Four Essays on Consumer Studies, Market Simulation, and International Trade of Fish

Fire essay om forbrukerstudier, markedssimuleringer og internasjonal handel med fisk

四篇关于水产品消费者研究、市场模拟和国际贸易的论文

Philosophiae Doctor (PhD) Thesis

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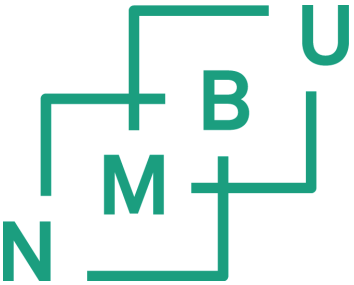
Ås (2015)



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Dedication

To my parents, Guifang Zhou and Shanfa Chen.

献给我的母亲周桂芳和父亲陈善法

Acknowledgment

I would like to thank my family and my friends for their love and company, my colleagues in Ås, Tromsø, and Laramie for their support, my coauthors for their collaboration, and especially my supervisors, Professor Kyrre Rickertsen, Professor Frode Alfnes, Professor Claire W. Armstrong, and Professor Jason F. Shogren, for their guidance. In addition, I am grateful for the financial support from Research Council of Norway (grants 199564/I10 and 216742/E40) and the European Commission's ERA-NET Scheme (the SUSDIET project). Finally, I thank my thesis evaluation committee for their comments and the support.

我感谢我的亲人和朋友们对我的爱和陪伴、同事们的支持、和导师们的指导。 我同时感谢挪威科研委员会（199564/I10号项目和216742/E40号项目）和欧盟委员会ERA-NET计划（SUSDIET项目）的经济支持。 最后，我感谢我的论文答辩委员会的建议和支持。

陈贤文

Ås, July 23, 2015

Contents

Abstract

This thesis consists of four empirical studies of fish markets, with emphases on consumer studies, market simulation and international trade. The topics of the papers are French consumers' preference for ecolabeled fish, the effects of negative environmental information about fish, simulation and prediction of market shares in the French seafood market, and salmon trade between Norway and China.

The first paper investigates French consumers' preference and willingness-to-pay (WTP) for ecolabeled fish in a choice experiment. Two ecolabels are used: the Marine Stewardship Council (MSC)'s label that certifies wild fish from sustainable fisheries, and the French Agriculture Biologique (AB) label that can be used to certify farmed fish from organic aquaculture. The analysis is conducted by using a generalized multinomial logit (GMNL) model and a mixed multinomial logit (MMNL) model in preference space and in WTP space. The GMNL model in preference space is found to fit the data slightly better than the other three models. The results indicate that French consumers are willing to pay approximately 10% in price premiums for ecolabeled fish. The WTP premium for the AB label is slightly higher (and more robust when considering the results from the second paper) than for the MSC label.

The second paper examines how negative environmental information affects French consumers' preference for non-ecolabeled and ecolabeled fish. Four types of negative environmental information were provided either in the presence or absence of the MSC and the AB label. Although the participants were willing to pay premiums for both ecolabels, these premiums are smaller than the reductions in WTP that are caused by the negative environmental information. Moreover, the estimated WTP for the MSC label is lower than

the estimate in the first paper, suggesting the first paper's WTP estimate for the MSC label is not robust. The lack of robustness may be due to participants' lack of familiarity with the MSC label. Finally, there are different indirect effects from the negative information on the substitutes to the fish that receives the negative information. The indirect effects depend on whether the substitute fish type is ecolabeled and whether it is produced by the same method (farmed or wild) as the fish type that receives the negative information.

The third paper applies the alternative specific constant (ASC) calibration method to the stated preference data from the choice experiment in France. After adjusting the ASCs by using real market shares, the calibrated models accurately predict the market shares in France in 2008. Predicted market shares from the calibrated models are compared with two naive predictions: observed market shares in the choice experiment and the predicted market shares from the uncalibrated model. The comparison finds that only the calibrated models predict accurate market shares in 2008. A "out of sample" validation is conducted on the calibrated models. Using the ASCs that are calibrated by using the 2008 market share data, the French seafood market shares in 2005, 2006, and 2007 are predicted; the predictions are quite close to the real market shares, contain smaller errors and represent an improvement as compared with the predicted market shares found by using uncalibrated ASCs. The calibrated model is used to predict French fish market shares in three scenarios with changed fish price or consumer preferences.

The fourth paper centers on the Chinese fresh/chilled whole salmon market. Since December 2010, it has been alleged that China has put up non-tariff barriers (NTBs) against salmon from Norway. This paper collects accounts from stakeholders in the five largest wholesale markets in China, and analyzes international and regional trade data, to triangulate the "salmon sanction". The majority of the interviewed stakeholders confirm the alleged NTBs, which do not exist in documented policies but in practice have been applied

to salmon from Norway. Since the NTBs were implemented the workarounds, that have been practiced by Norwegian exporters and Chinese importers to bust the sanctions, have distorted China's domestic market. The distortions are likely long term because the workarounds, particularly smuggling, may not stop after the NTBs are removed. Our findings suggest that consumers in mainland China are potentially paying for the increased costs and also reduced quality of Norwegian salmon as the consequence of the NTBs. Contrary to the popular misbelief, Norway has not lost much of its market share in China, and has increased its exports to mainland China since 2010. Finally, Norway's refusal to meet the Dalai Lama in May 2014 indicates that the China's sanction has obtained its political goal. The new health certificate agreement between the two countries suggest that the Sino-Norway relationship is warming up.

The thesis' main contributions are three-fold. First, the findings help understand consumer preference and demand for ecolabeled fish. The results offer insights on consumer preferences and WTP premiums for fish that are certified with ecolabels in France. The insights on ecolabeling effects and effects of negative environmental information may be useful for academic research, policy analysis, and product development, particularly for cost-benefit analysis of an ecolabel.

