeBank*, 2016) to convert the price to thousand of NOK, and then divide the specific tariffs (only per kilo tariffs) by the price to get the ad valorem tariffs. Due to changes in exchange rates the ad valorem tariffs will therefore differ from year to year even though the specific tariffs are the same. It is also worth mentioning that because I use import data to calculate the price and the ad valorem then these ad valorem tariffs will only represent tariffs of goods we actually import.

To avoid any disturbing factors in my analysis I will operate with a constant price and constant exchange rate. I start by dividing the import value by the import quantity to get the price in thousands of US dollars, then I find the average price of each goods from 2003 - 2013 and use this as the price. To convert the price to thousands of NOK I use the average of the annual average daily figures of exchange rates used before, which is 6.1646 (*NorgeBank*, 2016) . The tariffs per kilo is then divided by this price, giving the ad valorem tariffs of use in the analysis.

A.4 Estimation through ordinary least-square

Table 11: Ordinary least-square regressions. 2008 - 2013

Import	(1) Quantity	(2) Quantity	(3) Quantity	(4) Quantity	(1) Value	(2) Value	(3) Value	(4) Value
log(1+ $\tau^j_{i,t}$)	-0.0178	-0.0104	0.0756	0	-0.0776	-0.0719	-0.00360	0
	(0.0789)	(0.0846)	(0.0786)	(.)	(0.0731)	(0.0736)	(0.0657)	(.)
Constant	0.0184	0.531	3.198***	0.00623	1.652***	2.075**	4.303***	1.732***
	(0.523)	(0.735)	(0.189)	(0.319)	(0.397)	(0.647)	(0.159)	(0.283)
HS fixed effects	Yes	Yes	-	-	Yes	Yes	-	-
Time fixed effects	Yes	-	Yes	-	Yes	-	Yes	-
Country fixed effects	Yes	-	-	Yes	Yes	-	-	Yes
HS-country fixed effects	-	-	Yes	-	-	-	Yes	-
HS-year fixed effects	-	-	-	Yes	-	-	-	Yes
Country-time fixed effects	-	Yes	-	-	-	Yes	-	-
N	4588	4588	4588	4588	4588	4588	4588	4588
R^2	0.151	0.178	0.008	0.151	0.183	0.210	0.025	0.181

Source: The Norwegian Customs Tariff and BACI. 2003 - 2013

Standard errors are clustered and given in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$