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The Financial Impact of Informal Economic Sanctions

An empirical study of the impact of China's informal economic sanctions on Norwegian salmon exports following the 2010 Nobel Peace Prize

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Master Thesis in Economic Analysis and, Business Analysis and Performance Management

NORWEGIAN SCHOOL OF ECONOMICS

Abstract

In this study, we have investigated whether the Chinese informal economic sanctions against Norwegian salmon had a negative effect on Norwegian salmon exporting firms' financial performance. According to theory on international trade, economic sanctions distorts trade flows between countries and reduce the potential benefits and welfare gains from trade. Since trade takes place through firms, it is expected that firms will be negatively affected by economic sanctions. However, a firm's opportunity to circumvent such market distortions could lead to a different conclusion.

We performed a fixed effects estimation to examine whether Norwegian salmon exporters were financially affected by the Chinese sanctions. Our results indicate that the Chinese sanctions had a negative financial impact on Norwegian salmon exporting firms, and that this negative effect was larger in the first three years of the sanction period. This can be explained by the different costs an exporting firm may face when economic sanctions are imposed. However, the observed long-run effect is close to zero, supporting the empirical literature stating that sanctions-busting activities are always likely.

The normative implications of our study stress the importance of countries developing and evaluating their exporting industries' normative standards to prevent the potential criminalizing side effects of economic sanctions. However, firms are also responsible in these manners. Bribery and smuggling are criminalized because of their harmful consequences and informal economic sanctions are no legitimate excuse for criminal practices.

Acknowledgement

This thesis is written as part of our master´s degree in Economics and Business Administration at the Norwegian School of Economics (NHH). The thesis is included as an independent work in our profiles Economic Analysis and Business Analysis and Performance Management.

Our motivation for this study was an interest within corruption and compliance after taking the course BUS452 Corruption – Incentives, Disclosure and Liability, taught by our supervisor Tina Søreide. We started the project without much knowledge of the Norwegian salmon industry but have throughout the semester gained a deeper understanding of the industry.

We would like to give a special thanks to our supervisor, Tina Søreide, for her guidance and constructive feedback along our research journey. Her expertise in this field has been both inspiring and motivating for our future work.

Further, we would like to thank Ivar Kolstad and Shrey Nishchal for their availability and technical contributions. We would also like to thank the Norwegian salmon exporters responding on our emails and the interviewed firm representatives for taking the time to comment on our results. These commentaries gave us valuable information about the industry and inputs used to illuminate our results.

We would also like to thank the Norwegian Centre for Taxation (NoCeT) and the Norwegian Tax Administration for a pleasant lunch and for awarding us their grant.

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Clarification of Concepts

Impact of economic sanctions: is in our thesis defined as how firms are financially affected by an economic sanction in terms of profitability, increased costs and changes in business strategy.

Informal economic sanction: is an economic sanction that is not publicly declared.

Sender country: is the country imposing an economic sanction, thus the sanctioning party.

Target country: is the country an economic sanction is aimed at, thus the sanctioned party.

The Chinese informal sanctions: describes the informal restrictions imposed on Norwegian exports, especially Norwegian salmon, after the Nobel Peace Prize award in 2010. These restrictions included, among others, extended quarantine practices, stricter testing and inspection procedures, and more restrictive import licensing for Norwegian salmon exporters.

1. Introduction

1.1 Motivation and Purpose

In April 2018 the Norwegian newspaper "Fiskeribladet" published a series of articles documenting a Chinese-Norwegian woman imprisoned in China for smuggling salmon from a Norwegian salmon exporting firm into China through Vietnam.[1] This led to speculations whether the Chinese economic sanctions, imposed after the Nobel Peace Prize in 2010, have contributed to an increase in Norwegian salmon exporting firms participating or contributing to illegal actions due to difficult market conditions. Even though it has not been formally proven that Norwegian firms have been involved in illegal actions, the sanctions imposed by China may have forced Norwegian exporting firms to consider new strategies. Despite the sanctions, Chen and Garcia (2016) show that Norwegian salmon continued to enter the Chinese market, in both legal and illegal ways.

Following basic microeconomic theory, firms have incentives to change their business strategy, when there is a more profitable alternative. In other words, they will be inclined to change their strategy if the cost of staying in a sanctioned market is higher than doing something else. With our thesis, we would therefore like to investigate whether the Chinese sanctions placed on Norwegian salmon exports impacted Norwegian salmon exporters financially. Our research ambition is to show empirically whether the sanctions had a negative effect on Norwegian salmon exporter's financial performance or not.

The purpose of our study has been to provide evidence on how informal sanctions impact firms' financial performance. In this respect, the study contributes to the literature on the effects of economic sanctions. Additionally, our analysis contributes to literature by taking a private actor perspective and investigate how firms in the target country are impacted by informal economic sanctions.

[1] To read some of the articles see; (Fiskeribladet, 2018a), (Fiskeribladet, 2018b) and (Fiskeribladet, 2018c).

1.2 Background and Research Question

Countries have different motivation for imposing economic sanctions against another country. Economic sanctions enforced through the United Nations are generally implemented to restore international peace and security, e.g. sanctions against the Iranian government for lacking transparency about its nuclear program,[2] or the more recent sanctions against Korea's nuclear weapon testing.[3] On the other hand, the recent US steel sanctions against China is said to be mostly motivated by protectionism.[4] Even though most sanctions are unwanted by the countries that are targeted, sanctions may, in some cases, be desired by the target or actors within the target country. An example of this is the global campaign BDS (Boycott, Divestment and Sanctions), founded by Palestinians in Israel to promote the use of economic sanctions against Israeli interests, to place a non-violent pressure on Israel. The movement is said to be inspired by the South-African anti-apartheid movement from 1959.[5]

In our thesis, we investigate how the Chinese informal economic sanctions implemented after the Nobel Peace Prize in 2010 financially affected Norwegian salmon exporters. Informal economic sanctions are economic sanctions not officially declared, hence an informal economic sanction could be informal restrictions imposed by a country against another country. Since the late nineteenth century, China increasingly has used informal economic sanctions to advance its political and strategic objectives (Rielly, 2012). In addition, Chinese sanctions are often imposed to affect firms in the target country who have commercial interests in China and/or rely on Chinese trade.

When the Chinese dissident, Liu Xiaobo, was awarded the Nobel Peace Prize in 2010, China reacted by imposing informal economic sanctions in the form of non-tariff barriers on Norwegian exports (Kolstad, 2016). Ongoing negotiations of a free trade agreement were put on hold and Norwegian exporting firms met increased bureaucratic obstacles. In addition, the

[2] https://www.cfr.org/backgrounder/un-sanctions-mixed-record

[3] https://www.bbc.com/news/world-asia-41235157

[4] https://www.bbc.com/news/world-43512098

[5] https://bdsmovement.net/what-is-bds

Norwegian share of the Chinese salmon market was reduced from 90 to 25 percent at the lowest between 2010 and 2016. This reduction occurred despite an increase in China's total salmon imports and in Norwegian salmon export in general (Chen & Garcia, 2016). Due to the difficulties of exporting Norwegian salmon to the Chinese market, some firms found alternative strategies to sell fish. Following the 2010 Peace Prize, it has been proven that firms and private actors have circumvented the sanctions through both legal and illegal approaches.

Following theory on international trade, trade barriers, such as economic sanctions, distorts trade flows between countries and reduce the potential benefits and welfare gains from trade. Since trade takes place through firms, we would also expect firms to be negatively affected by economic sanctions. However, a firm's opportunity to circumvent such market distortions could lead to a different conclusion. Our thesis attempts to answer the following research question:

What was the financial impact of China's informal sanctions on Norwegian salmon exporting firms?

In order to do an empirical analysis to answer our research question, financial statement data on Norwegian salmon exporters was collected. A Norwegian salmon exporter is in this case defined as a Norwegian-registered legal entity, which exports fresh and/or frozen salmon produced in Norwegian seawater. The number of Norwegian salmon exporters to China is low, thus our empirical results are sensitive to the number observations we could include in our dataset. However, to increase the reliability of our results, interviews with representatives from the Norwegian salmon industry was conducted. This gives us an additional perspective on how firms have acted in this situation.

The thesis is structured as follows: Section 2 presents relevant theories and terminology, followed by section 3 presenting a review of the empirical literature on economic sanctions and its effect on trade and firms. Section 4 and 5 presents the dataset and empirical methodology, while section 6 and 7 presents and discuss the findings of the empirical analysis. Lastly, section 8 discusses our findings based on the information collected though the interviews with representatives from Norwegian salmon exporting firms. Section 9 concludes.

2. Relevant Theories and Terminology

In this section, relevant theories and terminology is presented to get a deeper understanding of what an economic sanction is and how it affects a sanctioned country. The first part looks at how sanctions are defined, and we distinguish between different types of economic sanctions. Further, we discuss what is meant by the terms effective, efficient and successful economic sanctions. Moreover, we define what is meant by a Norwegian salmon exporting firm and the firm's costs of economic sanctions. Lastly, we present related concepts from theory of international trade and microeconomic theory on firm behavior.

2.1 What are Economic Sanctions?

An economic sanction is a foreign policy instrument often used to change a sanctioned party's behavior, which is unwanted by the sanctioning party (Pape, 1997). The sanctioning and the sanctioned party are often exercised by countries or governments, but sometimes also by large multinational firms and organizations. Consistent with literature, the sanctioning party is referred to as "sender", while the sanctioned party is denoted "target" in our thesis.

Scholars have distinguished between two types of economic sanctions; positive and negative (Caruso, 2003). Positive economic sanctions are defined as actions taken to encourage cooperation between countries, while negative economic sanctions attempt to harm the target's economic interests (Caruso, 2003). In this thesis we deal with negative [informal] economic sanctions inflicted to hurt Norwegian salmon export. Therefore, the expressions "economic sanction", "the sanctions" and "the Chinese sanctions" all refer to what the literature defines as negative economic sanctions.[6]

Caruso (2003) divides economic sanctions into three types; boycotts, embargoes and financial sanctions. Boycotts limit the imports of goods from a target country by lowering demand for products from the targeted country. Hence, the sender country seeks to damage an industry of the target country by lowering its rents from international trade (Caruso, 2003). With

[6] Informal sanctions are further explained in section 2.1.1.

embargoes, exports of products to the target country are fully or partially restricted, while financial sanctions are financial penalties restraining investment and lending in the target country (Caruso, 2003). Thus, when economic sanctions are initiated to suspend trade in order to attain political objectives, it is occasionally also referred to as trade sanctions (Lindsay, 1986). For the purpose of this thesis, the definition presented by Chen and Garcia (2016) is suitable when defining the Chinese restrictions against Norwegian salmon. Here, the Chinese restrictions against Norwegian salmon are defined as "a *partial boycott*, imposed on one good for which there are reasonably close international substitutes, limiting the disruption to China's domestic market, while concentrating the effect on Norway" (Chen & Garcia, 2016). A partial boycott does not restrict all exports from the targeted country but only one or a few goods exported by the target.

Further, sanctions can be defined as multilateral or unilateral depending on the number of sanctioning actors involved (Caruso, 2003). A multilateral economic sanction is imposed by a cooperation of more than one actor, while a unilateral economic sanction means that only one country independently imposes a sanction on another country. Since China independently imposed an economic sanction on Norway, this sanction is characterized as unilateral. According to Drezner (2000), unilateral sanctions infer a more credible commitment from the sender, which makes them more likely to succeed. On the other hand, trans-shipment through third-countries makes unilateral economic sanctions less effective (Caruso, 2003; Chen & Garcia, 2016). Similarly, multilateral sanctions with international support are more effective compared to unilateral sanctions (Drezner, 2000).

Lastly, sanctions can be characterized trough their objectives. In many cases, a sanction´s objective is to force a change in the target's behavior, while it in other cases is to demonstrate a disapproval of the target country's policies (Malloy, 2000). There are also examples of cases where economic sanctions have been used against a country because of its violation of human rights,[7] or as a punishment of a country's use of military actions.[8] On the other hand, the

[7] See e.g. US sanctions against North Korea's for its human rights abuses (Forbes, 2017).

[8] See e.g. sanctions imposed against Yugoslavia between 1990 and 2000 (The New York Times, 1998).

motivations behind the imposition of economic sanctions can independently be based on the sender's status and behavior, e.g. protectionism.[9]

2.1.1 Informal Economic Sanctions

In this study, it is relevant to distinguish between formal and informal sanctions. A *formal* economic sanction is an economic sanction formalized through domestic law and/or presidential decisions, while *informal* economic sanctions are economic sanctions which rarely are officially declared (Rielly, 2012). To exemplify this, formal sanctions could be sanctions formally consolidated by the United Nations Security Council, while informal sanctions could involve unofficially selective boarder measures, which systematically discriminates against another country's imports or other informal measures which are difficult to prove (Chen & Garcia, 2016; Rielly, 2012; United Nations, 2018). Thus, an informal economic sanction could be seen as restrictions imposed by a country against another country.

In general, the legal status of economic sanctions is evaluated by the World Trade Organization (WTO), which seeks to limit the use of trade restrictions as a political tool. Because of the legal limitations set by the WTO, informal sanctions have been a preferable tool due to its flexibility and credible deniability, meaning they are difficult to prove (Chen & Garcia, 2016; Rielly, 2012). Informal sanctions have also been a frequently used tool by China in international trade politics to advance its strategic and diplomatic objectives (Rielly, 2012). The assumption behind China´s sanction strategy is that the threat of market loss on an industry or firm will compel these influential industries or firms to lobby their home government in a pro-China way (Rielly, 2012). The cost of these sanctions is here addressed specifically on the target country's participants in the Chinese market, with the power to influence the target country's state policies. The Chinese economic sanctions imposed on Norwegian salmon exporters is characterized as an informal sanction since it has not been formally legislated and has not been in line with WTO´s rules (Chen & Garcia, 2016; Kolstad, 2016).

[9] See e.g. US steel sanctions against China (BBC, 2018).

2.1.2 Efficiency versus Effectiveness of Sanctions

The literature on economic sanctions is strongly influenced by research on how well sanctions perform, and the terms "efficiency" and "effectiveness"' are widely used to explain sanctions performance. These two terms are commonly misused in the daily language. This is also the case when talking about economic sanctions efficiency versus effectiveness, and it is therefore important to distinguish between the two.

In terms of an economic sanctions' efficiency, Stepien, Pospienszna and Skrzypczynska (2016) defines this as the ratio of inputs (in economics usually refers to resources) to outputs (which is a specified outcome). Resources refer to both material and immaterial inputs, e.g. a combination of physical resources, information and intellectual capital. The definition of efficiency relies on an assumption that the costs following sanctions are measurable and traceable, and that the outcome is a well specified goal. In other words, economic sanctions' efficiency is defined as a measure of the resources needed to achieve a specified goal.

On the other hand, Stepien et al. (2016) shows that scholars attach different meaning to the understanding of an economic sanctions' effectiveness. They also highlight the fact that in many cases scholars do not even define what they mean by the sanctions' effectiveness, but rather focus on under what conditions sanctions fail or succeed. A common understanding of sanctions' effectiveness is conceptualized as the ability to reach a desired goal. Further, the effectiveness is described as a comparison of the benefits connected with achieving the sanction's goal and the necessary costs in order to achieve the goal, where the value of these benefits is subjectively assessed.

In order to make a distinction between the two terms, Stepien et al. (2016) states that the important difference is the way the "value" of the sanction is determined. Value is "the term that changes the way we evaluate the costs of the (sanction) leading to the outcome". While efficiency disregard the importance of a subjective valuation of the outcome, only focusing on the resources needed to reach a specific outcome, the effectiveness can be perceived differently depending on who evaluates the sanctions.

2.1.3 What Is Meant by a Succsessful Sanction?

A sanction´s success can be measured by its ability to reach a desired goal and its change in behavior of the target country (Chen & Garcia, 2016). Hence, a sanction´s success is defined similarly to a sanction´s effectiveness. Hufbauer, Schott, Elliott and Oegg (2007) argues that economic sanctions are used to trigger certain responses from the target country and that the obtained changes in the target´s behavior should be evaluated when determining a sanction's success.

When a researcher evaluates the success of an economic sanction, the choice of impact factor depends on the study in question. For instance, the impact could be a measure of how responsive the government in the target country is to the sanctions, or it could be measured by the economic or social pressure caused by the sanction (Stepien et al.,2016). Using different impact factors could lead to different conclusions for the same sanctions, when evaluating a sanction's success. Stepien et al. (2016) stresses the importance of taking spillover effects or externalities into account when evaluation sanction's success. This argument is based on the critics of economic sanctions, which claims that economic sanctions harm innocent people, and sometimes lead to an increase in criminal activities (for examples, see Andreas, 2005 or Redzic, 2012).

2.1.4 Norwegian Salmon Exporters

The Norwegian seafood industry is one of Norway's most important export industries, where 95% of the caught and produced fish in Norway are exported (NSC, 2018). If a firm is a Norwegian-registered legal entity, and exports fresh and/or frozen salmon produced in Norwegian seawater, it is defined as a Norwegian salmon exporter in our thesis. This includes firms of different sizes, measured in total sales which range from 9 million up to 15 billion NOK per year. Some have a multinational production, meaning that they have salmon farms in many different countries. The firms supply chains also varies, while some produce and sell their own salmon, others only buy and sell from producers. In the Seafood Councils Exporter Register 127 firms were registered as salmon exporters in November 2018. However, this is not a complete list because exporters voluntarily register to this list and controls of validity is seldom made. On the other hand, this is one of the few overviews that exist, and it is therefore used as one of our baselines in the data gathering process presented in section 4.