Second, novel econometric methods are applied and compared. The first paper compares WTP estimates from the MMNL model with the estimates from the GMNL model, in preference space and in WTP space. The comparison suggests that the differences among the four models are small. The third paper uses the ASC calibration method to combine stated preference data with real market shares, which are revealed preference data, and demonstrates that the calibrated models predict past market shares quite accurately.

Third, the thesis contributes to the literature on the highly exposed salmon sanction that is imposed by China on Norwegian salmon. The fourth paper provides firsthand

accounts from traders that are involved in the business and analyzes the international and regional trade flows. The strong evidences from the analysis of trade data, and the compelling accounts from stakeholders suggest that China has been sanctioning Norway by practicing NTBs on Norwegian salmon. The analyses on the implications of China's NTBs to trade flows, market distortion, and consumer welfare loss provide knowledge for the firms involved in the salmon trade, academic researchers, and international relation analysts.

Introduction

Introduction to the PhD Thesis

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1. Introduction

This thesis focuses on fish markets, consumer preferences in fish markets and international fish trade. Fish is an important source of nutrition globally (Mozaffarian and Rimm 2006; FAO 2011, 2013). With the world's growing population, the demand for food has been and will continue to increase (Godfray et al. 2010). Developing aquaculture and managing wild fish stocks sustainably are critically important to ensure current and future generations' supply of fish (Primavera 2005; Worm et al. 2006; Smith et al. 2010).

Certain segments of consumers are concerned with sustainability, environment, and ethical issues related to fish production (Wessells and Anderson 1995; Wessells, Kline and Anderson 1996; Teisl, Roe and Hicks 2002; Aarset et al. 2004; Jaffry et al. 2004; Verbeke et al. 2007; Brécard et al. 2009; Salladarré et al. 2010; Sogn-Grundvåg, Larsen and Young 2013; Asche et al. 2015). Ecolabels certify specific fish products' ecological attributes and help producers to assure the concerned consumers (e.g., Salladarré et al. 2010; Sogn-Grundvåg, Larsen and Young 2013). The Marine Stewardship Council (MSC)'s label, which is the most globally recognized ecolabel for fish, certifies wild fish that is from a sustainably managed fishery (MSC 2013). Farmed fish, on the other hand, has ecological attributes that are similar to agricultural products, for example organic production (Olesen,

Myhr and Rosendal 2011). In general, studies find positive willingness-to-pay (WTP) premiums for ecolabeled seafood from representative samples, suggesting that the segments of consumers that favor ecolabel and the sound environmental attributes behind the labels, are large enough (Roheim, Asche and Santos 2011; Chen, Alfnes and Rickertsen 2015).

It is critical for the industry and for the policy makers to understand how much consumers appreciate ecologically friendly fish in terms of WTP premiums, because the price premiums partly decide whether it will be profitable for a firm to voluntarily enroll in an ecolabel scheme (Stefan and Paul 2008). A firm will only enroll in an ecolabel scheme, when the ecolabel is anticipated to offer more benefits than costs. The potential benefits are mainly increased sales and/or price premiums. It is important to identify both the average WTP premium and the segments of the consumers who are willing to pay the premium (e.g., Grimsrud et al. 2013; Ellingsen et al. 2015). Moreover, robustness of such WTP premium estimates has to be tested (e.g., Hansen and Onozaka 2011; Uchida et al. 2014). The thesis' first two papers focus on sizes and robustness of ecolabels' price premiums.

France has one of the largest seafood markets in Europe (FAO 2014a). In 2014, France imported 1,382.99 million USD worth of fish (UN Comtrade 2015). Empirical findings from France are potentially important and useful for all stakeholders involved in the market. Furthermore, France is a top importer of fish from Norway (Norwegian Seafood Council 2015). In 2014, Norway exported 905.94 million USD worth of fish to France (UN Comtrade 2015). Figure 1 depicts, annually, French total imports of fish from the world, and Norwegian total exports of fish to France between 1996 and 2014. Empirical findings from the French market are potentially useful for the Norwegian seafood industry. The first three papers of the thesis include empirical studies that center on the seafood market in France.

(Insert Figure 1 here)

The thesis' first paper investigates French consumers' preference and willingness-to-pay for ecolabeled fish, and whether the recently proposed generalized multinomial logit (GMNL) model produces better WTP estimates, when compared to mixed multinomial logit (MMNL) model. Both models are estimated in both preference space and WTP space. Two ecolabels are used: Marine Stewardship Councils MSC label for wild fish from sustainable fisheries, and the Agriculture Biologique (AB) label that certifies farmed fish from organic aquaculture in France. The WTP estimates for the two ecolabels may be useful for fish producers when conducting cost-benefit analyses, who are interested in marketing ecolabeled fish in France.

Consumers are only willing to pay premiums for ecolabeled fish when they trust the ecolabels (e.g., Dekhili and Achabou 2014; Uchida et al. 2014; Yogo 2015). The second paper examines how negative environmental information affects French consumers' preference for non-ecolabeled and ecolabeled fish. Four types of negative environmental information were provided either in the presence or absence of the MSC and the AB label. If consumers fully trust the two ecolabels, then the negative environmental information would not affect their preference for the ecolabeled fish. However, the second paper finds that consumers reduce similar amounts of WTP for ecolabeled fish, as for non-ecolabeled fish, after receiving negative information. This result calls for more efforts from ecolabel certification organizations. Only when a substantial part of the consumers trust ecolabels, ecolabeled fish can provide sufficient economic incentives for producers to adopt ecologically friendly practices.

Whilst the first two papers are concerned with micro aspects of the seafood market, the third paper focuses on the entire French seafood market. Market analysis relies on quantitative tools that can simulate and predict market changes under different scenarios. Choice experiments are useful for eliciting consumer preference and WTP, for example, for

ecolabeled fish, but they tend to perform poorly when they are directly used to predict market changes (Chang, Lusk and Norwood 2009; Resano-Ezcaray, Sanjuán-López and Albisu-Aguado 2010; Hudson, Gallardo and Hanson 2012). The food marketing literature has been focusing on producing more accurate WTP estimates from choice experiments (e.g., Alfnes and Rickertsen 2007), but not on predicting market shares.

The third paper marks the first effort to fill in this gap in food economics literature. It applies the alternative-specific constants (ASC) calibration method (Manski and Lerman 1977; Cosslett 1981a, b; Manski and McFadden 1981; Ben-Akiva and Lerman 1985; Train 1986; Train 2009) to simulate and predict market shares in the French seafood market. Without calibration, the observed market shares in the choice experiment and predicted market shares from the uncalibrated multinomial logit model largely deviate from the real market shares. After calibration, the calibrated multinomial logit model is able to predict accurately the market shares in France in 2008. Moreover, the resulted calibrated model (using market share data in 2008) is robust, such that it predicts market shares well when predicting "out of sample" for the year 2005, 2006, and 2007. The usefulness of the calibrated model is further demonstrated by simulating French seafood market under different price and preference change scenarios, for example, ecolabeling of salmon. The ASC calibration method is potentially useful to analyze future market changes not only for fish but also other commodities.

The fourth paper, unlike the first three, focuses on the Chinese salmon market. China's economic development has contributed to its increasing global influence, particularly through international trades (e.g., Reilly 2012; Fuchs and Klann 2013). China's salmon market is already large. Although per capita consumption of salmon in China is much lower than in most developed countries, consumers in mainland China purchase 1,000 tons fresh/chilled whole salmon every week (UN Comtrade 2014). The salmon market in

China is expected to continue to grow rapidly. Hence, it is of economic interest to seafood producers globally, including the Norwegian seafood industry.

China's fresh/chilled whole salmon market was dominated by Norwegian producers until 2010 (UN Comtrade 2014). Since December 2010, this dominance has reportedly been broken. The media has alleged the Chinese government for creating trade barriers that are only applied to salmon from Norway, as a payback to the Norwegian Nobel Committee's decision to award the 2010 Nobel Peace Prize to a Chinese dissident (Amland 2011; Milne 2013; Dagens Næringsliv 2014). However, this has not been investigated by the research community.

The fourth paper focuses on China's "salmon sanction" on Norway. First-hand accounts from stakeholders in the five largest wholesale markets in China are, through in-depth interviews, collected. International and regional trade data are also collected and analyzed. The qualitative materials are combined with the quantitative analysis to triangulate (Jick 1979) the implementation and the effects of the sanction. The majority of the interviewed stakeholders confirm the alleged non-tariff barriers (NTBs), which do not exist in documented policies but in practice have been applied to salmon from Norway. However, the Norway-specific NTBs have been less effective in restricting the import volumes because Chinese consumers have a strong preference and hence demand for Norwegian salmon. Contrary to the popular misbelief, Norway has not lost much of its market share, but has increased its exports to mainland China since 2010. Our findings suggest that consumers in mainland China are paying, as the consequence of the NTBs, for the increased costs and also reduced the quality of Norwegian salmon. Furthermore, Norwegian exporters and Chinese importers have been practicing workarounds to get Norwegian salmon into mainland China, including methods such as smuggling, to bust the

sanction. These workarounds have been distorting China's salmon market, and will likely continue even after the NTBs are removed.

In the next section, literature on ecolabels used in seafood markets is reviewed. Then, the research questions are stated in the third section. Section 4 describes the datasets that are used in the thesis. Section 5 summarizes the motivations and the results of each of the four papers. The last section summarizes the contributions and limitations of the thesis.

2. Background

Fishery management policies have focused on developing and enforcing management schemes related to the supply side of the seafood market. To a large extent, such schemes have been ineffective in conserving wild fish stocks (Beddington, Agnew and Clark 2007). The Food and Agriculture Organization (FAO) of the United Nations estimated that almost 60% of the world's fish stocks were fully exploited in 2009, and almost 30% were overexploited (FAO 2011).

Meanwhile, consumers are increasingly concerned with environmental issues that are raised from the fishery and the aquaculture industry (Wessells and Anderson 1995; Wessells, Kline and Anderson 1996; Teisl, Roe and Hicks 2002; Aarset et al. 2004; Jaffry et al. 2004; Verbeke et al. 2007; Brécard et al. 2009; Salladarré et al. 2010; Sogn-Grundvåg, Larsen and Young 2013). For aquaculture, segments of consumers, once they become aware, are likely concerned with environmental consequences due to escape from breeding cages with associated genetic pollution of wild stocks, problems with parasites, problems with use of chemical to treat diseases, overexploitation of species used for feed, and pollution of the seabed (Sharron and Christopher 1996; Tveterås 2002; Elliott 2003; Naylor, Eagle and Smith 2003; Burridge et al. 2010; Olesen, Myhr and Rosendal 2011). Similarly, for wild fisheries, segments of consumers are likely concerned with problems such as

depleted stocks and discards of bycatches (Hall, Alverson and Metuzals 2000; Lewison et al. 2004; Jacquet and Pauly 2007; FAO 2014b).

Ecolabeling is a way to convey eco-friendly information, which may otherwise be difficult for consumers to know, for example, whether a fish stock is depleted or whether the fishing practice is environmentally friendly (Brécard et al. 2009; Asche et al. 2015). It may be insufficient to know the species of the fish, and information about where and when the fish was caught may be desirable. One example is the Norwegian cod. Cod from the North Sea and the Norwegian coast is believed to be under considerable pressure and the fishery has not been granted the MSC label, which certifies fish from a sustainably managed fishery. Meanwhile, the cod fishery in the Barents Sea, which is currently generating record landings, does have the MSC label. To further increase the confusion, cod from the Barents Sea, which comes to the shores of Northern Norway during the winter months to spawn, can be caught during this period and MSC labeled.