2.1.5 Exporting Firms Costs of Economic Sanctions

Sanctions as a foreign policy tool are extremely unpredictable for firms in both sender and target countries due to increased uncertainty and costs (Stepien et al.,2016). An economic sanction can be understood as an unexpected event, where the associated transaction costs related to trade increases for all parties involved. This type of disruption causes firms to act differently and find alternative ways to function in the market.

Cost of economic sanctions can be divided into three types; direct costs, indirect costs and potential costs (van Bergeijk, 1989; Losman, 1998). The direct costs involve additional financial costs immediately arising due to the sanctions, such as loss of sales and earnings, loss of asset value and reduced employment. Following van Bergeijk (1989), the indirect costs occur when the disruption causes the domestic market to slow down due to lower export. However, Losman (1998) is more "firm-oriented" in his definition and explains the indirect costs of sanctions as higher costs due to lower production runs and lower economies of scales. In addition, firms' indirect costs of sanctions could involve increased lobbying expenses to avoid the sanctions. Potential costs are related to anticipated future revenue which no longer will be realized. Depending on the type of economic sanction, potential costs could arise when the competition in the market changes as a result of the sanctions. Considering a boycott, potential costs arise when new firms develop in the sender country and fills the market share left by the firms in the targeted country, making it more difficult to re-establish in this market after the sanctions.

Further, sanctions lead certain costs associated with entering the foreign market to become sunk (Afesorgbor, 2016). Examples of firms' such sunk costs are market research or costs due to customization of goods toward the preferences or standards in that country.

2.1.6 Circumvention of Sanctions

The imposition of costs on firms followed by economic sanctions give firms strong incentives to evade and circumvent the sanctions (Hufbauer, Schott, Elliott, & Oegg, 2007). Economic sanctions can be circumvented in a variety of ways, for examples see e.g. Chen and Garcia (2016). In the literature on economic sanctions, several scholars describe the circumvention of sanctions by the term "sanctions busting" (e.g. Caruso, 2003; Drezner, 2000; Early, 2009).

Sanctions busting is a term often used to describe how sanctions imposed by a cooperation of countries, like a multilateral sanction, fail because of private actors in countries of the coalition who bust the sanctions and contradicts the coalition's agreement (Drezner, 2000). Drezner (2000) defines sanctions busting as the deliberate act of private actors to bust the sanctions in order to extract economic rent. He also states that in terms of economic sanctions, this is always likely to happen.

Following Chen and Garcia (2016), sanctions-busting activities comes at a cost. These costs are related to "premiums and discounts in the price of tradable goods, potential increase in marketing costs related to hiring intermediaries, rerouting of goods, and counterfeiting, smuggling, bribery and other forms of corruption" (Chen & Garcia, 2016). However, even if the term sanctions busting often relates to illegal actions by participants in international trade, it is important to address that to circumvent an economic sanction does not necessarily need to be illegal. Using the Chinese sanctions as an example, some exporters of Norwegian salmon were able to keep their market shares in the Chinese salmon market, by selling salmon originated from Chile or Faroe Island, instead of salmon originated from Norwegian seawater.

2.2 Related Concepts

International trade is associated with increased welfare and a variety of benefits for the participants involved. However, economic sanctions, and especially trade sanctions, are known for imposing barriers against international trade and, thus lowering the associated benefits. In this section general theory on international trade is presented, followed by a section discussing how economic sanctions may disrupt trade. Lastly, microeconomic theory on firm behavior is presented to explain how firms adapt to changes in their market environment.

2.2.1 Theory on International Trade

In order to explain why countries trade with each other, we use the classical concepts from theory on international trade. According to the principle of comparative advantage, a country will export goods in which it has a comparative advantage and import goods where its trade partners have comparative advantage (Norman & Orvedal, 2012). A country has a comparative advantage in the production of a good, if the alternative cost of producing this good is lower

for the country concerned, than for other countries. Following this, trade will utilize the different countries' comparative advantages leading to increased welfare gains for both countries.

Some of the stated benefits of international trade are related to economies of scale, increased productivity and innovation, increased competition, spillover effects in technology and knowledge, and general welfare gains, such as economic growth (Norman & Orvedal, 2012). Based on the concept of comparative advantage, several theories have been developed to explain how all countries can benefit from international trade. One of the theories frequently used is the Heckscher-Ohlin theory, which explains how comparative advantages is related to the factor endowment in each country. However, in order to illustrate how international trade is beneficial for all countries involved, a general equilibrium model for one country is used. This model is based on Norman and Orvedal (2012) which explains how a country adjusts in an autarky and when it opens up to trade.

In figure 1, the production possibility frontier (PPF) indicates the production possibility in the economy, which is limited by the economy´s access to resources and technology. Although the economy produces more than two goods, this analysis simplifies the economy by only looking at two goods. Further, the country is organized as an economy with perfect competition containing homogenous consumers which takes prices and income as given.

In autarky, profit maximizing producers choose an output such that the price ratio equals the marginal rate of transformation (MRT), and consumers choose their consumption level such that the price ratio equals the marginal rate of substitution (MRS). In the general (autarky) equilibrium, the domestic supply of goods is equal to domestic demand. This occurs at the point of tangency between the PPF and the indifference curve, which is represented by point A in figure 1. Since firms will produce at point A, where the slope of the PPF is equal to the price ratio $(p_1/p_2)^A$ and consumers will consume at point A where the slope of the indifference curve is equal to $(p_1/p_2)^A$, the market clearing point in A is given by the mutual tangencies of MRT and MRS. These mutual tangencies also represent the budget line in autarky for the consumers.

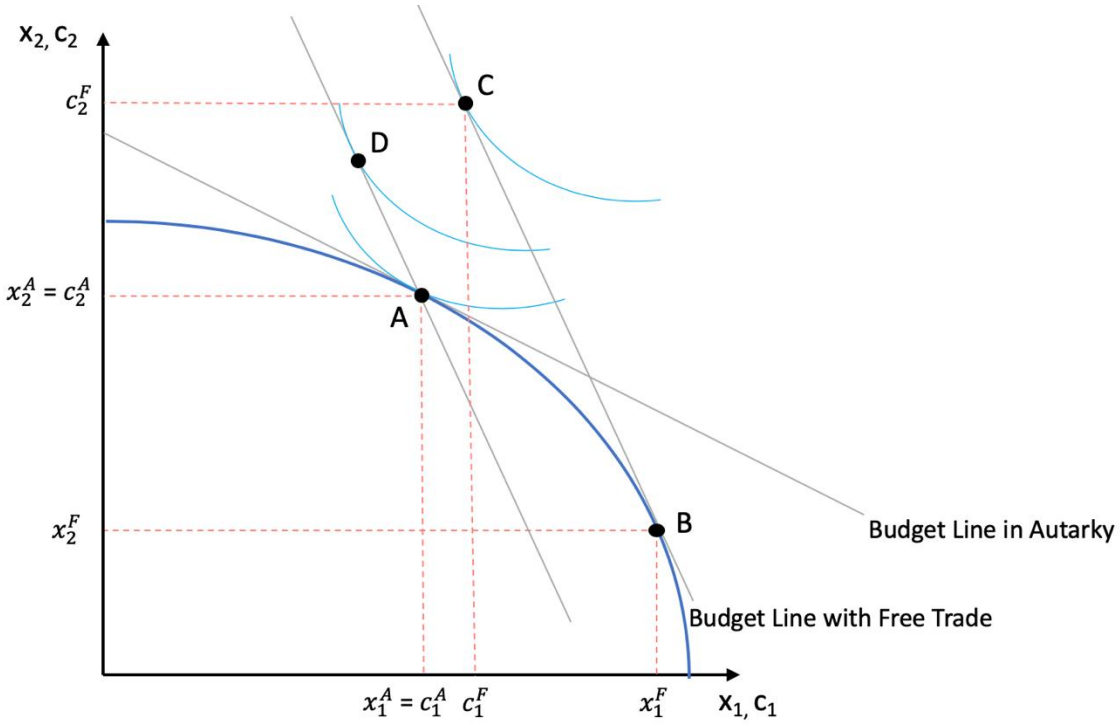

Figure 1: *Adjustment in autarky and free trade* (Norman & Orvedal, 2012).

If the country opens up to trade, the country is no longer restrained to only consume what it domestically can produce. Further, the price ratio changes as the economy now trades at a fixed world price. If we assume no transportation costs and that both producers and consumers behave optimally, producers will conform to point B in figure 1 where MRT equals the world price ratio, $(p_1/p_2)^F$. With trade, producers utilize their comparative advantage and the production shifts from A to B. Given the old budget line, the new price ratio brings consumers to a higher indifference curve represented by point D. However, with the domestic production in B and the price ratio $(p_1/p_2)^F$, consumers receive a new budget line given by the tangent in point B. As a result, they will adjust consumption to point C, where the international price ratio equals the MRS. This illustrates an even higher welfare gain for consumers, shifting from the indifference curve in point D to point C. The consumers´ gain from D to C can therefore be interpreted as the gain achieved by utilizing comparative advantages. In total, the country will export (x_1^F - c_1^F) units of good 1 and import ($c_2^F - x_2^F$) of good 2.

As this analysis shows, all countries can benefit from trade (Norman & Orvedal, 2012). In an open economy, the relative differences in prices creates a new general equilibrium allowing for allocations which were not feasible in an autarky. With trade, consumption is separated

from the domestic production, and the economy can achieve production- and consumption bundles which were not possible in an autarky. Hence, consumers are brought on a higher indifference curve and get a greater selection of goods. In an autarky, the consumer´s option was constrained by the PPF, while it with trade only is restrained by the budget constraint. Hence, consumers obtain a greater product variation and higher utility with trade.

2.2.2 Sanctions Impact on Trade

The Chinese economic sanctions were in the form of non-tariff barriers where the quantity of Norwegian salmon imported by China was reduced (Kolstad, 2016). Non-tariff barriers are non-tax measures imposed by a government to favor domestic production over foreign (Coughlin & Wood, 1989). In order to understand how sanctions impact trade, an analysis of the demand and supply of imports in a country is used to understand sanctions´ effect on trade. This theoretical analysis is based on Coughlin and Wood (1989) which describes the effect of non-tariff barriers in the form of quotas. Quotas are non-tariff barriers restraining imports by imposing a maximum number of products allowed to be imported in a specified period (Coughlin & Wood, 1989). Although, the Chinese sanctions did not set a maximum amount of import of Norwegian salmon, the quantity was reduced, implying many of the same effects occurred as with a quota. While, the theoretical analysis cannot quantify the effects of non-tariff barriers, it is useful to understand their effects on supply- and demand for imports.

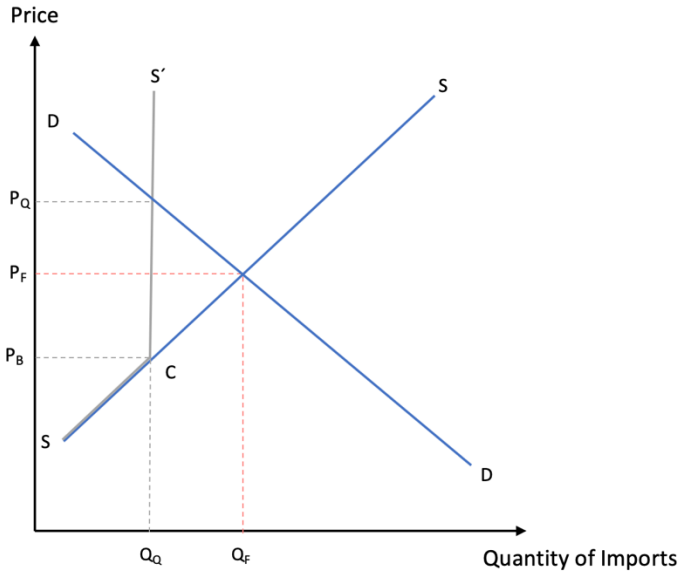

Figure 2: *Effects of a Non-Tariff Barrier* (Coughlin & Wood, 1989).

In figure 2, a country´s demand for imports of a good produced by domestic and foreign producers is represented by the demand curve, DD. The supply for imports is represented by the supply curve, SS. With free trade, the demand of imports equal supply of imports and the country will import Q_F units of a good at the price P_F per unit.

When a non-tariff barrier in the form of a quota is imposed, the amount supplied to the country is restricted to Q_Q. The restriction gives a vertical supply curve from the restricted quantity, Q_Q, meaning the supply curve now will be the kinked curve SCS´. Consequently, the amount imported is reduced from Q_F to Q_Q. The decreased imports increase the domestic price from P_F to P_Q, while the foreign price decreases from P_F to P_B. The difference in price between domestic and foreign consumers, P_QP_B, is a premium per unit imported and can be appropriated either by exporters, importers or by the government (Coughlin & Wood, 1989). The rise in domestic prices decreases total consumption of the good in the country. Hence, leaving the domestic economy worse off after the trade barrier by increased prices and lower total supply. Unless the foreign country has other markets to substitute its reduced imports to, they could also be worse off after the trade sanction in imposed. The foreign country's reduction in welfare can be explained by e.g. a reduction in their economies of scale and a lowering in trades positive spillover effects.

2.2.3 Microeconomic Theory on Firm Behaviour

In terms of predicting how firms behave and adapt to changes in their market environment, we use the neoclassical perspective of profit maximization. Here, firms are assumed to be rational profit maximizers where profits are maximized when marginal costs equal marginal revenue (Cowell, 2006). In a standard analytical framework, we assume the market has perfect competition, meaning a firm will take prices for input and output as given. The firm´s production function specifies the maximum amount of output produced given a vector of inputs, while the isocost line represents combinations of inputs with the cost. The figure below shows a simplified version of a firm and the production possibilities of two outputs x_1 and x_2. As stated earlier, PPF measures the maximum level of good $x_1$which can be produced given the amount produced of good x_2 (Cowell, 2006). The firm´s objective is to maximize profits, meaning it will minimize costs for a given output level by reaching the lowest isocost line, subject to the input requirements.

Figure 3 describes the firm's optimization problem. Here, the firm will produce at point A, where the MRT, the marginal value of the two goods, equals the price ratio (p_1/p_2). Hence, in a competitive market, the fundamental economic problem of the firm is to minimize the costs of inputs, for a given output and then optimally select output which maximizes profit (Cowell, 2006).

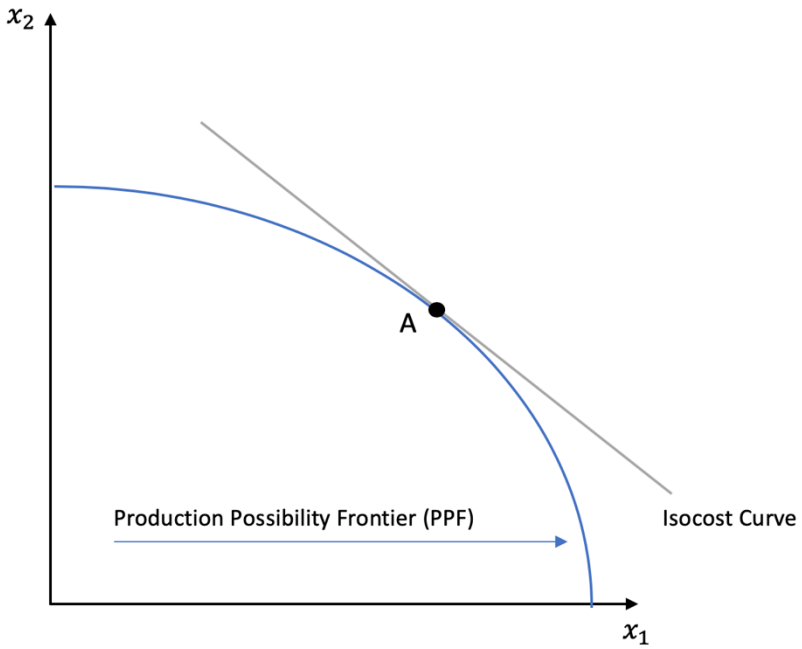

Figure 3: *Profit maximizing firm's optimal production* (Cowell, 2006).

In the short run, inputs are assumed to be fixed (Cowell, 2006). This means firms take input levels as given, making it less flexible to respond to market disruptions. Since the costs in the short run are both fixed and variable, while the costs in the long run are considered variable, a firm is more flexible in the long run.

Although, most papers assume firms to be profit maximizing, the assumption is unsatisfactory when taking uncertainty and risk aversion into account (Sandmo , 1971). Uncertainty and risk will in reality affect the decision-making process and the estimation of revenue and costs. This makes the rational firm continuously revising its expectations about future returns and amount traded to international markets (Li & Sacko, 2002). Furthermore, the firm will adjust its strategic objectives by creating tactics to overcome the uncertainty and complexity in the market (Kantarelis, 2007).

3. Empirical Literature

The previous section reviewed theoretical explanations behind economic sanctions and trade. When revising the empirical literature on sanctions, empirical research mainly takes a macroeconomic perspective, studying the aggregated behavior of the target and sender countries to determine how they are affected by sanctions. Empirical literature does, to a smaller extent, take microeconomic effects into account when evaluating sanctions.

In this section, relevant empirical literature is presented. The first three sub-sections take a macro perspective: 3.1 investigates economic sanctions' effectiveness, 3.2 presents empirical literature investigating the benefits of international trade, while 3.3 highlights the literature's perspective on how sanctions undermine benefits from international trade. Further, section 3.4 presents literature on how firms adapt to economic sanctions, followed by a summary of the reviewed literature. Section 3.6 presents our hypothesis based on the presented literature and theories.