A number of ecolabeling programs have been introduced following increased consumer concerns about overexploitation of wild fish stocks as well as other issues in seafood production. These issues include: (i) safety (e.g., Wessells and Anderson 1995; Wessells, Kline and Anderson 1996), (ii) quality (e.g., Verbeke et al. 2007; Brécard et al. 2009; Salladarré et al. 2010), (iii) environmental effect (e.g., Jaffry et al. 2004; Verbeke et al. 2007), (iv) sustainability (e.g., Sogn-Grundvåg, Larsen and Young 2013), and (v) fish welfare (e.g., Teisl, Roe and Hicks 2002; Aarset et al. 2004; Verbeke et al. 2007; Ellingsen et al. 2015). For more information on ecolabels, see Consumer Reports (2013).

An important success measure for ecolabeling programs is the size of the premium that consumers are willing to pay for the ecolabeled products (Thøgersen 2000; Nilsson, Tunçer and Thidell 2004). Many studies suggest that ecolabeling has a positive effect on consumer preference of fish. Jaffry et al. (2004) used a choice experiment and found that

ecolabeled seafood from a sustainably managed fishery had up to a 7% higher probability of being chosen by participants. Roheim, Asche and Santos (2011) analyzed scanner data of MSC-certified frozen processed Alaskan Pollock products and found that UK consumers were willing to pay a 14% premium for the ecolabel. Olesen et al. (2010) conducted a non-hypothetical choice experiment and found that the average Norwegian participant was willing to pay a 15% premium for organic salmon. Mauracher, Tempesta and Vecchiato (2013) found a significant price premium for organic Mediterranean sea bass.

The other important success measure for ecolabeling programs is the sales volumes. Producers and retailers' profitability of ecolabeling depends both on per unit price premium and sales volumes. Ecolabeling certifiers are concerned with sales volumes too. First, volumes are important indicators of the success of an ecolabel. Second, sales volumes are of extra importance for certifiers like MSC, which charge certification fees based on the sales volumes. As of June 2015, MSC, which is the most successful ecolabel for fish, certifies 9 million metric tons of seafood worldwide, which is close to 10% of world's wild fishery production (Marine Stewardship Council 2015). Finally, it is important whether an ecolabel is contributing to the sustainability of the certified fishery or aquaculture farm (Ponte 2012).

Norway is the second largest seafood exporter after China, and seafood exports generate about 7% of the Norwegian export value. The total Norwegian seafood export was about $10 billion in 2013. About 70% was from aquaculture (mainly salmon) and 30% from wild fisheries with cod and pelagic species as the most important fish types. France and Russia are the two most important markets for the Norwegian seafood export. In the French market, salmon and cod are the two most important species of fish.

Although several retailers have self-certified their products with ecolabels (Salladarré et al. 2010), there is no French national ecolabeling scheme for wild fish. As early as the spring of 2004, Carrefour launched its own ecolabel for wild cod products, and

other large retailers and processors of seafood followed with their own private ecolabels (Salladarré et al. 2010). The certification program of the MSC is currently the most widely used and recognized sustainable wild fish ecolabeling scheme in the world, and it is also used in France (Gulbrandsen 2009; Thrane, Ziegler and Sonesson 2009). As of June 2015, 373 fisheries have been certified by the MSC program, and another 102 fisheries were being assessed (Marine Stewardship Council 2015).

The MSC label only certifies wild fish. No ecolabeling program for farmed fish has so far gained wide international acceptance as the MSC label. The Aquaculture Stewardship Council (ASC) is the aquaculture counterpart to the MSC, which was founded in 2009 by the World Wide Fund for Nature (WWF) and the Dutch Sustainable Trade Initiative. The ASC aims to provide certification schemes for responsibly farmed fish. As of June 2015, the ASC now certifies bivalve, pangasius, salmon, shrimp, tilapia, and trout, and their certification program have participating countries from every continent except for Africa (Aquaculture Stewardship Council 2015). Marine Harvest, which is the world's biggest producer of salmon, announced in May 2013 that it would seek companywide ASC certification by 2020.

There is no national ecolabel for farmed fish in France. France, however, has an organic label that is nationally known, Agriculture Biologique (AB), which certifies organic food from agriculture. The AB label is recognized virtually by all households and is the most widely used ecolabel for food in France. It certifies food products with an organic content of at least 95%. Aquaculture is the farming in the water, as compared to agriculture, which is farming on the land. In theory, farmed fish from water, just as farmed products from land, can be labeled as organic, whereas wild fish cannot.

3. Research Questions

This thesis seeks to answer four research questions. First, the literature has extensively investigated consumers' preference and WTP for ecolabels that certify wild fish, such as the MSC label for wild fish from sustainable fisheries (Mozaffarian and Rimm 2006; FAO 2011, 2013). However, the effects of ecolabels that certify farmed fish are less researched. Organic labels are widely used for agricultural products, and consumers are concerned with whether their food is from organic production (for a review, see Hughner et al. 2007). Hence, the first research question is whether consumers are willing to pay a premium for organic labels for farmed fish.

Second, ecolabels typically provide positive information about a product, for example, organic production. Meanwhile, consumers receive all types of information in real life, and some of the information are related to negative environmental consequences of fish production, both from capture fishery and farming. Little is known on how an ecolabel performs, when a consumer learns negative environmental information on the attribute of fish that the ecolabel assures. For example, after reading news on the consequence of non-organic production of fish to the environment, will a consumer, who is concerned with the environment, continue to trust organic-labeled fish? An organic label certifies that the fish is from organic production. However, it is not guaranteed that the organic label will assure the concerned consumer. It will depend on several factors including, for example, the consumers' trust in the ecolabel. The second research question is to investigate how negative environmental information affects consumers' preferences for ecolabeled and non-ecolabeled fish.

Third, choice experiments, which are widely used to investigate consumer preference for different food attributes, cannot fully represent the complexity of real

markets. A number of calibration methods have been proposed in the literature to provide more accurate estimates of preferences (Alfnes and Rickertsen 2007; Resano-Ezcaray, Sanjuán-López and Albisu-Aguado 2010). But how can choice experiments be calibrated to better predict market changes? This is the third research question.

Fourth, country of origin is an important attribute for consumers. Consumers in China, for example, strongly prefer salmon from Norway to salmon from any other producing country (Bjørgo 2014). Since December 2010, it has been alleged by the media that China has been applying NTBs against Norway's salmon. What has happened in the Chinese salmon market, when NTBs have allegedly been targeted at Norwegian salmon, of which the country-of-origin is most preferred by the consumers? What are the effects of the NTBs? This is the fourth research question.

4. Data

The thesis uses several datasets. The econometric analyses in Paper 1, 2, and 3 are carried out on two datasets from France: a stated preference dataset from a choice experiment (Dataset 1), and a revealed preference dataset that is recorded by French households using home scanners (Dataset 2). The analyses in Paper 4 are based on one qualitative dataset from field interviews of stakeholders, who were involved in the salmon trade between Norway and China and had establishments in Hong Kong Special Administrative Region (SAR) or mainland China (Dataset 3), and one trade dataset that was compiled by using trade statistics from the United Nations, the Norwegian Seafood Council (NSC), and the Government of Hong Kong (Dataset 4).

4.1. Dataset 1: Stated Preference Data

The stated preference dataset is obtained from a choice experiment. The experiment was carried out in the sensory laboratory of l'Institut National de la Recherche

Agronomique (INRA) in Dijon in December 2008. Potential participants were randomly drawn from INRA's consumer panel.[1] In the recruitment process, they were asked to answer a short survey on their consumption and purchasing frequencies of fish. Only those who ate fish at home more than once a month and bought fresh fish themselves at least every second month were recruited. Each participant was paid € 25 to participate in the experiment.

Two types of ecolabels are used in the choice experiment: the MSC label and the AB label. The former certifies wild fish from sustainable fisheries, while the latter is a nationally recognized organic label in France. There were five non-ecolabeled and three ecolabeled fish types included in the experiment. Each fish type was labeled with species, area or country of origin,[2] and price. Furthermore, the farmed fish types were labeled as such. Monkfish was included as an expensive substitute for cod and salmon, and pangasius was included as inexpensive substitute. Both monkfish and pangasius were always non-ecolabeled. The price range of the non-ecolabeled fish was based on market prices in Dijon at the time of the experiment. In the market, the prices varied considerably, and the price variation reflects factors such as size, quality, cut, outlet, day, and promotions. For the

[1] The consumer panel is a database of participants who volunteer to participate in sensory experiments. The volunteers have been recruited in several ways: random selection of phone numbers in representative districts of all socioeconomic classes of Dijon and the suburbs, advertisements in the local press, and during exhibitions. Dijon is a city with about 150,000 inhabitants and is located 300 km southeast of Paris. The city is representative of France in terms of household disposable income and socio-demographic composition. Fresh fish consumption in Dijon is slightly below the average consumption in France, but representative of the noncoastal regions.

[2] For wild fish, its origin is the area where it was harvested. For farmed fish, its origin is the country where it was farmed.

ecolabeled products, the price ranges were set € 1.50-2.00 above the price ranges of the corresponding non-ecolabeled products.

To reduce the hypothetical nature of the experiment, we used real fish that were professionally packed in 300 grams packages of fish loins (Figure 2). Loins are the best cuts of the fish. No ecolabeled farmed fish types were available in France at the time of the experiment, and non-ecolabeled fish was ecolabeled for use in the experiment. To avoid selling these mislabeled products to the participants, a stated choice format was selected.

(Insert Figure 2 here)

We constructed 112 choice sets that were divided into seven blocks with 16 choice sets in each block. We had 14 sessions and each block was used in two sessions. In each choice set, three products were presented in a Styrofoam box filled with ice, and a none-of-these alternative was included as an additional alternative. Two example choice situations are presented in Figure 3. To avoid systematic ordering effects, the participants could start at any of the 16 choice sets.[3]

(Insert Figure 3 here)

One hundred and sixteen participants had previously taken part in one or more fish experiments. We refer to them as experienced participants, while the remaining 78 participants are referred to as new participants. There were six sessions with new participants and eight sessions with experienced participants. The experienced participants conducted two rounds of choices with an information treatment between the two rounds, while the new participants only completed one round of choices with information given

[3] The choice design with eight products sold at varying prices was constructed by the SAS macro MktEx with zero priors, and the D-efficiency of the total design was 96.52.

before the choices. In two of the sessions with new participants, no information was provided, while each of the four information treatments was used in one of the other four sessions with new participants. In the sessions with experienced participants, each information treatment was used in two sessions. The distribution of choice blocks and information treatments across sessions was determined before the experiment. At the time of recruitment, each participant was given a choice between available sessions he or she would participate in, but did not know any details about the choice experiment.

Each of the 78 new participants made 16 choices resulting in 1,248 choices (1,246 usable choices). Each of the 116 experienced participants went through 16 choice situations first, then received the information treatment allocated to the session, and then went through the same 16 choice situations again. This resulted in 3,712 choices (3,709 usable choices). By this procedure, we created between-subject variation among new participants and within-subject variation among experienced participants.

4.2. Dataset 2: Revealed Preference Data

The second dataset is a subset of the TNS Worldpanel.[4] The subset includes only the quantities and prices of daily purchases of fish in France in 2005, 2006, 2007, and 2008, recorded by participating households themselves using home scanners, in addition to the socioeconomic information of the households. The TNS Worldpanel has been used to investigate food purchases (e.g., Allais, Bertail and Nichèle 2010). A representative sample of around 6,000 households participated in the panel. Each household registered their daily purchases through a home scanner. It is, however, not documented for how long a

[4] The TNS Worldpanel data used in this thesis was assembled by INRA. In 2010, TNS Worldpanel was rebranded as Kantar Worldpanel.

household on average participates in the panel. In the dataset, households recorded the types of fish purchased, the quantity purchased, and the prices. However, no additional information about the fish was recorded.