3.1 Effectiveness of Economic Sanctions

A significant part of research on economic sanctions examines a sanction´s effectiveness, and under what conditions a sanction is likely to reach its desired goals or political objectives (Stepien et al., 2016). The most influential and widely cited source on economic sanctions comes from the researchers Hufbauer, Schott and Elliott which in 1982 registered and studied 103 episodes of economic sanctions, published in E*conomic Sanctions Reconsidered: History and Current Policy* (Hufbauer et al., 2007). The purpose of their study was to determine the effectiveness of economic sanctions as a foreign policy tool and identify under what conditions they are most likely to reach their policy goal. Later, several editions of their study were published with an updated dataset including new cases of economic sanctions. The newest edition includes over 200 cases of economic sanctions which have been summarized over 14 different variables in order to analyze their effectiveness. In contrast to current beliefs on sanctions being ineffective, their research found sanctions only reached their policy objectives one third of the time. Theirs empirical results caused a shift in the consensus from skepticism to positivism in academia (Pape, 1998).

Doubtful to the emerging optimism about economic sanctions, Robert Pape challenged the study of Hufbauer, Schott and Elliott and claimed their database (HSE-database) had major flaws. Through a reexamination of the 40 cases claimed successful, Pape concluded only 5 as successful. The reason was the methodological error in the HSE-database which "inappropriately includes (…) commercial negotiations and economic welfare" (Pape, 1997). In his study, he concludes economic sanctions have a low success rate and that they frequently fail in reaching their policy objective.

In order to identify factors affecting the success and failure of sanctions, van Bergeijk (1989) conducted a study to analyze the conditions in which an economic sanction causes a reaction from the target. His results support the idea of longer sanction periods making sanctions less successful. He also finds that the probability of success increases with a higher trade linkage in pre-sanction periods, and the more unstable the target´s political situation is. This is explained by a hypothesis that potential damage increases as trade linkages increase and that a sanction has a better chance to succeed against a weak regime.

Further, Dizaji and van Bergeijk (2013) detected how economic and political impacts of an economic sanction can explain why a sanction is more successful in the first two years. In their empirical analysis, using Iran as a case study, they find that a sanction´s effect can be linked to its duration or time span. Here, a sanction has a greater effect in the initial phase, which decreases with time. Hence, sanctions have a higher probability of success in the earlier stages since the possibility of economic adjustments makes it possible to alleviate the impacts of sanctions in the long run.

Afesorgbor (2016) finds a similar result where the effectiveness of a sanction is determined by its duration. Here, sanctions with longer time span are less successful. The reason is that the time dimension gives actors negatively affected in the target economy, the possibility to adopt strategies that can mitigate the costs of the sanctions.

In addition to research on sanctions' effectiveness and success, newer literature focus on the unintended consequences of sanctions and highlights the importance of including such factors when evaluating a sanction´s effect, success or failure. Although, the sanction's objective is meant to target the government, civilians are often caught in the crossfire capturing many of the negative effects. As a result, sanctions decrease the economic growth and development in

the target country (Afesorgbor, 2016). These adverse effects have caused a shift towards the use of “smart sanctions” where the consequences of the sanction are targeted towards the government in order to protect the civilian population. As a result, smart sanctions are considered more effective compared to broader sanctions (Hufbauer & Oegg, 2000).

Andreas (2005) also look at the broader effects of sanctions and contributes to the literature by looking at the criminalizing consequences of economic sanctions. His research analyzes the potential criminalizing effects of sanctions within and around the target country, and during and after the sanction period. Here, he has developed his own analytical framework to identify and categorize potential criminalizing effects, such as organized crime, smuggling, underground economic activity and corruption. The results suggest that sanctions unintentionally can contribute to criminalization of the state, economy and civil society.

3.2 Benefits of International Trade

Sachs and Warner (1995) conducted a study to assess the effect of global integration on economic growth in countries undergoing economic reforms to integrate the country with world systems. They found a positive correlation between trade liberalization and economic growth, and that openness to trade is correlated with stable macroeconomic policies and a more responsible government.

Further, Fetahi-Vehapi, Sadiku and Petkovski (2015) conducted a panel data analysis of 10 countries in South-East Europe to estimate the effect of openness to trade on economic growth. They find that positive effects of trade are contingent on initial levels of income per capita and that higher initial income per capita causes trade to be more beneficial for a country. Samimi and Jenatabadi (2014) conducted a similar study where they investigated members of the Organization of Islamic Cooperation (OIC) in order to deter the effect of globalization on economic growth and income levels. Their study finds evidence of economic globalization increasing economic growth and that this effect increases when workers in a country have higher education and better financial systems. Further, they find that benefits from trade depend upon the income level in a country, where countries of high or middle income have the highest benefits, while the effect is small for low-income countries. This is explained by

low-income countries suffering from underdeveloped financial systems and less skilled labor, making it more difficult to utilize from trade.

Following Schneider (2004), trade encourages innovation in a country as foreign technology gets available. These findings are found by empirically investigating whether trade can determine the rate of innovation and economic growth in developed and developing countries. Additionally, he locates market size and infrastructure as the most important factors for the rate of innovation resulting from international trade.

Moreover, Keller and Yeaple (2009) estimate international technology spillovers to U.S. manufacturing firms via imports and foreign direct investments (FDI). Their results suggest that FDI lead to substantial productivity gains, accounting for around 14 percent of U.S. firms' productivity growth between 1987 and 1996. Similarly, Chuang and Hsu (2004) finds that the presence of foreign ownership in a country has a positive effect on domestic firms' productivity, investigating China's manufacturing sector. In addition, they find that trade helps Chinese firms get access to newer technology and information, which increase their productivity and makes the country able to compete in international markets. These findings are also supported by Koko, Zejan and Tansini (2001) who looks at the spillover effects of FDI in Uruguay. They find that the labor productivity of local firms increases with the presence of older multinational companies (MNC) in their industry. Additionally, they find evidence that local firms may pick up skills from the outward-oriented foreign MNCs, which increase the local firms' likelihood to engage in exporting. Lee (2005) find support that international knowledge spillovers increase through inward FDI, however outward FDI does not show to conduct this knowledge spillover in his research.

3.3 Economic Sanctions and Their Impact on Trade

Regardless of the effectiveness of sanctions, economic sanctions can still affect the trade relation between the sender and target country (Afesorgbor, 2016). When trade is deprived, it reduces the benefits from international trade and consequently lowers welfare (van Bergeijk, 1989). Whether the sender or target country is more or equally affected by this loss in benefits depends on a various of factors, e.g. type of sanction (embargo versus boycott) or the possibility to substitute goods (both for imports and exports).

Following Morrow, Siverson and Tabares (1998), trade flows are affected by politics since actors in international trade care about political risk. They argue that increased political conflict between countries, disrupt trade between countries by introducing risk to economic actors. The greater the likelihood of a conflict, the more profitable trade must be to compensate for the risk of disruption (Afesorgbor, 2016; Morrow, Siverson, & Tabares, 1998). This view is also confirmed by Fuchs and Klann (2013), who empirically investigate whether countries that officially receive the Dalai Lama, despite China's opposition, are punished for this through a reduction in their exports to China.[10] They prove that even without an explicit conflict or formally declared economic sanction, political disagreement can affect bilateral trade.

Further, Heilman (2016) uses a difference-in-difference method in order to estimate the impact of several incidents of politically motivated boycotts in the time period 2005 until 2016. His results show that boycotts can have a significant negative effect on bilateral trade. However, Heilman estimates a rather small effect of the boycott on the boycotted country's overall trade. This suggest that countries with diverse range of export goods and destinations, can substitute some of their exports towards non-boycotting countries.

Kolstad (2016) uses a synthetic control approach to estimate the effect of the Chinese sanctions following the 2010 Nobel Peace Prize on Norwegian exports of fish and other goods. In addition, he estimates the effect of the prize on Norwegian foreign policy on human rights. He finds that the sanctions reduced both direct total exports and direct exports of fish from Norway to China. These results suggest that direct total exports would have been 10 to 16 percent above their actual levels in the period between 2011 and 2013, and that direct fish exports would have been 10 to 14 percent above their actual levels. Commenting on these results he adds that some of the reduction in exports could have been "compensated through higher exports through third countries such as Hong Kong or Vietnam" (Kolstad, 2016). He also finds that by 2014 exports rebounded to normal levels, meaning that he could not find any significant difference between Norwegian exports and the comparable control group. He explains this normalization by a weakening of Norwegian foreign policy and Norwegian

[10] The so called "Dalai Lama effect" (Fuchs & Klann, 2013)

government's efforts to distance itself from the prize. His research also shows that immediately after the prize, Norwegian agreement with Chinese voting in the UN on human right resolutions increased.

Caruso (2003) investigates the impact of economic sanctions on international trade, using a gravity model approach to estimate the impact of [negative] economic sanctions on international trade. His results, using data on bilateral trade between the U.S. and 49 target countries, show that multilateral sanctions have a large negative effect on trade flows. Part of his study focuses on the impact of unilateral U.S. sanctions on bilateral trade between sanctioned countries and the other G-7 countries. Unilateral extensive sanctions show to have a large negative effect, while limited and moderate sanctions cause a positive effect on other G-7 countries aggregate bilateral trade. These results confirm the fact that sanctions-busting actions are always likely to occur, and that in terms of imposing an economic sanction there is always a risk that the sanction will be inefficient because of sanctions-busting activities.

3.4 How Firms Adapt to Economic Sanctions

How a country responds to an economic sanction does not only rely on the reactions from the government, but also upon consumers and producers in the economy and their behavior (Afesorgbor, 2016). Van Bergeijk (1989) states that "quite generally sanctions are believed to be ineffective because it is normally impossible to create the necessary political unity for a forceful embargo and (if established) embargoes and trade warfare are easy to circumvent". Firms and private actors do not necessarily comply to the sanctions imposed by foreign and national governments but adapts to the sanctions in order to minimize/maximize the potential negative/positive impact. The literature highlights this in different ways.

Chen and Garcia (2016) combine personal interviews of stakeholders in the Norway-China salmon trade with examinations of trade data to investigate several aspects of the Chinese sanctions against Norwegian salmon. In particular, the study confirms that China's economic sanctions were implemented through non-tariff barriers due to awarding the Chinese dissident, Liu Xiaobo, the Nobel Peace Prize. In addition, they describe how Chinese and Norwegian firms, and other regional players, circumvented the sanctions. They suggest that private actors have busted the Chinese sanctions by circumventing stricter border measures, rerouting of

goods, falsifying country-of-origin certification and smuggling among other illegal actions. They point out that even though official statistics show a reduction in Norway's market share in the Chinese salmon market, despite a growth in total imports of salmon to China, official data do not record Norwegian salmon entering illegally.

The study of Chen and Garcia (2016) is somewhat related to the results of Heilmann (2016). Part of his analysis suggests that firms that face boycotts, with a diverse range of export goods and destinations, can substitute some of their exports to other non-boycotting countries.

Afesorgbor (2016) takes a different perspective and looks at the impact of the threat of sanctions compared to imposed sanctions. Equivalent to Caruso (2003) and Heilmann (2016) his results imply that imposed sanctions lead to a decreased bilateral trade flow between target and sender country. On the other hand, a threat of an economic sanction leads to an increase in these trade flows. This positive impact on trade flows is explained by economic agents' actions to minimize the negative consequences of an actual imposition of sanctions (Afesorgbor, 2016). Following Fuchs and Klann (2013), firms engaging in international trade do not only make strategic decisions based on measures such as price and quality, but also based on the political risk associated with trade and its financial return.

Moreover, Li and Sacko (2002) investigates how uncertainty in the form of conflict affects trade. In their paper, they state that governments in conflict has incentives to inflict trade restrictions on the other parties involved. When implementing trade restrictions, the government has several options to choose from as economic sanctions, embargoes or other limitations on export. Their research suggests information conditions affect trading firms' beliefs about expected returns and that they adjust trade accordingly. Hence, firms will continuously evaluate and update their expectations of future returns and take this into account in their decision making.

3.5 Summary of the Empirical Research

A significant part of the research on economic sanctions examine a sanction's effectiveness, and what factors determine a sanction's success or failure. The two most discussed articles in the literature is the research done by Hufbauer, Schott and Elliott in 1982 and Robert Pape in

1997, who genuinely disagree about to which extent economic sanctions is an effective foreign policy tool. Some of the important conditions identified in the literature to determine a sanctions success is the duration of the sanction, degree of trade linkage between sender and target country and target county's political regime (e.g. van Bergeijk, 1989; Dizaji & van Bergeijk, 2013). Newer research on sanction's effectiveness and success focus more on its unintended consequences (e.g. Andreas, 2005; Afesorgbor, 2016).

Regardless of the effectiveness of sanctions, economic sanctions can still affect the trade relation between the sender and target country. Theory and empirical literature on international trade emphasize the wealth gain and benefits which follows trade (e.g. Fetahi-Vehapi et al., 2015; Keller & Yeaple, 2009; Schneider, 2004; Samim & Jenatabadi, 2014). In addition, the empirical literature on economic sanctions shows that economic sanctions reduce trade flows between countries (e.g. Morrow et al., 1998; Caruso, 2003; Fuchs and Klann, 2013; Kolstad, 2016), hence lower the potential wealth gains and benefits.

Furthermore, the literature on economic sanctions identifies how firms and private actors adapt to sanctions by circumventing them. Circumvention can in some situations be done through both legal and illegal actions (Chen & Garcia, 2016), and the duration of the sanctions is said to give the firms involved, the possibility to adopt strategies that can mitigate the costs of the sanctions (Afesorgbor, 2016). Firms also seem to take political risk into account in their decision making, where economic sanctions and political instability increase the potential costs on firms and their aversion to trade (Fuchs & Klann, 2013; Li & Sacko, 2002).

3.6 Hypotheses

Economic sanctions are sometimes imposed to affect influential firms or industries in the target country negatively, in order to compel these firms or industries to lobby their home government in senders desired direction (Rielly, 2012). It has also been proven that the economic sanctions China imposed against Norwegian salmon have been successful in terms of being able to change Norwegian foreign policy (Kolstad 2016). Following both terminology and theories presented in section 2 and the literature review in section 3, the first hypothesis of our thesis is:

Hypothesis 1: *The Chinese sanctions had a negative financial impact on Norwegian salmon exporters.*

The first hypothesis does not take the time dimension of the sanctions into account. There might be that the impact of the Chinese sanctions differed over time. The second hypothesis of our thesis is therefore:

Hypothesis 2: *The Chinese sanctions had a greater negative impact on Norwegian salmon exporters in the short run than in the long run.*

4. Data

To test the stated hypotheses in the previous section empirically, we have gathered a dataset containing financial statement data on Norwegian salmon exporters. In this section the process of retrieving data is elaborated. Section 4.1 presents how the sample was built, while 4.2 explains how the data was collected. Furthermore, section 4.3 describes the reasoning behind the chosen variables in our model, followed by 4.4 presenting the sample restrictions. Lastly, descriptive statistics are presented in section 4.5.

4.1 Building the Sample

Our thesis investigates the financial impact of the Chinese sanctions on Norwegian salmon exporters. Since there exist no official records of which Norwegian firms that export salmon to China, these firms had to be identified. We contacted institutions and organizations in Norway that most likely had an overview of which firms have China as their export market. Among these, the Norwegian Seafood Council (NSC) and the Norwegian Food Safety Authority (NFSA) were contacted. This gave us three separate lists with information about Norwegian firms which may have exported salmon to China.

The Exporter Register ("Eksportørregisteret") is a list facilitated by the NSC, where Norwegian firms provide information about which species they sell and/or produce and their export destinations.[11] However, the register does not provide detailed information about time, and species per export destination, which makes it difficult to detect the firms exporting salmon to China before and during the sanctions. Another problem with this list, is that it is voluntarily for firms to register and the NSC is not responsible for updating the list. This means there could be an undefined number of firms exporting salmon to China that are not represented in this register.

Due to the weaknesses with the Exporter Register, firms from two additional lists are included when building the sample. The NFSA provided us with a list of Norwegian firms exporting

[11] The Exporter Register can be found here: https://seafood.no/eksportorer/eksportorregister/

salmon to Vietnam in 2016 and 2017. These firms are evaluated with the argument from NFSA stating that firms exporting salmon to Vietnam also are likely to export salmon to neighboring countries, as China.[12] Additionally, they provided a list of firms that received a license to import different types of seafood to China in 2017. Out of this list, we extracted the firms which were given a license to export "fish".

From the three lists, we have a total number of 82 firms which may have exported salmon to China. Further, firms not exporting fresh and/or frozen salmon were excluded based on information from the firms' websites and annual reports. This process gave us a sample of 46 firms,[13] which we assumed had exported salmon to China before and/or during the sanction period. However, in order to confirm whether they had exported salmon to China before or during the sanctions, we had to contact these firms directly. This gave us the following results:

- 14 "Salmon exporters", Norwegian firms having China as export destination before and/or during the sanctions.
- 18 "Non-salmon exporters", Norwegian firms not exporting salmon to China.
- 14 firms were "lost".[14]

Due to the time limit and scope of our thesis, the dataset is limited to contain firms that we were able to get in contact with and confirm to be a salmon- or non-salmon exporter. Hence, we have maximized the number of observations to include in our sample based on the present limitations. Since there exists no full overview of Norwegian salmon exporters and their export destinations, this has added some additional weaknesses to the data gathering process. This is further elaborated in section 7.3.

[12] Information gathered from email correspondence with NFSA dated 21st of September 2018.

[13] Five firms were also excluded due to bankruptcy, non-Norwegian registration, or missing website and contact information.

[14] The "lost" firms were firms not replying after both a follow-up email and two follow-up phone calls. This group also includes firms that were not allowed to give up this kind of information or the ones not wanting to give an answer to the question.

4.1.1 Control Group

The non-salmon exporters are used as a control group, in order to evaluate how the Chinese economic sanctions affected Norwegian salmon exporters to China. This will also increase the number of observations in our dataset and improve the estimates of the control variables. The chosen method for our empirical analysis does not rely on any specific assumptions about a control group but including one will affect the interpretation of our results and potentially also our results. When it comes to the interpretation, we look at the effect on Norwegian salmon exporters relative to Norwegian non-salmon exporters to China. Whereas the results will be affected if Norwegian non-salmon exporters also were affected by the sanctions.

A more appropriate control group would be a group of salmon exporting firms that were neither directly or indirectly affected by the economic sanctions. However, a control group with these properties is difficult to find, and the time constraint of our thesis leaves us with the non-salmon exporters as the best possible alternative.

4.2 Data Collection

The dataset used in this thesis builds on data collected from various sources. Firstly, financial statement data on the identified firms are collected from the database SmartCheck. This database contains financial statement data for over 8000 Norwegian firms, including officially available firm reports and statutes. Secondly, since SmartCheck only allows us to export financial statement data dated back to 2008, data for the years between 2005 and 2007, was conducted using the Norwegian information platform Proff.no. Thirdly, to be able to calculate the age of the firms, information about the firms' year of foundation was gathered from The Brønnøysund Register Center.[15]

[15] Brønnøysund Register Center is a publicly available and trustworthy registers for individuals and businesses in Norway. www.brreg.no

4.3 Variable Selection

In the following sections we present the variables used in the empirical analysis, which includes arguments for why they are chosen and how they are measured.

4.3.1 Dependent Variable

To test the financial impact of the Chinese sanctions on Norwegian salmon exporters, a financial measure capturing the salmon exporters' performance has been used as a dependent variable. There are several approaches to measure firm's financial performance using financial statement data. The measures most frequently used are the following four accounting-based measures: return on asset (ROA), return on equity (ROE), return on sales (ROS) and return on capital employed (ROCE). In this study, ROA is used and calculated as net income in percent of total assets for the opening balance.

The literature commonly uses ROA as a measure of performance or profitability (e.g. Yazdanfar & Öhman, 2014; Goddard et al., 2015). ROA is found to be the most relevant measure to explain financial performance of Norwegian salmon exporters, due to the fact that the salmon industry is a capital-intensive industry and ROA is a measure of how well the return on firm's capital is. It is also argued by Hagel, Brown and Samoylova (2013) that ROA "is the most effective, broadly available financial measure to assess company performance".

ROCE could similarly be a relevant measure of firm performance, since the salmon industry is capital-intensive, while it also measures how effectively a firm uses its capital. This measure is calculated as EBIT over capital employed. Due to the lack of information to calculate the firms' capital employed, ROA has been used. The robustness of the results is checked considering return on equity and return on sales as dependent variable.

4.3.2 Independent Variables

The explanatory variable of interest in this study is the effect the Chinese sanctions had on Norwegian salmon exporters having China as one of their export markets. This effect is represented by indicator variables for the sanction period.

The main model specification includes an indicator variable representing the whole sanction period, from 2011 until 2017. This variable equal 1 if a firm is a salmon exporter, and 0 otherwise. The time dimension of the sanction period is defined from 2011 to 2017 because the Nobel Peace Prize award was in late 2010, not giving the Chinese government enough time to implement restrictions that would affect Norwegian exporters until 2011. This choice is supported by both Chen and Garcia (2016) and Kolstad (2016), who also use 2011 as a starting point for the sanction period. The end of the sanction period is defined as 2017 since this year, the Norwegian- and Chinese government started the negotiations about a Free Trade Agreement for the first time since the Nobel Prize (Regjeringen, 2017). Even though the relationship between Norway and China was formally "normalized" in 2016, the sanctions did not seem to be fully over (Bjerkan & Lohne, 2016). Norwegian exporters did not experience increased exports until 2017 and salmon from farms in the municipalities Troms, Nordland and Sør-Trøndelag were abandoned from the Chinese market until June 2018 (Hagen, 2017; Regjeringen, 2018). The sanction period therefore seems to have taken place throughout 2017, which is an argument for the time period chosen in our analysis.

To test the second hypothesis, on whether the duration of the sanctions was of importance to the financial impact on Norwegian salmon exporters, two more indicator variables were defined. Following the results from Kolstad (2016), the Chinese sanctions only had an effect in the beginning of the sanction period, but from 2014 the effect of the sanctions on Norwegian salmon exports seemed to normalize. The whole sanction period is therefore split in two. One variable represents the short-run effects, ranging from 2011 until 2013, and the other represents the long-run effect, ranging from 2014 until 2017. The indicator variables equal 1 for the years they represent if a firm is a salmon exporter, and 0 otherwise.

4.3.3 Control Variables

Extra control variables are included to isolate the casual effect of the specific variable(s) of interest (Wooldridge, 2012). For example, when looking at the relationship between the Chinese sanction period and Norwegian salmon exporter's ROA, it is relevant to include variables representing the size and experience of the firms, since these factors may also explain differences in firms' ROA.

Our vector of control variables is based on different sources from literature on firm performance and is consistent with pervious literature using financial statement data, e.g. Bakke, Hopland & Møen (2018) and Gurbert, Goodspeed & Swenson (1993). With a relatively small sample, the model should not be overfitted by including too many control variables. An overfitted model may lead to an over-specified model, where the data does not contain enough variation to separate the effects of the different variables (James, Witten, Hastie, & Tibshirani, 2013). The following control variables are used:

Total Sales

A commonly used measure of firm size is total sales (e.g. Bakke, Hopland & Møen, 2018; Grubert, Goodspeed & Swenson, 1993; Yazdanfar & Öhman, 2014). This control variable is expected to be positively correlated with a firm's performance since larger firms have greater possibilities of taking advantages of economies of scale and diversification of activities, markets and products (Yazdanfar & Öhman, 2014). Tests[16] have shown that by using the natural logarithm of total sales instead of the absolute value satisfies our empirical models' assumptions better. Logarithmic transformation of variables is a common way to handle non-linear relationships between dependent and independent variables (Benoit, 2011). The log transformation of total sales has therefore been applied in our models to control for differences in size between firms and within firms over time. This makes the estimated value of total sales a semi-elasticity in our models, which are also easier to interpret because they represent the percentage effects in ROA in terms of one percent change in total sales (Wooldridge, 2012).

Age

Age is included as a measure of experience and calculated by subtracting the firm's year of observation with the firm's year of foundation. The assumption behind this variable is that older firms are more likely to benefit from past learnings and business experience (Majumdar & Chibber, 1999; Cabral & Mata, 2003). Older firms might also have access to more resources and have a well-known reputation, which may trigger better performance. On the other hand, Yazdanfar & Öhman (2014) finds a negative relationship between a firm's age and ROA, explaining their results through life-cycle theory; that older firms "tend to be more likely to

[16] Reported in appendix A.1 *Test of Linearity*

transition towards being less-profitable". The overall effect of a firm's age on its ROA is therefore uncertain. In our models the age variable is split into three categories, one category represents the firms from the age between 0 and 10, a second category represents the firms from the age between 11 and 20, and the last category represent the firms older than 20. This categorization is similar to Hopland (2017). A dummy variable is created for each category of age, where the category of firms older than 20 is left out to avoid perfect multi-collinearity.

Debt ratio

Several studies on firm performance also include debt ratio as a control variable. Debt ratio is in our model calculated by opening long term debt divided by opening total debt. The relationship between a firm's performance and its debt ratio is presumed to be negative since larger interest payments leads to a reduction in taxable income (see e.g. Gurbert, Goodspeed and Swenson, 1993; Sheikh & Wang, 2011).

Fixed assets ratio

The last control variable included in our models is the fixed asset ratio, which is calculated by dividing opening fixed assets on opening total assets. This factor controls for capital intensity among firms and within firms over time. Having a high share of fixed assets gives firms more assets to be used as collateral. However, having more fixed assets also mean higher depreciation costs, which makes the overall effect on firms' performance uncertain.

Time dummies for each year is also included to control for macro trends which affects all firms in the sample equally, e.g. these variables will catch the effects of the financial crisis in 2008. Firm fixed effects are controlled for using 1-k dummy variables where k equals the total number to firms in our sample. This is done to control for unobservable heterogeneity between firms that affects firms' performance. This is further elaborated in section 5. Table 1 summarizes the chosen variables.

Table 1: *Description of variables*

ROA	*Firm's return on assets*
Sanction period	*= 1 if a salmon exporter in year 2011 - 2017, otherwise zero*
Sanctions short term	*= 1 if a salmon exporter in year 2011 – 2013, otherwise zero*
Sanctions long term	*= 1 if a salmon exporter in year 2014 - 2017, otherwise zero*
ln of total sales	*The natural logarithm of firm's total sales (in 1000 NOK)*
Age between 0-10	*= 1 if a firm's age lies between 0 and 10, otherwise zero*
Age between 11-20	*= 1 if a firm's age lies between 11 and 20, otherwise zero*
Age above 20	*= 1 if a firm's age is above 20*
Debt ratio	*Firm's long-term debt over total debt*
Fixed assets ratio	*Firm's fixed assets over total assets*

4.4 Sample Restrictions

When a sample is collected from a small population, chances of potential outliers in the dataset increase (Osborne & Overbay, 2004). In order to make the dataset suitable for the empirical analysis, we introduce some restrictions on our sample due to certain observations differing substantially from the rest of the observations in the sample. Including observations that deviates severely from the norm for variables or the population can lead to increased error variance and reduced power of the statistical tests or influence estimates that may be of interest (Osborne & Overbay, 2004). It is especially important to carefully consider the exclusion of potential outliers in a small sample because if influential, these observations can have a large impact on the OLS estimates (Wooldridge, 2012).[17] A common rule of thumb is to consider outliers as observations lying three standard deviations outside the mean (Osborne & Overbay, 2004). Even though our dataset is small and excluding observations would reduce the sample

[17] Influential observations are observations that drastically chances the OLS estimates when dropped from the analysis (Wooldridge, 2012).

size further, it is only a few observations in our dataset deviating severely from the rest, e.g. representing a measure of ROA over 300 percent, compared to a mean of 8 percent.[18] Therefore, three observations are excluded when applying this criterion on the variable ROA in our sample.[19]

In addition to removing the identified outliers in our sample, two observations with total sales equal zero were removed. This makes it possible to take the logarithm of total sales, which is further explained in section 5.1.2. Alternatively, we could have replaced the zeroes with very low numbers in order to do the log transformation without losing observations. However, since there were only two observations with total sales equal to zero, removing these two observations were evaluated to be a better option.

Given the method for how the sample was collected, some of the restrictions to the sample were already made before we collected the data. Firms not replying on our requests were not included, since we were not able to identify whether China was their export market or not. Further, firms not exporting salmon themselves, but through other firms, were not included. Lastly, Norwegian salmon exporters only exporting salmon produced in other seawaters than Norwegian waters were excluded, since the sanctions only were against salmon produced in Norway.

4.5 Descriptive Statistics

Summary statistics of the salmon exporters and non-salmon exporters are presented in table 2. There are no large differences in the number of observations in the two groups of firms, where there are four more of the non-salmon exporting firms. Since the dataset does not include observations for all firms for all years, it is unbalanced and on average consists of more firm-year observations for non-salmon exporters. On average salmon exporters have a much higher ROA, than non-salmon exporters. This is reflected in both the mean and the median ROA in

[18] See for boxplot of potential outliers in appendix A.5 *Boxplots of Potential Outliers*

[19] The following rule was applied on ROE and ROS too, in order to run valid robustness checks of the model. One observation bas excluded based this.

table 2. The reason for this large difference can be explained by the fact that 25 percent of the non-salmon exporters in the dataset have a ROA below one percent. Salmon exporters in the dataset is also noticeably larger than the non-salmon exporters. Additionally, both average debt ratio and the fixed effects ratio are higher for salmon exporters than for non-salmon exporters.

Table 2: *Summary Statistics*	***Salmon exporters***	***Non-salmon exporters***
Number of obs.	175	227
Number of firms	14	18
Average number of years per firm	12.5	12.61
Mean ROA	11.15 %	5.58%
Median ROA	10.19%	3.92%
25th percentile ROA	4.12 %	0.45%
75th percentile ROA	16.29 %	9.76%
Average total sales (in 1000 NOK)	2 198 479	525 242
Median total sales (in 1000 NOK)	1 003 539	136 019
Average debt ratio	22.04%	11.81%
Average fixed assets ratio	34.08%	12.90%
Average age	20.85	15.34

4.5.1 Financial Performance

In figure 4 the yearly average return on assets from 2005 until 2017 for salmon exporters and non-salmon exporters are presented. For all firms, both salmon exporters and non-salmon exporters, the mean ROA is positive for all time periods. Salmon exporters have a higher mean ROA than non-salmon exporters for all years except in 2012 and 2014. The two groups follow a somewhat similar pattern before the sanction period, even though the levels of ROA are different. After 2011 the salmon exporting firms in our dataset have decreased their average ROA the first year, followed by years of fluctuation until 2017. The non-salmon exporters in the dataset experience a slight increase in average ROA from 2011 until 2014, followed by a decrease. For the time period around the financial crisis in 2008, both groups of firms experienced a reduction in their average ROA, followed by a strong increase the following year.

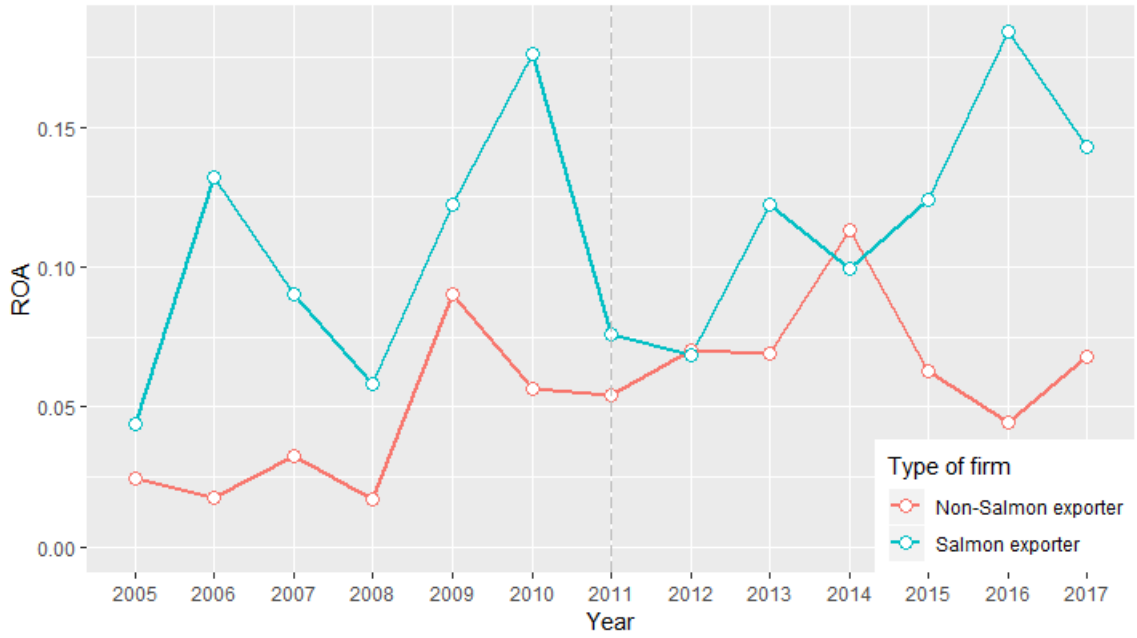

Figure 4: *Mean ROA Over Time*

The reason that salmon exporters have a generally higher average ROA than non-salmon exporters might be due to many different factors. On average, salmon exporting firms in our dataset is notably larger than non-salmon exporters, which could affect their profitability. This is further controlled for in our econometric models.

Table 3: *Summary Statistics for Sanctioned Firms*

	Before period	**Sanction period**	**Short term**	**Long term**
Number of obs.	77	98	42	56
Mean ROA	10.47%	11.68%	9.82%	13.76%

Figure 4 also indicates that the salmon exporting firms had a larger growth in average ROA in the periods after the sanctions were implemented. In table 3 the time periods used in this thesis, and their respective average ROA is presented. The table shows that the average ROA increases when comparing the before period against the sanction period. However, when splitting the sanction period in short run and long run we see that the average ROA decreases a couple of years after the sanctions where implemented but increases in the long run.

5. Empirical Methodology

The purpose of our study is to examine the financial impact the Chinese sanctions had on Norwegian salmon exporting firms. To analyze this, we have presented two hypotheses based on existing theory and literature on economic sanctions and international trade. The hypotheses are tested through an empirical analysis.

In this section, we present the empirical methodology used to test the hypotheses. In order to identify a casual effect of the Chinese economic sanctions on Norwegian salmon exporters' financial performance, a fixed effects method is conducted. There are several reasons why this method is chosen. Normally, several unobserved factors affect a firm's performance, such as firm strategy, quality of leadership, firm culture, etc. These unobserved factors are likely to be correlated with other explanatory variables in our model and can be controlled for in a fixed effects method. Compared to an alternative approach, difference-in-difference, a fixed effects approach increases the robustness of our estimates and enables us to control for unobserved firm specific factors.

The difference-in-difference method may seem like a natural choice for our study since it is applicable for studies of systematic differences between two groups. However, difference-in-difference requires a control group with parallel trends, which in our case would be a sample of salmon exporting firms not affected by the sanctions. Some researchers argue that the sanctions did affect the competition in the Chinese market for fresh and frozen salmon (Chen & Garcia, 2016). In addition, it is reasonable to think that if Norwegian salmon not exported to China went to other markets instead, the competition in these markets was indirectly affected by the sanctions. This makes it challenging to find a good control group for our study. Firstly, non-Norwegian salmon exporters exporting to China, could have been indirectly affected by the sanctions due to lower competition in the Chinese market. Secondly, Norwegian salmon exporters and non-Norwegian salmon exporters that did not export to China could indirectly have been affected by the sanctions through increased competition in other markets. Lastly, Norwegian exporting firms of other types of seafood could also have been affected by the sanctions, which coincide with Kolstad's (2016) findings of all Norwegian exports to China being affected by the sanctions due to the Peace Prize. Because there exists no perfect control group for our group of Norwegian salmon exporters, and

because the fixed effects method allows us to control for possible unobserved heterogeneity among firms, fixed effects appears to be a better alternative for our analysis.