4.3. Dataset 3: Qualitative Data from Field Interviews in China

The third dataset is based on semi-structured in-depth field interviews, which were conducted in January 2014 in Hong Kong and mainland China. Three separate questionnaires were developed, corresponding to the three types of organizations to be interviewed: representatives of Norwegian salmon producers, representatives of salmon importers in mainland China, and representatives of salmon importers in Hong Kong. The three questionnaires are attached in the Appendix of Paper 4. In addition to the NSC, 21 companies were interviewed. Each interview was conducted separately using one of the three questionnaires as guide.

During each interview, the person(s) interviewed was (were) met in person, and questions were asked following a pre-designed survey. For firms, each questionnaire inquired on: (1) basic information of the firm; (2) the species, volumes, values, and shipment of fish being traded; (3) experiences and knowledge of Chinese/Hong Kong's customs practices in clearing imported salmon; (4) experiences and knowledge on transshipments; (5) experiences and knowledge on China's import licensing system; (6) experiences and knowledge on China's sanitation testing and veterinary inspection; and (7) the firm's market share in China/Hong Kong and anticipation of future market developments. Finally, the interview with the NSC was not pre-planned and we only raised questions that are relevant to the Council. During all interviews, out-of-questionnaire questions were always asked whenever it was deemed necessary. For more details on the field interview, see Paper 4.

4.4. Dataset 4: Data on the Norway-China Salmon Trade

This dataset is compiled from three sources: the United Nation's Comtrade database (UN Comtrade 2014), the NSC, and the Hong Kong Government. Annual trade statistics by country from 2000 to 2014 are based on the 1996 Harmonized Commodity Description and Coding System (HS) of the tariff nomenclature at the 6-digit level obtained from the UN's online database. Weekly, monthly and annual Norwegian salmon export data from January 2007 to April 2015 were provided by the NSC. Finally, we collected re-export statistics of salmon from Hong Kong to mainland China from Hong Kong's Census and Statistics Department (Hong Kong Government Census and Statistics Department 2014).

5. Summary of the Papers

The general objective of this thesis is to contribute to the existing literature on: (1) consumer and market studies of fish, by mainly focusing on the effects of ecolabels and environmental information to consumer preference and WTP; (2) market simulation under different price and preference scenarios; (3) applications of econometric techniques including advanced discrete choice models and a calibration method; (4) analyses of the effects and implications of China's salmon sanction in the contexts of international politics and international trade.

In line with most of the literature on consumer and market studies of ecolabeled seafood, the four papers in this thesis are empirically oriented, with some emphasis on the application of novel econometric methods. The first and the second papers use only the stated preference data from the choice experiment (Dataset 1). The first paper uses only a part of the choice experiment data. Only the choices made by participants without receiving environmental information are included and analyzed. The second paper uses all the choice experiment data. The third paper uses both the choice experiment data (Dataset 1) and part

of the revealed preference data from TNS Worldpanel (Dataset 2). The fourth paper uses both Dataset 3 and 4.

The main objectives of the four papers are:

- To estimate French consumers' preference and WTP for ecolabeled and organic fish, to introduce and apply GMNL model and estimation in WTP space to food economics, and to compare WTP estimates from GMNL model and MMNL model in preference space and in WTP space (Paper 1)
- To investigate the effects of negative environmental information to French consumers' preference of non-ecolabeled and ecolabeled fish (Paper 2)
- To compare and validate methods that can predict real market shares, and to use the best method to simulate and study market changes of French seafood market under different price and preference scenarios (Paper 3)
- To investigate whether there is discriminative import policy and/or practice in China regarding salmon from Norway; and if there is, what are the effects and implications of such policy and/or practice (Paper 4)

Each of the four papers is described and summarized below.

5.1. Paper 1: The Generalized Multinomial Logit Model in Willingness to Pay Space: The Case of Ecolabeled Fish (coauthored with Frode Alfnes and Kyrre Rickertsen)

It is typically costly to certify one's products with ecolabels. First, it costs to implement the requirements of an ecolabel scheme. Second, unless it is self-certified ecolabel, it is costly to join and stay in an ecolabel scheme, which typically requires initial assessment before the ecolabel is granted, and periodical reassessments to remain certified. It is therefore important for the industry to know the price premiums from ecolabels, for example, to do a cost-benefit analysis of implementing an ecolabel scheme. Existing literature has studied French consumers' general preferences for ecolabeled fish (Brécard et

al. 2009; Salladarré et al. 2010). However, these studies did not investigate consumer preferences or WTP for organic-labeled fish in France, which has one of Europe's largest seafood markets.

More advanced econometric models are continuously developed and applied to study consumer preferences (McFadden 1973; McFadden and Train 2000; McFadden 2001; Fiebig et al. 2010; Greene and Hensher 2010; Czajkowski, Giergiczny and Greene 2014). Two recent developments in discrete choice modeling are the GMNL model (Fiebig et al. 2010; Greene and Hensher 2010) and estimation in WTP space (Train and Weeks 2005; Scarpa, Thiene and Train 2008). This paper applies the MMNL model and the GMNL model, which are estimated in WTP space and preference space, in the context of food economics. Results from MMNL model and GMNL model in preference space and in WTP space are compared.

The similarity of the results from the above mentioned four models demonstrates a robustness to model specification, at least for our dataset. Although all four models fit the data well, the GMNL model in preference space fits slightly better than the other three models. The WTP values from the four models are relatively close for wild cod, farmed cod, farmed salmon, and wild monkfish. The models also produce results that are close for the two types of ecolabels included in the experiment. The estimated WTP values from one model are within the 95% confidence intervals (CIs) of the corresponding WTP values for the other three models, and vice versa, with only one exception. Moreover, all four models produce similar plots of the distributions of individual-specific WTP estimates across participants.