5.1 Panel Study

In our thesis, we study Norwegian salmon and non-salmon exporters over the time period 2005 until 2017, thus making it a panel study. Having a dataset that varies both over time and across individual units, makes it possible to employ a broader range of econometric techniques than in the case of only cross-sectional or time series data. A typical panel data model is presented in equation (1).

$$y_{it} = \beta x_{it} + \alpha_i + \delta_t + \varepsilon_{it} \quad (1)$$

Equation (1) represents a linear regression, where y denotes the dependent variable and x_{it} is the independent variable varying across time and units. β is the coefficient describing the expected change in y as a result of a one-unit change in x_{it}. Additionally, the equation contains three error terms α_i, δ_t and ε_{it}, which represents variation in the dependent variable that is not explained by the independent variable x_{it}. α_i is the error term which only varies across units and is time invariant, δ_t varies over time and not across units, while ε_{it} varies across both time and unit, making it an observation-specific error term. The footprints i and t, represent the cross-sectional units and the time period. In our model the cross-sectional unit is firms, while the time unit is years.

5.1.1 Pooled OLS

Estimating equation (1) directly using the ordinary least squares (OLS) estimator is called Pooled OLS. When employing the OLS method, the relationship between the dependent variable and one or more independent (explanatory) variables is determine by minimizing the squared difference (residual) between a specified model's estimated values of the dependent variable and the corresponding observed values. This is also called a linear regression, based on the assumption of linearity between dependent and independent variables (Wooldridge, 2012).

Pooled OLS will provide us with unbiased estimates if certain assumptions hold (Wooldridge, 2012). However, to include all relevant control variables is more difficult in a panel dataset, due to variation in two dimensions. In our dataset, containing observations of firms over time, there will be both firm- and time specific factors affecting a firm's performance that are difficult to include in a model. Firm specific factors are factors that are constant across time but varies across firms, such as firm strategy, quality of leadership, employee morals, etc. Correspondingly, time specific factors are factors that are constant across firms but varies over time, typically macro factors, such as economic cycles, financial crisis, interest level, etc. When these firm- and time specific factors are not included in a model, *unobservable heterogeneity* arise. Unobserved heterogeneity can be removed by controlling for these factors one at a time, which is tedious and not likely to be a success. Alternatively, these factors can be controlled for more efficiently by employing a fixed effects estimation.

5.1.2 OLS Assumptions

Fixed effects estimation is a special application of the OLS estimator. The challenges related to bias, inconsistency and unreliable results of the OLS estimator must therefore be considered (Wooldridge, 2012). To prove a causal relationship between the dependent and independent variable(s), the Gauss-Markov assumptions must hold. Satisfying these assumptions will lead the OLS estimator to be the best linear unbiased estimator (BLUE). Consequently, in this section our models' fulfilment of the OLS assumptions is elaborated.

Linearity

The first assumption states the model needs to be linear in its parameters (Wooldridge, 2012). This means there must be a linear relationship between the parameters specified for the dependent and independent variable(s) (control variables). In our specified model, the linearity assumption is violated for the control variable representing total sales. This is controlled for by using the log transformed total sales, which fits a linear regression line between ROA and total sales better. For the remaining control variables in our model, the linearity assumption is fulfilled, and therefore not a problem when included in our models.[20]

[20] All testes of linearity reported in appendix A.1 *Test of Linearity*

Multicollinearity

Further, there cannot exist perfect collinearity between any of the independent variables in a multiple regression (Wooldridge, 2012). When one of the independent variables can be predicted using a linear function of one of the other independent variables, the model will not be able to distinguish the effect from each of the independent variables, giving a collinearity problem. A way to detect this, is to check the correlation matrix of the independent variables. In our models, collinearity seems not to be a problem. [21]

Unfortunately, collinearity can also exist between three or more independent variables, called multicollinearity (James et al., 2013). Usually, problems with multicollinearity is reduced in panel data, due to variation between both cross-sections and time (Wooldridge, 2012). To test for multicollinearity, the Variance Inflation Factor (VIF) can be calculated, which is a factor estimating the linear relationship among independent variables in a multiple regression. It has a lower bound of 1 and no upper bound, while a common rule of thumb is to be cautious of VIF values that exceeds 10 (Allison, 2012; James et al., 2013). When running the VIF-test on our models, we obtain average VIFs of 1.7 and 1.8, indicating that multicollinearity is not a problem in our case.[22]

Zero Conditional Mean

The next assumption is that the error term has a zero-conditional mean. This assumption implies that the error term needs to have an expected value of zero and that the independent variables are uncorrelated with the error term (Hopland, 2017). Violation of this assumption may lead to a problem with endogeneity, which causes the OLS estimates to be biased (Wooldridge, 2012). Endogeneity problems are usually a result of wrongly specified models and may occur because of simultaneity between independent and dependent variables, omitted variable bias, or measurement error in the independent variable. There exists no formal test to see if this assumption holds. However, the choice of control variables and method can limit the chances of bias.

[21] Correlation matrix is presented in appendix A.1 *Test for Multicollinearity*

[22] The VIF-test are reported in appendix A.1 *Tests for Multicollinearity*

We have based our choice of control variables on research with similar approaches, in order to minimize the risk of simultaneity and measurement error. When employing a fixed effects method, unobserved factors that are specific to each firm is controlled for. In this way, the risk of excluding relevant variables, omitted variable bias, is reduced. Hence, the fixed effects method reduces the bias of the OLS estimates when this assumption does not hold. Omitted variables bias is also considered in the choice of control variables.

Homoscedasticity

The residuals of the model are assumed to be homoscedastic, meaning the error terms have constant variance regardless of the value of the independent variables. A violation of this assumption is called heteroscedasticity. In cross-sectional and panel data, this is likely to occur because the volatility of each unit in the dataset is likely to vary, producing non-constant variance (Wooldridge, 2012).

In our data, homoscedasticity is tested for using a Breusch-Pagan test. This test gives a p-value lower than 0.05, which means we can reject the null hypothesis of homoscedasticity, suggesting the alternative hypothesis of heteroskedasticity.[23] Since heteroscedasticity may lead to wrong conclusions, we have controlled for it by applying robust standard errors in all our models.

No serial correlation

For panel data and time series, an additional assumption for OLS to be BLUE is that there should exist no serial correlation. No serial correlation means that all observations of the error term are uncorrelated with each other. This is likely to happen when you have data over several years (Wooldridge, 2012). In our dataset it is expected that serial correlation will be a problem, since we observe the same firms over time. A firm's financial performance in one year, can be an indicator of how well that firm will perform in the following year.

Problems with serial correlation may lead the standard errors of the coefficients to be over- or undervalued, thus affecting the precision and significance of our estimated parameters (Williams, 2015). However, the results may still support our hypotheses and indicate whether

[23] Reported in appendix A.1. *Test for Homoscedasticity*

Norwegian salmon exporting firms were negatively affected by the Chinese economic sanctions or not, since serial correlation does not affect the unbiasedness or consistency of the estimators. Based on formally conducted tests, serial correlation shows to be a problem in our case and is controlled for by applying serial correlation consistent standard errors.[24] [25]

Normality

In order to perform statistical inference, the residuals of the regression model must be normally distributed. This is not a necessary assumption for the OLS estimates to be BLUE, but if it does not hold it will affect the interpretation of test statistics and p-values (Wooldridge, 2012). Violation of this assumption deprive us the ability to perform statistical hypothesis testing and generate reliable confidence intervals (Frost, 2018). When studying a normal Q-Q plot of the residuals, it suggests that our distribution is slightly skewed.[26] In terms of this, inference may not be valid for our dataset. However, this is not surprising, considering the small sample we are working with and our models could still give indications on the hypotheses.

5.1.3 Fixed Effects Estimation

One of the main advantages with panel data is the possibility to control for unobservable fixed effects (Hopland, 2017). The fixed effects (FE) estimator is one of the most frequently used methods to control for unobservable heterogeneity in panel data. By including cross sectional unit dummies in the model, unobserved firm specific effects are removed. Another name for FE estimation is therefore *within groups transformation*, as it removes the unobserved unit specific effects, α_i from equation (1) (Wooldridge, 2012). This can be analyzed formally.

In the original FE estimator, it is often assumed that time effects are constant for all individuals. We start with equation (2), leaving the time-varying error term, δ_t, out:

[24] Reported in appendix A.1 *Test of Serial Correlation*

[25] We applied Newey-West standard errors which is both heteroscedasticity and serial correlation corrected standard errors. In addition, the standard errors a clustered on firm level since the ROA residuals are likely to be correlated within each firm (McKenzie, 2017)

[26] Reported in appendix A.1 *Test of Normality*

$$y_{it} = \beta x_{it} + \alpha_i + \varepsilon_{it} \qquad (2)$$

When averaging this equation over time and for each unit, we get:

$$\bar{y}_i = \beta \bar{x}_i + a_i + \bar{\varepsilon}_i \qquad (3)$$

When subtracting (2) from (3), we obtain:

$$y_{it} - \bar{y}_i = \beta(x_{it} - \bar{x}_i) + (\varepsilon_{it} - \bar{\varepsilon}_i) \qquad (4)$$

When applying OLS on equation (4) we get the FE estimator. As we can see, the time invariant variable, α_i, is eliminated in the transformation. Hence, FE can overcome some of the problems with omitted variables (Wooldridge, 2012).

In cases where time is not unit invariant, meaning that the error term, δ_t, does exist, the model can be extended to also include time dummies for all years in the dataset, minus one. In our model it has been formally tested whether we should include time dummies in the FE model or not.[27] However, this is also reasonable, considering exogenous macro factors that potentially can have affected the firms in our dataset over time, e.g. the financial crisis in 2008.

5.2 Sample size and Statistical Inference

The size of a sample is one of the factors determining the precision of our estimates, where smaller samples will have higher variance, thus lower precision (Litter, 2018). This means that, for us to detect a significant effect of how the Chinese sanctions financially affected Norwegian salmon exporters, we would have to increase our sample size. When the sample is too small, the effect is masked by randomness in the sample which reduces the statistical power of our models (Litter, 2018). In other words, in small samples, the probability of finding a significant result is lower than in larger samples.

Following the central limit theorem, for large samples, the sampling distribution of most estimators is approximately normal (Wooldridge, 2012). With a small number of observations

[27] Reported in appendix A.3 *F-Test for two-ways effect*

in our dataset, the same does not apply. However, the results may still support our hypothesis and indicate whether Norwegian salmon exporting firms where negatively of positively affected by the Chinese economic sanctions.

5.3 Model Specification

Our main model specification is as follows:

$$ROA_{it} = \beta_0 + \beta_1 sanction\_period_{it} + x'_{it}\beta_x + \varepsilon_{it} \qquad (5)$$

This model includes one coefficient of interest, β_1, which is the indicator variable representing the whole sanction period, explained in section 4.2.2. This coefficient presents the financial impact the Chinese sanction had on Norwegian salmon exporters and can be interpreted as the change in ROA a firm experience due to the Chinese sanctions on Norwegian salmon export. x'_{it} is a vector of the first control variables described in section 4.2.3. ε_{it} is the error term.

Following the second hypothesis of our thesis, the model represented by equation 6 includes two indicator variables representing the short- and long run effects of the Chinese sanctions. This model is defined to capture the time effect of the sanctions. The coefficients of interest are here β_1, representing the short-run effect, and β_2, representing the long-run effect. All other components are equal to equation 5.

$$ROA_{it} = \beta_0 + \beta_1 sanc\_short\_term_{it} + \beta_2 sanc\_long\_term_{it} + x'_{it}\beta_x + \varepsilon_{it} \qquad (6)$$

6. Empirical Findings

This section presents the regressions we have performed to test our hypotheses on whether the Chinese economic sanctions had a financial impact on Norwegian salmon exporters. The main specification of the model and findings related to the first hypothesis are presented in section 6.1, while section 6.2 presents the findings related to the second hypothesis. Section 6.3 contains the conducted robustness checks to test the robustness of our results.

6.1 Main Specification

Table 4 presents the results from our main model specification presented in section 5.3. The table contains seven columns of different regressions, with the dependent variable in all regressions being return on assets and the indicator variable for the whole sanction period being the independent variable of interest. For each regression new controls are introduced in order to isolate the possible effect the sanction period had on Norwegian salmon exporter´s financial performance. The first two columns originate from a pooled OLS regression, while the following five regressions are based on fixed effects estimation as described in section 5.1.

As previously mentioned, the sanction period's effect on Norwegian salmon exporters are seen in relation to Norwegian non-salmon exporters. This means that when interpreting the results, the estimated coefficients represent the effect of the sanction period on Norwegian salmon exporters, relative to Norwegian non-salmon exporters.

In the first regression, based on pooled OLS without firm fixed effects and with time dummies as the only control variables, we have a significant positive coefficient for the sanction period. This suggests that a Norwegian salmon exporting firm on average experienced an increase in their ROA during the sanction period relatively to Norwegian non-salmon exporters. However, in this model firms are not comparable, as no control variables are included, nor does it account for the underlying differences between firms that affect their financial performance. For these reasons, the only thing the model indicates is that on average, Norwegian salmon exporting firms are more profitable than Norwegian non-salmon exporting firms, and that this also holds for the sanction period. This result is the same as suggested in figure 4 in section 4.5.1.

Table 4: *Main Regression Results*

	Dependent variable:						
	ROA						
	Pooled OLS	Pooled OLS	FE	FE	FE	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sanction period	0.052***	-0.008	-0.003	-0.004	-0.004	-0.005	-0.020
	(0.016)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)
ln of total sales		0.014***		0.011	0.011	0.012	0.008
		(0.004)		(0.011)	(0.011)	(0.011)	(0.011)
Debt ratio		-0.072			-0.016	-0.027	-0.005
		(0.048)			(0.059)	(0.065)	(0.063)
Fixed assets ratio		0.138**				0.050	0.053
		(0.056)				(0.081)	(0.079)
Age between 0-10		-0.016					-0.075*
		(0.018)					(0.039)
Age between 11-20		-0.031**					-0.083***
		(0.015)					(0.028)
Constant	0.033**	-0.130**					
	(0.014)	(0.061)					
Observations	402	402	402	402	402	402	402
R^2	0.059	0.130	0.0001	0.004	0.004	0.005	0.047
Adjusted R^2	0.027	0.090	-0.123	-0.122	-0.125	-0.127	-0.086
F Statistic	1.869** (df = 13; 388)	3.193*** (df = 18; 383)	0.024 (df = 1; 357)	0.637 (df = 2; 356)	0.450 (df = 3; 355)	0.450 (df = 4; 354)	2.864*** (df = 6; 352)

Note: All regressions include time dummies but not reported. Newey-West robust standard errors clustered on the firm level in parentheses. *p<0.1; **p<0.05; ***p<0.01

When controlling for differences among firms across time by including control variables for total sales, debt ratio, fixed assets ratio and age in the pooled OLS, the second regression shows that the sanction period no longer is significant. In addition, the sign of this coefficient has become negative, suggesting that the sanction period on average had a negative effect on Norwegian salmon exporter´s financial performance relative to Norwegian non-salmon exporters. An increase in the correlation coefficient, R-squared, when including more controls suggests that the model explains more of the variation in firm's financial performance. However, this coefficient is low and only suggests that 13 percent of the total variation in ROA is explained by the model.

From the regressions based on fixed effects estimation we are unable to identify a significant association between the sanction period and Norwegian salmon exporters´ financial performance. However, the sign and magnitude of the estimated coefficients still sends a signal about the relationship.

Column (3) presents the first model using the fixed effects estimator. This is the most parsimonious model after the pooled OLS in column (1), including only the indicator variable for the sanction period and firm- and time dummies. Compared to the pooled OLS, when controlling for firm specific effects, we see that the coefficient for sanction period now is negative and insignificant. By controlling for these underlying systematic differences in financial performance between firms, this entails that if there exist unobserved factors that are the same within each firm over time, the model controls for them. In the following four regressions the control variables are included one at a time, however this does not change any of our estimated coefficients much. The variable representing the sanction period is consistently negative, indicating that salmon exporters were negatively affected by the sanctions relatively to non-salmon exporters. In the main specification of our model the only significant variables are the control variables representing a firm's age. They are both negative, indicating that firms younger than 20 years have a lower return on assets than older firms.

It is worth noticing that the models based on fixed effects estimation have a very low coefficient of determination (R-squared), thus giving us negative adjusted R-squared. There can be various reasons for why an adjusted R-squared turns negative. The formula for adjusted R-squared allows the coefficient to become negative. The formula is presented in equation 7,

where SSR is the sum of squared residuals, SST is the sum of total squares, n is the number of observations in the dataset and k is the number of independent variables in the model.

$$adjusted\ R^2 = 1 - \frac{SSR/(n-k-1)}{SST/(n-1)} \qquad (7)$$

While the normal R-squared is formulated as in equation (8):

$$R^2 = 1 - \frac{SSR}{SST} \qquad (8)$$

In that sense, the adjusted R-squared introduces a punishment for including additional variables in the model (Hopland, 2017). If the coefficient of determination does not increase more than the punishment when including more variables in the model, the adjusted R- squared might become negative if R-squared is already low. Looking at the pooled OLS, the R-squared was already very low. Introducing new variables through firm fixed effects seem to decrease the overall explanatory power of our model, leading to a negative adjusted R-squared.

Low explanatory power of a model can occur because of too much variation in a dataset. High variance can occur in datasets based on small samples, but it could also occur in samples with observations or groups of observations that are very different from each other. Our 14 salmon exporting firms are very different from each other in terms of size, international scope and age, which leads to high variation on our models. Following the formula in equation (7), a negative adjusted R-squared may occur when the sum of squared residuals approaches the sum of total squares. However, it will not turn negative unless the number of control variables, k, is sufficiently large.[28] Thus, leading the explanatory power of our models towards zero and insignificance in our explanatory variables. It is also worth noticing that the control variables in our models are rarely significant. In empirical analysis using the same control variables, but with a much larger dataset, these are almost always significant (e.g. see Bakke, Hopland & Møen, 2018). Thus, an increased sample size would potentially improve our results.

[28] By testing our models with and without time effects, we find that the inclusion of 13 minus 1 more control variable turns the adjusted R-squared negative.

6.2 The Effect of Time

To test the second hypothesis, that the Chinese sanctions had a greater negative financial impact on Norwegian salmon exporters in the short run than in the long run, the sanction period is divided into two time periods. The sanctions´ short run ranges from 2011 until 2013, while long run is defined as the years 2014 until 2017. Splitting the sanction period in two sub-periods could also be seen as a robustness test of the main model specification.

Table 5 presents the regressions to test our second hypothesis. In the first column, a pooled OLS is conducted by only including the variables of interest, the short run and the long run indicator variables for the sanction period, in addition to time dummies for all years in the sample. The coefficients for the short run and the long run effects of the sanctions are both positive, however, only the variable representing the long run effect is significant.

When we control for firm fixed effects in the second regression the variable representing the short-run effect turns negative, while the variable for the long-run effect is still positive. In this simplified fixed effects estimation, we find no significant effect of the Chinese sanctions on Norwegian salmon exporting firms' financial performance in respectively short- and long run.

Controlling for all additional control variables; total sales, debt ratio, fixed assets ratio and age, does not incur any major differences to our estimates. In the full specification of the model in column (4), the coefficient representing the short-run effect indicates that Norwegian salmon exporting firms on average have a 5 percent lower ROA than Norwegian non-salmon exporters in the first three years of the sanctions. Though, the effect is not significant. The coefficient representing the long-run effect of the sanctions is also insignificant and turns negative when all control variables are included. However, we see that the estimated effect in the long run is less negative than in the short run, which corresponds to our hypothesis. Out of the four control variables, only the variables representing a firm's age is significant, at one and five percent level. Equivalent to the main model specifications in table 4, the regressions in table 5 also have a negative adjusted R-squared.

In terms of interpreting the robustness of the main specification, the results from testing the short- and long run seem to follow the same direction as the overall sanction period, of a negative sign for both coefficients of interests.

Table 5: *The Effect of Time*

	Dependent variable:			
	ROA			
	Pooled OLS	FE	FE	FE
	(1)	(2)	(3)	(4)
Sanction short run	0.026	-0.030	-0.032	-0.050
	(0.029)	(0.030)	(0.030)	(0.031)
Sanction long run	0.065***	0.010	0.010	-0.005
	(0.018)	(0.020)	(0.020)	(0.021)
ln of total sales			0.012	0.009
			(0.011)	(0.011)
Debt ratio			-0.012	-0.001
			(0.060)	(0.064)
Fixed assets ratio				0.061
				(0.079)
Age between 0-10				-0.077*
				(0.039)
Age between 11-20				-0.084***
				(0.028)
Constant	0.033**			
	(0.014)			
Observations	402	402	402	402
R^2	0.061	0.004	0.008	0.051
Adjusted R^2	0.027	-0.122	-0.124	-0.084
F Statistic	1.809** (df = 14; 387)	0.664 (df = 2; 356)	0.715 (df = 4; 354)	2.712*** (df = 7; 351)

Note: All regressions include time dummies but not reported. Newey-West robust standard errors clustered on the firm level in parentheses. *p<0.1; **p<0.05; ***p<0.01

6.3 Other Types of Performance Measures

Financial performance can be measured in several ways, and it is not obvious that ROA is the best measure in terms of predicting the financial impact of the Chinese sanctions on Norwegian salmon exporters. Consequently, a robustness check is performed by running all the models using a variety of performance measures.

Table 6: *Comparing Different Performance Measures*

	Dependent variable:					
	ROA	ROE	ROS	ROA	ROE	ROS
	FE	FE	FE	FE	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Sanction period	-0.020	0.147	0.825**			
	(0.021)	(0.261)	(0.363)			
Sanction short run				-0.050	-0.221	0.606*
				(0.031)	(0.311)	(0.347)
Sanction long run				-0.005	0.329	0.932**
				(0.021)	(0.285)	(0.459)
Observations	402	402	402	402	402	402
R^2	0.047	0.011	0.085	0.051	0.016	0.085
Adjusted R^2	-0.086	-0.126	-0.043	-0.084	-0.124	-0.045
F Statistic	2.864*** (df = 6; 352)	0.673 (df = 6; 352)	5.425*** (df = 6; 352)	2.712*** (df = 7; 351)	0.835 (df = 7; 351)	4.683*** (df = 7; 351)

Note: All regressions include time dummies but not reported. Newey-West robust standard errors clustered on the firm level in parentheses. Control variables are included but not reported. *p<0.1; **p<0.05; ***p<0.01

Table 6 presents our two specified models with three different financial performance measures per model. All regressions are based on fixed effects estimation, including all previously defined control variables, in addition to time and firm fixed effects. The different performance measures used are return on equity (ROE) and return on sales (ROS), calculated by net income over total equity and total sales over total assets respectively. Column 1 – 3 present the regressions based on our main model specification, where the first column is our baseline model having ROA as independent variable. We see that when using ROE instead of ROA as independent variable, the coefficient representing the sanction period goes from positive to negative. Similarly, when using ROS as performance measure, the coefficient turns positive

but is also here significant at five percent level. These results imply that our main model specification is sensitive to the type of performance measure used.

Furthermore, column 4 – 6 present the regressions based on our second model which tests the sanctions´ effect over time. In contrasts to the first model, when including ROE, the coefficient representing the short-run effect stays negative, which corresponds to the baseline with ROA as independent variables. However, the coefficient representing the long-run effect changes from negative to positive and none of the coefficients are significant. When using ROS as performance measure, the coefficient for both the short- and long run effect turns positive and significant at respectively ten and five percent level.

This shows that our model and dataset is sensitive to changes in its specification. However, based on the previously mentioned weaknesses related to a small sample, high variance and low explanatory power, this is not surprising. A larger sample, with more salmon exporters included could possibly improve our results to some degree.

7. Discussion of Empirical Results

Economic sanctions impose uncertainty in markets and increase firms' risk when participating in international trade. The findings in our thesis suggests that informal economic sanctions affect exporting firms negatively. This supports the literature, stating that business risk related to international trade is dependent on the political relationship between countries. In the following section, we briefly discuss some of the underlying explanations of our results based on the earlier presented theories and empirical literature. Furthermore, we discuss some of the potential implications of our study and current limitations.

7.1 Underlying Explanations

The empirical analysis supports our stated hypotheses, but we cannot confirm that the Chinese sanctions had a negative effect on Norwegian salmon exporting firms. In this section, we discuss our results in light of how firms adapt to trade based on the empirical literature and economic theory earlier presented. We start by looking at how theories and empirical literature support our results of a negative effect, followed by a discussion of the size of our estimates.

In terms of how sanctions negatively impact international trade, it is reasonable that economic sanctions have negative consequences for exporting firms, since firms are actors in trade relations between countries. The results of our empirical analysis confirm this and indicate that the Chinese economic sanctions had a negative effect on Norwegian salmon exporters' financial performance. However, as discussed in section 3.4, firms and private actors do not necessarily comply to the sanctions imposed by a foreign or national government. Instead, firms adapt to sanctions in order to minimize/maximize the potential negative/positive effects.

The terminology section 2.1.5 presents various costs firms may face when economic sanctions are imposed, thus leading to a reduction in their financial performance. Some costs are inflicted immediately after sanctions are imposed, such as loss of sales and earnings or increased marginal costs due to lower economies of scale (van Bergeijk, 1989; Losman, 1998). Others are potential costs related to the competition in the market and firms' future profitability potential. In addition, the literature review in section 3.1 explains that firms' costs associated with economic sanctions are closely dependent on the duration of the sanctions.

Thus, a sanction's duration gives firms the possibility to adopt strategies that can mitigate the costs of the sanctions (Afesorgbor, 2016).

Our results suggest that the Chinese economic sanctions had a greater negative effect in the first three years of the sanctions, than in the 4-6 years after the sanctions' beginning. The observed long-run effect was also negative, but close to zero, suggesting that firms face increased costs in the short run but adapt to the changed market environment by choosing more profitable strategies in the long run. The literature suggests that time gives economic agent's the possibility to minimize the negative consequences of an imposed economic sanction though strategic actions (Afesorgbor, 2016). Potential costs arise when new firms develop in the sender country and fills the market share left by the firms in the targeted country, making it more difficult to reestablish in this market after the sanctions (Losman, 1998). However, the sanctions' potential effects on firms' future profitability could not be investigated in our thesis, due to the recency of the case used.

The observed estimates for our results suggest that the negative financial impact of the Chinese economic sanctions was quite small. On average the salmon exporters' ROA was 2 percent lower than for non-salmon exporters for the years representing the whole sanction period, compared to the period's average ROA of 12 percent. A relatively low impact could be explained by the results obtained by Heilman (2016), who estimates a rather small effect of boycotts on a boycotted country's overall trade, suggesting that countries with diverse range of export goods and destinations, can substitute some of their exports towards non-boycotting countries. Following Chen and Garcia (2016), this could also imply that firms and/or private actors in the Norwegian-China salmon trade circumvented the Chinese economic sanctions and sold Norwegian salmon to the Chinese market despite its informal restrictions. Such strategic actions would decrease the potential financial effect the sanctions could have had on Norwegian salmon exporters.

However, our results for the short-run effect, is somewhat larger. Here salmon exporters' average ROA was 5 percent lower than for non-salmon exporters, compared to the short run average of only 10 percent. The corresponding long-run effect is very small, estimated to be 0.5 percent, compared to an average of 14 percent. These results are best explained by looking at the time dimension of the sanctions, where some costs that are fixed in the short run may

be variable in the long run (Afesorgbor, 2016). On the contrary, Kolstad (2016) argues that the long-run effect could be explained by actions at the political level, such as the Norwegian government distancing itself from the Peace Prize by refusing to meet the Dalai Lama in 2014.

Furthermore, some scholars explain the impact of sanctions on trade through firms' evaluation of risk (Morrow et al. 1998; Fuchs and Klann, 2013; Afesorgbor, 2016). As section 3.3 presents, empirical literature shows that economic sanctions reduce trade flows between the countries involved. This is explained by firms' evaluation of risk of doing business in a political uncertain environment. Hence, economic sanctions increase exporting firms' exposure to risk and reduce their probability to engage in these trade relations. In extension to our results, this explains how firms' incentives are affected to evolve new strategies when sanctions are imposed. Thus, reducing firms' negative impact from economic sanctions.

7.2 Further Implications on Firms and Regulators

Our findings suggest that the Chinese economic sanctions were not particularly harmful to the Norwegian salmon industry. However, the reason why this is the case could be a severe issue for regulators in both Norway and China. Even though it is generally positive that the Chinese economic sanctions do not seem to have had a major negative impact on the Norwegian salmon industry, the more important issue for regulators is whether the sanctions increased the involvement in illegal actions, such as smuggling and falsifying the products country-of-origin in order to get their products sold. It has been proven that economic sanctions can lead to an increase in criminal activities within and around the involved countries (Andreas, 2005; Chen & Garcia, 2016). The adversely effects of economic sanctions have caused a shift towards the use of "smart sanctions", where the consequences of the sanctions are targeted towards the government in order to protect the civil society. However, the engineering of economic sanctions that takes all unintended factors into account is not easy, if not impossible. It is therefore important that countries develop and evaluate their exporting industries' normative standards, in order to prevent the possible criminalizing effect of sanctions.

Furthermore, the political consequences of the Chinese economic sanctions seem to be more severe than the sanctions' financial impact on the Norwegian salmon industry. Kolstad (2016) explains that the experienced normalization of export levels in the long run could be caused

by “a weakening of the Norwegian foreign policy position on human rights”. This suggests that Norwegian government traded market access for human rights concessions (Kolstad, 2016). In that way, our results of an almost negligible long-run effect support and strengthen Kolstad’s statement that “to avoid the (…) negative effects on foreign policy (…), it seems vital to ensure the independence of human rights promoting institutions from commercial and economic interests”.

In addition, evidence from other studies of the Chinese economic sanctions point out that smuggling and trans-shipment through China’s neighboring countries is a growing issue, rising from China´s increased use of trade barriers in general (Chen & Garcia, 2016). This highlights the importance of firms’ individual evaluation of exposure to risk when operating in a foreign country. This risk also involves firms’ exposure to law enforcement in the countries they do business, which firms should consider in their decision making.

7.3 Limitations

The most noticeable limitation of our study is that we cannot draw statistical inference between the Chinese sanctions and sanctioned firms’ financial performance. However, not finding a significant effect is a discovery in itself. A question that evolves is whether the Chinese sanctions affected Norwegian salmon exporters at all. Our results indicate that Norwegian salmon exporting firms did experience lower profitability than non-salmon exporting firms during the sanction period, with a larger negative effect in the short run than in the long run. Though, if the negative effect of the sanctions was small or only experienced by a few firms in our sample, the results are expected to be insignificant. Based on the conducted empirical analysis, and the lack of information about the firms’ involvement in the Chinese market, these are difficult questions to answer. Section 8 is therefore included in our thesis, to highlight some of the questions we were not able to answer through the literature or the conducted empirical analysis.

An additional limitation of our empirical analysis is related to the potential of other events occurring in the same time period as the Chinese sanctions, thus affecting the firms in our sample somewhat similarly. In such a case, our model would not be able to distinguish the effect of the event from the effect of the Chinese sanctions. An example of such an event is

the sudden Russian boycott of Norwegian salmon in 2014.[29] This event could potentially overestimate the negative effect of the sanctions, if the salmon exporters in our dataset also export salmon to Russia.

Furthermore, since the sanction period's effect on Norwegian salmon exporters is seen in relation to Norwegian non-salmon exporters in our study, we assume that the Chinese sanctions only hit Norwegian salmon. On the contrary, it is argued that the sanctions also impacted overall export from Norway to China. Chen and Garcia (2016) state that the Chinese sanctions did only affect the Norwegian salmon industry, while Kolstad (2016) argues that industries other than the salmon industry also were affected by the sanctions. However, if the non-salmon exporters were affected by the sanctions as well, the sanctions´ negative effect on salmon exporters would be larger than what we have estimated.

Moreover, Norwegian salmon exporting firms may have experienced the Chinese sanctions very differently, e.g. depending on how integrated their supply chains were in the Chinese market before the sanctions, or whether they had the possibility to change from salmon originated in Norway to salmon originated in other seawater. Based on the limited amount of time compared to what is needed to collect a proper dataset, this was our result. However, with a more comprehensive information gathering process, we would be able to identify more interesting variables related to the characteristics of firms over time. This would enable us to distinguish between different firm characteristics, and whether these characteristics are an essential factor when determining how economic sanctions affect firms. Additionally, a more wide-ranging data gathering process would potentially also increase the number of firms in our dataset, thus making our coefficients more robust.

[29] See e.g. article from Norwegian Seafood Council about Russian boycott of Norwegian salmon. https://seafood.no/aktuelt/Fisketanker/hva-skjer-nar-russland-ikke-har-norsk-laks/

8. Discussion of Interviews

Complementary interviews have been conducted to extend the understanding of our empirical findings and investigate whether our results match salmon exporters' experience of the sanctions. Section 8.1 presents how the interviews were conducted, followed by a presentation of how salmon exporters experienced the sanctions. Lastly, section 8.3 summarizes the inputs we retrieved from the interviews.

8.1 Conducting the Interviews

To conduct interviews as a part of our thesis, we applied for an approval from the Norwegian Centre for Research Data (NSD). Hence, the interviews are performed according to NSD´s regulations and guidelines concerning privacy issues. Since some of the encountered participants in the process requested anonymity, all information received through email correspondences and interviews are handled discretely and with confidentiality. In addition, we do not call our interviewed firm representatives by name to comply with the desire of anonymity. During the process of collecting data, we reached out to potential representatives of Norwegian salmon exporters which exported salmon to China during the sanction period. Through this email correspondence, we came across people showing special interest in our research question and following hypotheses. As Norwegian salmon exporters where the ones experiencing regulations on the Chinese market, they possess valuable information and insights on the situation. The knowledge and experience they obtained are difficult to capture in an empirical model and we therefore reached out to potential participants and arranged interviews, in order to get a deeper understanding of our results.

The interviews were conducted through Skype where we started the conversation by asking an open question of their experiences from the Chinese sanctions. Then, we proceeded with more concrete questions concerning their strategies for adapting to the new market situation, before we continued with comments on our hypotheses. In the following section, comments received from the interviews are elaborated in order to obtain a deeper understanding of how Norwegian salmon exporters were financially impacted by the Chinese sanctions. These insights can also tell us if our results resemble the salmon exporters experiences of the sanctions.

8.2 How the Sanctions Were Experienced

One of the main insights we received from the interviews with representatives from Norwegian salmon exporters was that firms may have experienced the Chinese sanctions differently. One of the interviewed representatives, told us that China was a small market for them and that they mainly supplied frozen fish to other markets than China. When the sanctions were imposed, they experienced a small negative effect on its frozen products, however this effect was negligible. Another representative also stated that the Chinese sanctions caused a minor impact on their financial performance. This was explained by the firm's strategy to focus on smaller niche markets with higher quality and prices than in China. Hence, it only exported salmon to China in periods with overcapacity in their production and the sanctions were therefore of minor relevance. However, both representatives stated that firms heavily involved in the Chinese salmon market *prior to* the sanctions, potentially experienced a larger negative effect.