The estimated WTP per kilogram of wild cod, farmed cod, farmed salmon, and wild monkfish are €16.43, €16.45, €18.62, and €19.49 according to the GMNL model in WTP space. For these four fish types the mean WTP estimates are significantly different from

zero at the 1% level. For wild cod and farmed salmon, which are the most commonly purchased types in France, the estimated prices are within the range of prices charged by local stores at the time of the experiment. Farmed cod was not available in local stores, and monkfish was sold in small quantities at market prices significantly above our WTP estimates. Except for pangasius, the mean WTP values do not differ much across models.

The mean WTP estimates for the two labels are significantly different from zero at the 5% level of significance. The mean WTP for the MSC label ranges from €1.39 to €2.26 in the four models, and the mean WTP for the AB label ranges from €1.73 to €2.44. These values correspond to a premium of about 10%, which is consistent with previous estimates (Olesen et al. 2010; Roheim, Asche and Santos 2011; Sogn-Grundvåg, Larsen and Young 2013). The higher WTP values for the AB label may be result of (i) participants' higher familiarity and trust in the AB label, and (ii) the AB label's greater use in the experiment. Half of the wild cod was MSC labeled, while half of the farmed salmon and half of the farmed cod were AB labeled.

5.2. Paper 2: Consumer Preferences, Ecolabels, and Effects of Negative Environmental Information (coauthored with Frode Alfnes and Kyrre Rickertsen)

The literature from the past one and half decades shows that consumers prefer ecolabeled fish to non-ecolabeled counterparts (Wessells, Johnston and Donath 1999; Gulbrandsen 2009; Thrane, Ziegler and Sonesson 2009; Roheim, Asche and Santos 2011; Sogn-Grundvåg, Larsen and Young 2013; Asche et al. 2015). Meanwhile, a separate line of literature has shown that consumers are concerned with environmental consequences of fish production (Grankvist, Dahlstrand and Biel 2004; Brécard et al. 2009; Hansen and Onozaka 2011). However, little is known about the effects of ecolabels when consumers are simultaneously exposed to negative environmental information about the ecolabeled products. This paper uses the choice experiment data from Dijon, France in December 2008,

in which four treatments with different types of information concerning potential negative environmental effects of wild fisheries and/or fish farming were used. The data were analyzed in an MMNL model.

The results indicate a 4% premium (€0.80) for MSC labeled wild cod, and a premium of about 11% (€1.84) for AB labeled farmed salmon and farmed cod. The premium for the MSC label is much smaller than the estimate from Paper 1, suggesting that the WTP estimate for the MSC label in Paper 1 may not be robust. Furthermore, negative environmental information reduces the WTP values by €2.16 and €2.32, depending on whether the fish is ecolabeled or not, respectively. Therefore, although French consumers are willing to pay premiums for ecolabels, negative environmental information reduces more than these premiums regardless of whether the fish is ecolabeled or not. The results indicate that the ecolabeling organizations have yet to better inform consumers about their ecolabels and their credibility.

We also find cross effects of negative environmental information aimed at one fish type on substitute fish types, depending on whether the substitute fish type is ecolabeled and on whether the substitute fish type is from the same production technology. By production technology, we refer to whether the fish is farmed or wild-caught. These effects may be different for: (i) ecolabeled substitute fish that is produced with the same production technology, (ii) ecolabeled substitute fish that is produced with the other production technology, (iii) non-ecolabeled substitute fish that is produced with the same technology, and (iv) non-ecolabeled substitute fish that is produced with the other production technology. First, there is a positive effect on the WTP for fish that is produced with the same production technology as the fish that received the negative information. The effect is about €1 per kg and the magnitude is independent of the ecolabeling of the substitute fish. This indicates that the participants do not generalize negative information concerning the

production technology, which is used for one species, to other species produced by using the same technology. Second, there is an unexpected negative and significant effect of information on the WTP for substitutes produced by the other production technology when the substitute is non-labeled, however, this effect becomes insignificant when the substitute is ecolabeled.

5.3. Paper 3: Stated Preference Model Calibration and Market Share Prediction (single-authored)

Choice experiments are widely used to investigate preferences and willingness to pay for food products and quality attributes (Alfnes et al. 2006; Carlsson, Frykblom and Lagerkvist 2007; Loureiro and Umberger 2007; Scarpa et al. 2012). The complexity of the real-life market setting, however, cannot be represented in a choice experiment. A number of articles point out that choice experiments data cannot accurately predict market shares (Chang, Lusk and Norwood 2009; Resano-Ezcaray, Sanjuán-López and Albisu-Aguado 2010; Hudson, Gallardo and Hanson 2012). Hence, it is important to find a method to improve market predictions.

Existing calibration of choice experiments in food marketing has calibrated WTP from survey data with data from incentive-compatible experiments (e.g., Alfnes and Rickertsen 2007) or conducted joint estimation of stated preference and revealed preference data (e.g., Resano-Ezcaray, Sanjuán-López and Albisu-Aguado 2010). This paper introduces the ASC calibration method for stated preference data (Manski and Lerman 1977; Cosslett 1981a, b; Manski and McFadden 1981; Ben-Akiva and Lerman 1985; Train 1986; Train 2009). A feature of the method is that the stated preference data is combined with real market share data. By calibrating the constant terms of each alternative's utility function, the utility function is numerically augmented to correctly predict market shares that are observed in real life.

Three methods for predicting market shares in France in 2008 from choice experiments are compared: the observed market shares in the experiment, the predictions of an uncalibrated logit model, and the predictions of calibrated logit models. Without calibration, the choice experiment predicts market shares with larger errors. Calibrating using observed market shares secures that the model predictions equal the 2008 observed market shares.