Further, the interviews gave us insight on how a firm's strategy may be of importance determining the sanctions' financial impact. One representative informed us that the Chinese sanctions would be more difficult to handle for a small trading company. A small trading company would be more vulnerable in China due to potential unstable delivery of salmon certified for the Chinese market. With an unstable delivery of salmon, the trading company would not be as well-functioning in this market, and the fluctuating supply could affect the company´s relationship with customers.

Characteristics of the global market for salmon does also seem to have been important in determining the sanctions financial impact on exporters. Another representative stated that the global dynamics of the salmon market makes it possible to sell a product as a substitute in an existing- or new market if the quality is lower than expected. This is further explained by a current high demand of salmon worldwide and a shortage of this product on the global market.

Throughout the interviews, we also found support that sanctions-busting activities have occurred. One of the firm representatives perceived the sanctions as a way for China to regulate the market without full closure. The representative further explained how import licenses were imposed to regulate the market. In China, an import license applies for one firm and for a fixed quantity. When a firm has imported 90 per cent of its allowable quota, it can be renewed,

which can take up to 2-3 months. As a response to this restriction, Chinese importing firms established new firms to get new import licenses. This way, they kept selling salmon to the Chinese market without being restrained by the license. When the Chinese government discovered the circumvention, import licenses were no longer available for recently formed firms which led to import licenses being leased out.

The incident of import licenses indicates that firms during the Chinese sanctions adapted to new market conditions. As one of the representatives stated, “a product finds its way to a market, if there is a demand for it”. In addition, it was said that globalization and digitalization can have made it easier for a product to find a market through more efficient communication.

Furthermore, the representatives described the incident where the Russian market was fully closed for Norwegian salmon in 2014 as bigger challenge than the Chinese sanctions. In the Russian market, only a few approved suppliers of Norwegian salmon were authorized to supply fresh whole salmon to the market, making it a well-payed market for the exporters involved. Based on this, it was indicated that the Russian sanctions potentially had a greater financial impact on firms, compared to the Chinese sanctions.

8.3 Summary of Findings From the Interviews

According to the interviewed representatives, the Chinese sanctions’ effect on firms’ financial performance depends on the relative importance of trade with China in the total export portfolio. The respondents represented middle-sized firms for which China was a small market prior to the sanctions. Thus, they have not been largely affected which supports our empirical findings. Here, it is worth mentioning that the interviews conducted can be colored by the fact that we were not able to interview representatives from firms which can have experienced a larger negative financial impact. It may be that firms with other characteristics, such as larger size or different export strategy, experienced the sanctions differently. This was also presumed by the interviewed representatives.

Furthermore, the global dynamics of the salmon market may have curbed the negative effect on the salmon exporters’ financial performance. One of the representatives described the international salmon market as a “lucrative market”, with high global demand and a shortage

of this product worldwide. This makes it easier for firms to change export destinations, and sell unsold salmon to other markets, thus reducing the possible negative impact of economic sanctions on firms. However, a reduced negative effect of the sanctions may be especially related to salmon because of its restrained production capacity as a natural resource. In other words, without a restriction in production of salmon, it is plausible that all global demands would already be served prior to the sanctions, thus making firms' negative financial effect greater.

Moreover, circumvention by Chinese importers could be one explanation for why firms may have experience a small negative financial impact of the sanctions. This is supported by the statement, "a product finds its way to a market, if there is a demand for it", and suggests that firms in the global salmon markets easily adapt to changes market conditions.

9. Conclusion

9.1 Summary of Findings

In this thesis, we have investigated whether the Chinese informal economic sanctions against Norwegian salmon had a negative effect on Norwegian salmon exporting firms' financial performance. In light of our research question, we revised the extensive empirical literature on economic sanctions, in addition to relevant theories on international trade. Based on this review we presented two hypotheses concerning how firms have been financially affected by the sanctions. Our overall expectation was that the Chinese sanctions had a negative financial impact on Norwegian salmon exporters. We also expected that the time dimension of the sanctions was of importance and that the sanctions had a greater negative impact on Norwegian salmon exporters in the short run than in the long run.

Challenges regarding the data gathering process and the obtained sample size made us unable to find a significant association between the sanction period and Norwegian salmon exporters' financial performance. However, empirical support is found for both of our hypotheses.

The results from our empirical analysis indicate that the Chinese sanctions had a negative financial impact on Norwegian salmon exporting firms, and that this negative effect was larger in the first three years of the sanction period. This can be explained by the costs an exporting firm may face when economic sanctions are imposed. A sanction's direct effect could be reduced sales and earnings, which immediately affect a firm's profitability. In addition, the indirect costs may affect firms by lowering their production runs and decrease their benefits from trade, such as economies of scale. However, the observed long-run effect of the sanctions was close to zero, suggesting that firms may face increased costs in the short run, but adapt to the changed market situation by choosing new and more profitable strategies in the long run. This supports the empirical literature which states that sanctions-busting activities always are likely.

Furthermore, our results indicate that the observed negative effect of the sanctions was small, suggesting that Norwegian exporting firms are relatively flexible and easily can change their export destinations. The complementary interviews with representatives from Norwegian

salmon exporting firms suggests that the sanctions hit exporters very differently. Both degree of involvement in the Chinese market and type of export strategy prior to the sanctions may be important factors determining how heavily a firm was financially affected. In addition, one of the interviewed representatives stated that the international market for fresh and frozen salmon is a profitable market for the time being, making it easy to sell unsold salmon to other markets. This may also be due to the salmon industry's restricted production capacity.

Moreover, it is generally positive that the Chinese sanctions were not particularly harmful to the Norwegian salmon industry. However, one reason why this is the case could be a severe issue for regulators in both Norway and China. If the sanctions increased the involvement in illegal actions, such as smuggling and falsifying the products, this is an unacceptable consequence. It is therefore important that countries develop and evaluate their exporting industries' normative standards, to prevent the potential criminalizing side effects of economic sanctions. In addition, firms should consider their exposure to risk when operating in a foreign market and evaluate their contribution in trade and their social responsibility. Bribery and smuggling are criminalized because of their harmful consequences and informal sanctions are no legitimate excuse for criminal practices.

9.2 Suggestions for Future Research

A further extension to our thesis, could be to see whether other imposed sanctions would lead to the same conclusions. This could illuminate whether different sanctions affect firms differently. However, this requires available information about affected firms' export destinations over time and that the group of firms is large.

We obtained numerous insights on the challenges related to the Chinese sanctions and the international market for salmon during the process of conduction complementary interviews. Using a qualitative approach with in depth interviews instead of a quantitative approach, sensitive to the data gathering process, could lead to a deeper understanding of how firms where affected and how they adapt to economic sanctions. Firms in the affected industry possess much knowledge and insight of the industry in general.

Lastly, a topic for future research could be to investigate how trade relations between China and its neighboring countries are affected by China's extensive use of informal economic sanctions.

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Appendix

A.1 Tests of Ordinary Least Squares Assumptions

Test for Serial Correlation

Two tests were conducted in terms of evaluating whether we have a problem with serial correlation (autocorrelation): A Durbin-Watson test and a Wooldridge's test for serial correlation in FE panels. Given a p-value lower than 0.05 in both tests, we can conclude that serial correlation is a problem in our model. Robust standard errors correcting for this has been applied.

```
> dwtest(ols1)

        Durbin-Watson test

data:  ols1
DW = 1.3423, p-value = 3.621e-12
alternative hypothesis: true autocorrelation is greater than 0

> dwtest(ols2)

        Durbin-Watson test

data:  ols2
DW = 1.3534, p-value = 6.989e-12
alternative hypothesis: true autocorrelation is greater than 0

> pwartest(fixed.time111)

        Wooldridge's test for serial correlation in FE panels

data:  fixed.time111
F = 17.398, df1 = 1, df2 = 369, p-value = 3.784e-05
alternative hypothesis: serial correlation

> pwartest(fixed.time222)

        Wooldridge's test for serial correlation in FE panels

data:  fixed.time222
F = 14.212, df1 = 1, df2 = 369, p-value = 0.0001902
alternative hypothesis: serial correlation
```

Test for Multicolinearity

Checking the correlation matrix of the control variables included in our models, collinearity seems not to be a problem in our data. We see that the correlation between debt ratio and fixed

assets ratio is a bit high. Since they are only control variables, correlation between them is not that big of a problem for our independent variable representing the sanction period.

	Sales	***Debt ratio***	***Fixed assets ratio***	***Age***
Sales	1,00			
Debt ratio	- 0,12	1,00		
Fixed assets ratio	0,02	0,77	1,00	
Age	0,57	- 0,10	- 0,06	1,00

Table A.1: *Correlation matrix*

Calculating the Variance Inflation Factor, multicollinearity nor seems to be a problem in our models. Average VIFs of 1.8 and 1.7 indicate that multicollinearity is not a problem in our case. The VIF has a lower bound of 1 and no upper bound, while a common rule of thumb is to be cautious of VIF values that exceeds 10.

```
> vif(pool11)
sanc_2011_2017        log(Sales)         Debt_ratio
1.409640              1.231237           2.539894

Fixed_assets_ratio        age_0_10           age_11_20
2.718171                  1.518361           1.561858

> mean(vif(pool11))
[1] 1.82986

> vif(pool22)
sanc_2011_2013     sanc_2014_2017         log(Sales)         Debt_ratio
1.149895           1.339984               1.232769           2.544458

Fixed_assets_ratio         age_0_10           age_11_20
2.718193                   1.523967            1.563058

> mean(vif(pool22))
[1] 1.724618
```

Test for Linearity

OLS assumes a linear relationship between the dependent and the independent variables (control variables). In order to evaluate the linearity of the control variables, we used the crPlot-function from the *car* package in R. This function outputs a component residual plot, which means that it adds a line indicating where the line with the best fit lies (Paruchuri, 2012). A significant difference between the residual line, the blue dotted line, and the component line indicates a non-linear relationship between the dependent and independent variable.

Figure A.1 right side plot shows that the variable representing total sales is not linear in its relationship with the dependent variable ROA. Using the logarithm of total sales clearly improves the relationship, shown in figure A.1 left side plot. Logarithm of total sales is therefore used. The other control variables, shown in figure A.2, are slightly concave shaped, but compared to sales they are close to linear. The linearity assumption is seen as fulfilled.

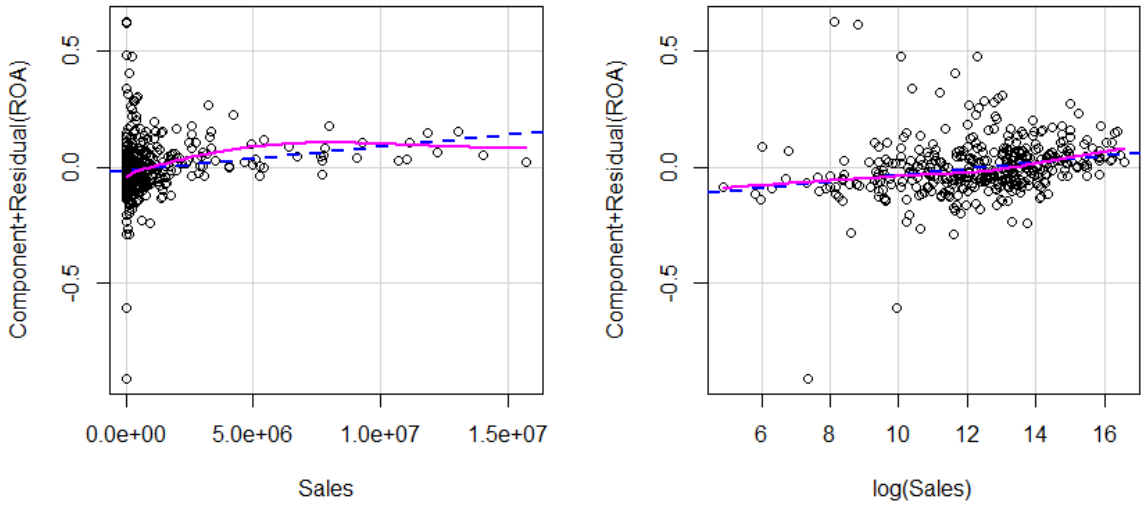

Figure A.1: *Total sales against ROA*

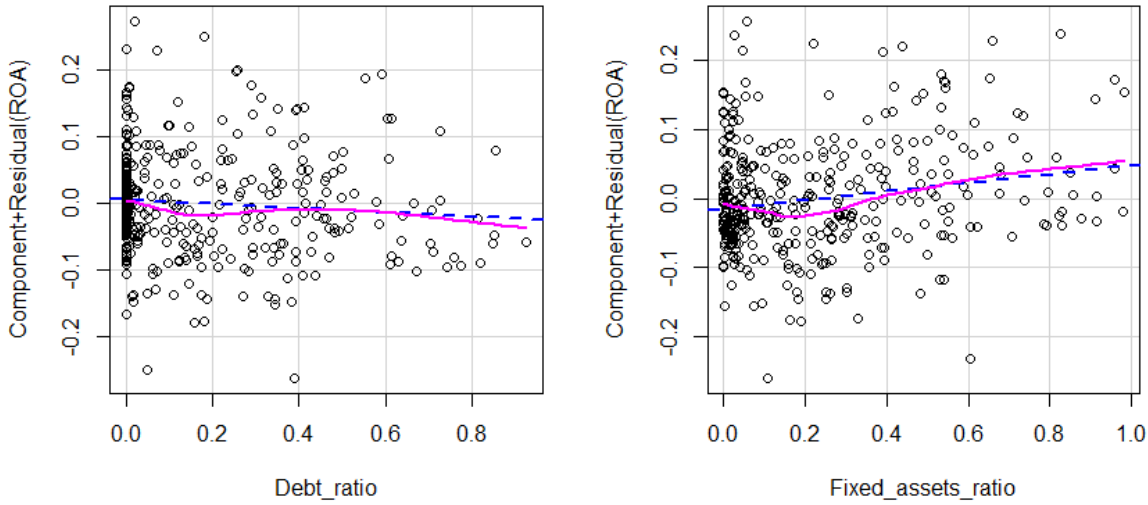

Figure A.2: *Debt ratio against ROA, and fixed assets ratio against ROA*

Test for Homoscedasticity

To test for heteroscedasticity a Breuch-Pagan test was conducted. Since the p-value is lower than 0.05 we reject the null hypothesis that the variance of the residuals is constant. This suggests that we have a problem with heteroscedasticity in our model, and robust standard errors correcting for heteroscedasticity has been applied.

```
> bptest(pool11, data = Full_dataset, studentize = F)

        Breusch-Pagan test

data:  pool11
BP = 116.81, df = 6, p-value < 2.2e-16

> bptest(pool22, data = Full_dataset, studentize = F)

        Breusch-Pagan test

data:  pool22
BP = 118.24, df = 7, p-value < 2.2e-16
```

Test for Normality

Studying a normal Q-Q plot of the residuals, suggests that our distribution is slightly skewed. However, when working with a small sample with high variation, this is expected.

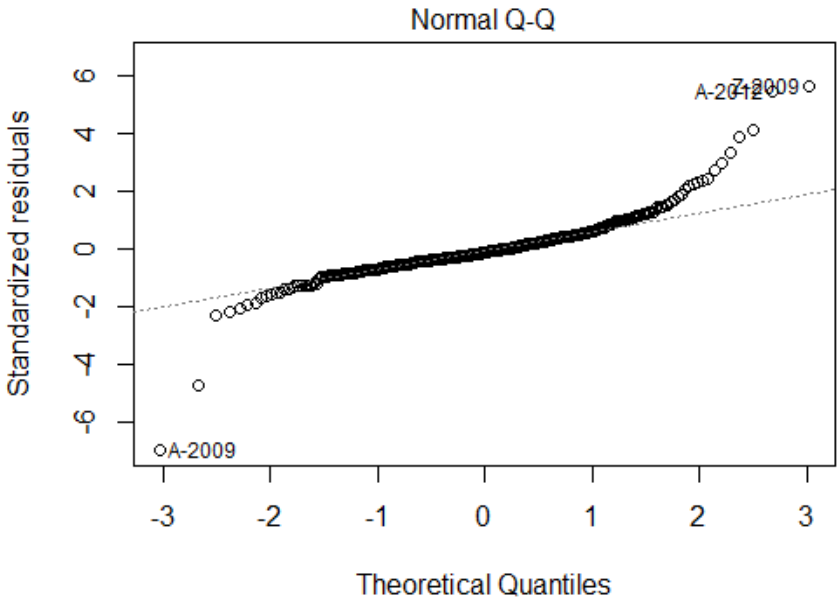

Figure A.3: *Q-Q plot of residuals*

A.2 F-test Comparing Pooled OLS and Fixed Effects

Using a F-test for individual effect, we discard the null hypothesis that pooled OLS is better than Fixed Effects.

```
> pFtest(fixed, ols) # p-value <0.05 -> USE FE

        F test for twoways effects

data:  ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio + Fixed_assets_ratio +  ..
.
F = 7.4994, df1 = 42, df2 = 323, p-value < 2.2e-16
alternative hypothesis: significant effects

> pFtest(fixed2, ols2)# p-value <0.05 -> USE FE

        F test for individual effects

data:  ROA ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) + Debt_ratio +  ...
F = 8.8965, df1 = 30, df2 = 334, p-value < 2.2e-16
alternative hypothesis: significant effects
```

A.3 F-test for two-ways effect

Using a F-test for two-ways effect, both firm and time effects, we discard the null hypothesis that no time effects are needed. A p-value lower than 0.05 indicates that we should also include time fixed effects in our models.

```
> pFtest(fixed.time, fixed) # p-value <0.05 -> Include time fixed effects

        F test for twoways effects

data:  ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio + Fixed_assets_ratio +  ..
.
F = 2.7322, df1 = 12, df2 = 323, p-value = 0.001537
alternative hypothesis: significant effects

> pFtest(fixed.time2, fixed2) # p-value <0.05 -> Include time fixed effects

        F test for twoways effects

data:  ROA ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) + Debt_ratio +  ...
F = 2.5771, df1 = 12, df2 = 322, p-value = 0.002809
alternative hypothesis: significant effects
```

A.4 Boxplots of Potential Outliers

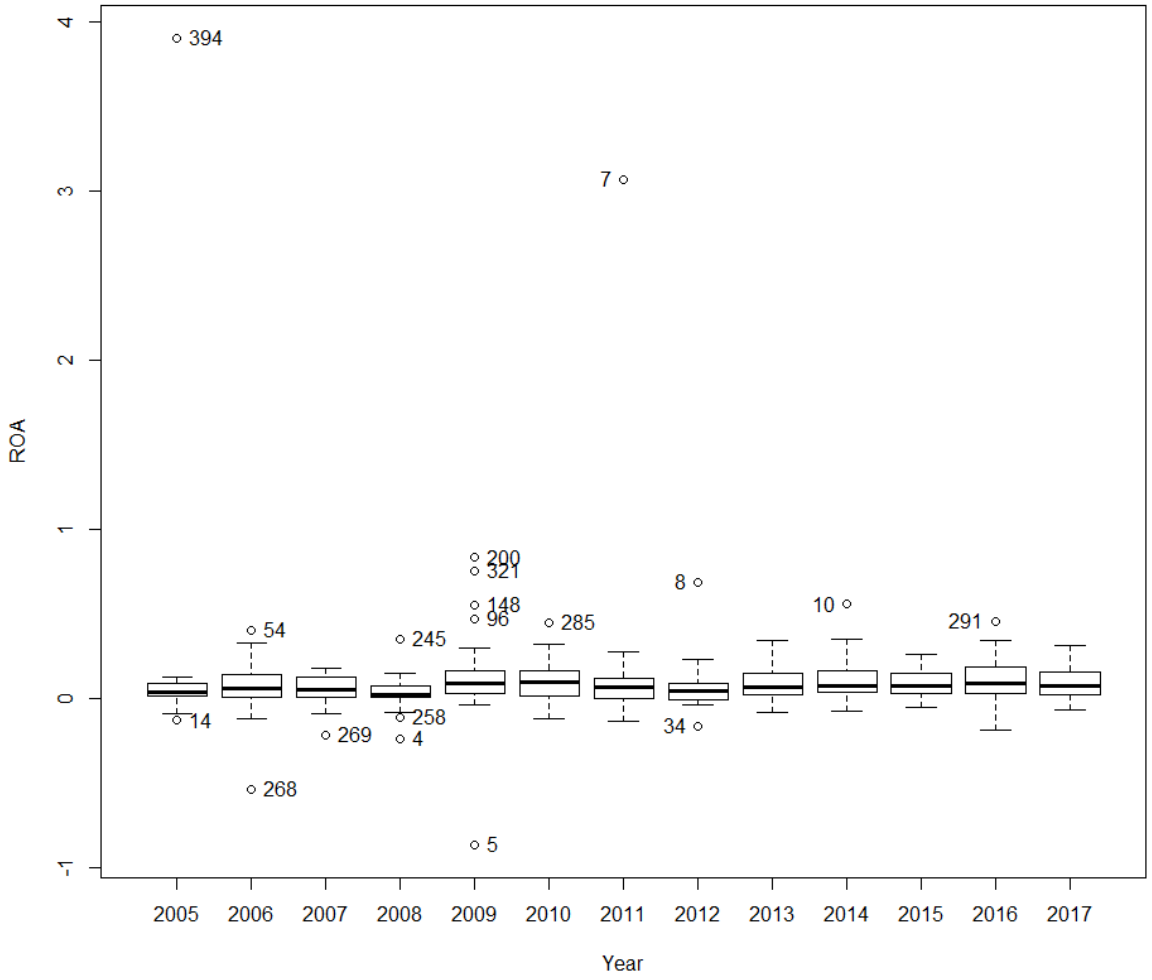

Figure A.4: *Boxplot of potential outliers in ROA. Dotted lines indicate 95% confidence intervals around the mean. Potential outliers are defined as the data points outside the fences of the boxplot. Observation 7, 200 and 394 was removed.*

A.5 List of Included Firms

We have chosen not to include a list of the Norwegian salmon exporters in our dataset, since some of the encountered salmon exporters requested that information about their export destinations were handled discretely. The number of exporters in the industry is low, making it possible to identify the firms desiring confidentiality. Hence, we have not included the list of in order to comply with some firms' desire of anonymity.

A.6 R code

```
#Load packages
library(tidyverse) # Modern data science library
library(plm)       # Panel data analysis library
library(car)       # Companion to applied regression
library(tseries)   # For timeseries analysis
library(lmtest)    # For heteroskedasticity analysis

library(stargazer) # For html table form R statistical output
library(gplots)    # Various programing tools for plotting data
library(ggplot2)

#Import dataset
library(readxl)
Full_dataset    <-    read_excel("~/Studie    NHH/NHH    Master/Hørs    2018    (4-
semester)/Masteroppgave/Full dataset 2.xlsx",
                           col_types = c("text", "text", "text",
                                         "numeric", "numeric", "numeric",
                                         "numeric", "numeric", "numeric",
                                         "numeric", "numeric", "numeric",
                                         "numeric", "numeric", "text", "numeric",
                                         "text", "text", "text", "text", "text",
                                         "text"))
attach(Full_dataset)

#Declare the dataset as panel data
Full_dataset <- pdata.frame(Full_dataset, index = c("FirmID", "Year"))

# Function for detecting outliers 3 sd outside of the mean
findOutlier <- function(Full_dataset, cutoff = 3) {
  ## Calculate the sd
  sds <- apply(Full_dataset, 2, sd, na.rm = TRUE)
  ## Identify the cells with value greater than cutoff * sd (column wise)
  result <- mapply(function(d, s) {
    which(d > cutoff * s)
  }, Full_dataset, sds)
  result
}

outliers <- findOutlier(Full_dataset)
outliers

#Create variable for ROS
ROS <- Net_income/Sales

#Boxplot of ROA over time among the firms
scatterplot(ROA~Year|FirmID,  data  =  Full_dataset,  main  =  "Boxplot  identifyin
potential outliers")

#Boxplot of ROS over time among the firms
scatterplot(ROS~Year|FirmID,  data  =  Full_dataset,  main  =  "Boxplot  identifyin
potential outliers")

#Remove identified outlliers
Full_dataset <- Full_dataset[-c(7, 9, 200, 394),]
attach(Full_dataset)

#Create year dummies
age_0_10 <-as.numeric(Age < 11)
age_11_20 <- ifelse(Age > 10 & Age < 21,1,0)
age_over20 <- ifelse(Age > 20,1,0)

### MAIN MODEL SPECIFICATION
```

```
pool1 <- plm(ROA ~ sanc_2011_2017 + factor(Year), data = Full_dataset, model =
"pooling")
pool11 <- plm(ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio + Fixed_assets_ratio
+ age_0_10 + age_11_20 + factor(Year), data = Full_dataset, model = "pooling")
fixed.time1 <- plm(ROA ~ sanc_2011_2017, data = Full_dataset, model = "within",
effect = "twoways")
fixed.time11 <- plm(ROA ~ sanc_2011_2017 + log(Sales), data = Full_dataset, model
= "within", effect = "twoways")
fixed.time111 <- plm(ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio, data =
Full_dataset, model = "within", effect = "twoways")
fixed.time1111 <- plm(ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio +
Fixed_assets_ratio, data = Full_dataset, model = "within", effect = "twoways")
fixed.time11111 <- plm(ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio +
Fixed_assets_ratio + age_0_10 + age_11_20, data = Full_dataset, model = "within",
effect = "twoways")

#Applying Newey-West HAC robust standard errors
covPool1 <- vcovNW(pool1, type = "HC1", cluster ="group") #Pool 1
robust.pool1 <- sqrt(diag(covPool1))
covPool11 <- vcovNW(pool11, type = "HC1", cluster ="group") #Pool 2
robust.pool11 <- sqrt(diag(covPool11))
covFE1 <- vcovNW(fixed.time1, type = "HC1", cluster ="group") #FE 1-1
robust.se.FE1 <- sqrt(diag(covFE1))
covFE11 <- vcovNW(fixed.time11, type = "HC1", cluster ="group") #FE 1-2
robust.se.FE11 <- sqrt(diag(covFE11))
covFE111 <- vcovNW(fixed.time111, type = "HC1", cluster ="group") #FE 1-3
robust.se.FE111 <- sqrt(diag(covFE111))
covFE1111 <- vcovNW(fixed.time1111, type = "HC1", cluster ="group") #FE 1-4
robust.se.FE1111 <- sqrt(diag(covFE1111))
covFE11111 <- vcovNW(fixed.time11111, type = "HC1", cluster ="group") #FE 1-5
robust.se.FE11111 <- sqrt(diag(covFE11111))

#Output statistics for Main model specification
stargazer(pool1, pool11, fixed.time1, fixed.time11, fixed.time111, fixed.time1111,
fixed.time11111,        se=list(robust.pool1,robust.pool11,        robust.se.FE1,
robust.se.FE11, robust.se.FE111, robust.se.FE1111, robust.se.FE11111),
          column.labels=c("Pooled OLS", "Pooled OLS", "FE", "FE", "FE", "FE",
"FE"), align=TRUE, type = "html", out="Main_specification_with_time.html")

### TESTING THE EFFECT OF TIME
pool2 <- plm(ROA ~ sanc_2011_2013 + sanc_2014_2017+ factor(Year), data =
Full_dataset, model = "pooling")
fixed.time2 <- plm(ROA ~ sanc_2011_2013 + sanc_2014_2017, data = Full_dataset, model
= "within", effect = "twoways")
fixed.time2222 <- plm(ROA ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) +
Debt_ratio, data = Full_dataset, model = "within", effect = "twoways")
fixed.time22222 <- plm(ROA ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) +
Debt_ratio + Fixed_assets_ratio + age_0_10 + age_11_20, data = Full_dataset, model
= "within", effect = "twoways")

#Applying Newey-West HAC robust standard errors
covPool2 <- vcovNW(pool2, type = "HC1", cluster ="group") #Pool 2-1
robust.pool2 <- sqrt(diag(covPool2))
covFE2 <- vcovNW(fixed.time2, type = "HC1", cluster ="group") #FE 2-1
robust.se.FE2 <- sqrt(diag(covFE2))
covFE2222 <- vcovNW(fixed.time2222, type = "HC1", cluster ="group") #FE 2-2
robust.se.FE2222 <- sqrt(diag(covFE2222))
covFE22222 <- vcovNW(fixed.time22222, type = "HC1", cluster ="group") #FE 2-3
robust.se.FE22222 <- sqrt(diag(covFE22222))

#Output statistics for model testing the effect of time
stargazer(pool2,        fixed.time2,        fixed.time2222,        fixed.time22222,
se=list(robust.pool2, robust.se.FE2, robust.se.FE2222, robust.se.FE22222),
          column.labels=c("Pooled OLS", "FE","FE","FE"), align=TRUE, type = "html",
out="Effect_of_time.html")
```

```
####################################
############# TESTING ##############
####################################

#Models for testing
ols1 <- lm(ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio + Fixed_assets_ratio +
age_0_10 + age_11_20, data = Full_dataset)
ols2 <- lm(ROA ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) + Debt_ratio +
Fixed_assets_ratio + age_0_10 + age_11_20, data = Full_dataset)
ols3 <- lm(ROA ~ sanc_2011_2017 + Sales + Debt_ratio + Fixed_assets_ratio + age_0_10
+ age_11_20)
pool <- plm(ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio + Fixed_assets_ratio +
age_0_10 + age_11_20, data = Full_dataset, model = "pooling")
pool2 <- plm(ROA ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) + Debt_ratio +
Fixed_assets_ratio + age_0_10 + age_11_20, data = Full_dataset, model = "pooling")
fixed <- plm(ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio + Fixed_assets_ratio +
age_0_10 + age_11_20, data = Full_dataset, model = "within")
fixed2 <- plm(ROA ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) + Debt_ratio +
Fixed_assets_ratio + age_0_10 + age_11_20, data = Full_dataset, model = "within")
fixed.time <- plm(ROA ~ sanc_2011_2017 + log(Sales) + Debt_ratio +
Fixed_assets_ratio + age_0_10 + age_11_20, data = Full_dataset, model = "within",
effect = "twoways")
fixed.time2 <- plm(ROA ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) + Debt_ratio
+ Fixed_assets_ratio + age_0_10 + age_11_20, data = Full_dataset, model = "within",
effect = "twoways")


#Testing for serial correlation
dwtest(ols1) # Durbin Watson
dwtest(ols2)
pwartest(fixed.time) # Wooldridge's test for serial correlation in FE panels
pwartest(fixed.time)

#Breusch-Pagan test heterocedasticity
bptest(pool, data = Full_dataset, studentize = F)
bptest(pool2, data = Full_dataset, studentize = F)

#Test for linearity
library(car)
par(mfrow = c(1,2))
crPlot(ols3, Sales) ## linear assumption does not hold for Sales -> use log(sales)
crPlot(ols1, log(Sales))
crPlot(ols1, Debt_ratio)
crPlot(ols1, Fixed_assets_ratio)

#Test for normality
plot(ols1)

#Test for Multicolinearity
CorData <- Full_dataset[c(4, 13, 14, 16)] # Correlation matrix
cormat <- round(cor(CorData),2)
head(cormat)

vif(pool11) # VIF test
mean(vif(pool11))
vif(pool22)
mean(vif(pool22))

#Test for two-ways effect. The null is that no time-fixed effects are needed.
pFtest(fixed.time, fixed)
pFtest(fixed.time2, fixed2)
```

```
#######################################
####### DESCRIPTIVE STATISTICS #######
#######################################

#Subsetting dataset
Yes <- Full_dataset[which(salmon_exporter == 1),] #dataset of salmon exporters
No <- Full_dataset[which(salmon_exporter == 0),] #dataset of non-salmon exporters

stargazer(Yes, type = "html", out = "descriptive1.html", digits = 4)
stargazer(No, type = "html", out = "descriptive2.html", digits = 4)

#Function to calculate the mean and the standard deviation
data_summary <- function(data, varname, groupnames){
  require(plyr)
  summary_func <- function(x, col){
    c(mean = mean(x[[col]], na.rm=TRUE),
      sd = sd(x[[col]], na.rm=TRUE))
  }
  data_sum<-ddply(data, groupnames, .fun=summary_func,
                  varname)
  data_sum <- rename(data_sum, c("mean" = varname))
  return(data_sum)
}

library(dplyr)
#Summarize the data
df <- data_summary(Full_dataset, varname = "ROA", groupnames = c("Year",
"salmon_exporter"))

#Diagram of mean ROA over time
p <- ggplot(df, aes(x=Year, y=ROA, group = salmon_exporter ,color=salmon_exporter))
+
  geom_line(size = 1) +
  geom_point(size = 3, shape = 21, fill ="white")+
  ggtitle("Mean ROA over time")+
  scale_color_hue(name = "Type of firm", labels = c("Non-Salmon exporter", "Salmon
exporter"))+
  theme(legend.justification=c(1,0),
        legend.position=c(1,0))+
  expand_limits(y=0)+
  geom_vline(xintercept = 7, color ="gray", linetype = "longdash")
print(p)

#######################################
######### ROBUSTNESS CHECKS ##########
#######################################

fixed.timeROS <- plm(ROS ~ sanc_2011_2017 + log(Sales) + Debt_ratio +
Fixed_assets_ratio + age_0_10 + age_11_20,
                     data = Full_dataset, model = "within", effect = "twoways")

fixed.timeROE <- plm(ROE ~ sanc_2011_2017 + log(Sales) + Debt_ratio +
Fixed_assets_ratio + age_0_10 + age_11_20,
                     data = Full_dataset, model = "within", effect = "twoways")


covFEROS <- vcovNW(fixed.timeROS, type = "HC1", cluster ="group") #FE ROS
robust.se.FEROS <- sqrt(diag(covFEROS))

covFEROE <- vcovNW(fixed.timeROE, type = "HC1", cluster ="group") #FE ROE
robust.se.FEROE <- sqrt(diag(covFEROE))
```

```
fixed.time2ROS <- plm(ROS ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) +
Debt_ratio + Fixed_assets_ratio + age_0_10 + age_11_20,
                      data = Full_dataset, model = "within", effect = "twoways")

fixed.time2ROE <- plm(ROE ~ sanc_2011_2013 + sanc_2014_2017 + log(Sales) +
Debt_ratio + Fixed_assets_ratio + age_0_10 + age_11_20,
                      data = Full_dataset, model = "within", effect = "twoways")

covFE2ROS <- vcovNW(fixed.time2ROS, type = "HC1", cluster ="group") #FE ROS
robust.se.FE2ROS <- sqrt(diag(covFE2ROS))

covFE2ROE <- vcovNW(fixed.time2ROE, type = "HC1", cluster ="group") #FE ROE
robust.se.FE2ROE <- sqrt(diag(covFE2ROE))

#All models in one table
stargazer(fixed.time11111      ,fixed.timeROE,fixed.timeROS,      fixed.time22222,
fixed.time2ROE,    fixed.time2ROS,    se=list(robust.se.FE11111,    robust.se.FEROE,
robust.se.FEROS, robust.se.FE22222, robust.se.FE2ROE, robust.se.FE2ROS),
          column.labels=c("FE","FE",  "FE",  "FE","FE",  "FE"), align=TRUE, type =
"html", out="Robustness_checksALL.html")
```