The calibrated model is validated for robustness, by using the ASCs, which are calibrated using the 2008 market share data, to produce "out of sample" market shares predictions for the French seafood market in 2005, 2006, and 2007. The predicted market shares in 2005, 2006, and 2007 are compared with market shares found in scanner data. The comparison finds that the calibrated models, in general, predict better than uncalibrated model. For robustness check, new balanced choice experiment designs of four fish species and of three fish species are created. The new choice experiment designs are balanced in terms of species, such that one species appears as frequently as any other species. The new choice experiment designs are used to confirm that the better predictions of the calibrated model is not dues to the design of the original choice experiment, which was used in Dijon in 2008.

The calibrated model is used to predict changes in market shares from changes in prices and preferences. Predictions for three market scenarios are conducted. The three scenarios are designed to correspond to three real-life scenarios: (1) ecolabeling of a fish species, (2) overexploitation of a wild fish stock, and (3) increased supply of a fish stock. The calibrated model predicts the market changes under the three scenarios reasonably well. The predicted changes are in the expected directions, and the predicted market shares are reasonable.

5.4. Paper 4: China's Sanction on Norwegian Salmon: Sanction-Busting Strategies, Market Distortion and Efficacy (coauthored with Roberto J. Garcia)

With its growing economic power, China has turned to using economic sanctions, however subtle, to obtain desired political outcomes in bilateral foreign affairs. Angered by the Norwegian Nobel Committee's awarding of the 2010 Peace Prize to a Chinese dissident, China allegedly applied more stringent regulatory measures and import licensing procedures on salmon imports into its market. Medias, both in Norway and internationally, have widely covered this incident. However, there has been lack of effort from the scientific community to investigate this phenomenon.

Paper 4 attempts to fill in this gap. It focuses on China's salmon sanction on Norway and contributes to the literature in four ways. First, the paper provides, for the first time, first-hand accounts from stakeholders that involved in the salmon trade between China and Norway. These accounts suggest that the NTBs that salmon from Norway have been facing since mid-December 2010 are country specific (i.e., Norway). The personal accounts are supplemented by analyses of salmon trade data from Norway to mainland China, Hong Kong, and Vietnam, and from Norway and the rest of the world to mainland China. The paper uses interviews and a quantitative analysis of trade data to triangulate and to confirm the effects of the sanction.

Second, the paper refutes a popular misbelief on the issues. The analysis shows that Norwegian market share has not been much reduced after 2010. Actually, Norway has increased its exports to mainland China. Large volumes of Norwegian salmon have been transshipped to mainland China via Vietnam and Hong Kong SAR, beside the Norwegian salmon that has been directly exported to mainland China. Hence, the business sector has successfully busted China's salmon sanction.

Third, although the NTBs have not stopped Norwegian salmon from being imported into mainland China, the NTBs have reduced the welfare of the Chinese consumers and distorted the salmon market in mainland China. The welfare loss is due to increased costs and reduced quality of the Norwegian salmon. Furthermore, the workarounds that have been practiced by Norwegian exporters and Chinese importers, particularly smuggling, have distorted China's domestic market since the NTBs were implemented.

Fourth, the Norwegian government's refusal to meet the Dalai Lama in May 2014 (Gladstone 2014) suggests that the full effect of China's salmon sanction has affected Norway's foreign policy. Moreover, the newly signed agreement on health certificate in April 2015 (Norwegian Food Safety Authority 2015) signals that the relationship between Norway and China has warmed up.

6. Contributions, Implications, and Limitations of the Thesis

Overall, the empirical studies in the thesis provide knowledge of the consumers and seafood markets in France and China. The empirical results is potentially important and useful for firms, policy makers, and ecolabel certification organizations. The preference and WTP analyses in the first two papers may be helpful for business and policy analysis of ecolabel schemes. The ASC calibration method is useful for analyzing market changes. And the case study from China provides knowledge on the firms and the countries that involved in global salmon trade, and on China's usages of economic sanctions in international politics.

Viewing the contributions in fields and disciplines, the thesis contributes to the empirical literature of consumer economics, food economics, international trade, and political science. The application of the GMNL model and the ASC calibration methods sheds insights to other researchers who are interested in such methods. The findings from

China's salmon market demonstrates how NTBs may hurt domestic consumers and market, while achieving political goals in foreign relations. It may also provide knowledge to researchers who are interested in China's foreign policy analysis.

Paper 1 finds that French consumers are willing to pay significantly more for ecolabeled wild fish and organically labeled farmed salmon and cod than for their unlabeled counterparts. On average, both labels attract a premium of about 10%. The ecolabeling of farmed fish is likely to become increasingly important: the share of farmed fish increased from 13% of total production in 1990 to 47% in 2010 (FAO 2013). The introduction of organic, and alternatively, ecolabeled farmed fish will be successful if their production costs are no more than 10% above those of their unlabeled counterparts. Otherwise, organic and ecolabeled farmed fish will likely only be niche products in the French market. The WTP estimate will be useful for seafood industry when evaluating the costs and benefits of enrolling in an ecolabel certification scheme.

However, Paper 2 find that negative environmental information reduces the WTP with a larger amount than the premiums of the ecolabels regardless of whether the fish is ecolabeled or not. This suggests that the consumers' trust in the included ecolabels is limited. When consumers receive negative environmental information from other sources, the ecolabels have not the intended shielding effect. Instead of flocking to the ecolabeled products, the consumers become more skeptical about both unlabeled and labeled products.

In light of the results from Paper 2, the ecolabeling organizations need to improve consumers' trust in their ecolabeled products. Increased trust will be beneficial for consumers, the fishery and aquaculture sectors, retailers and the government. Building trust may be a costly activity for the labeling organizations. However, increased trust will result in higher WTP for the fish and increased fish sales. Some of the increased revenues will be paid back to the labeling organizations for their labeling services. Public authorities can also

play a more active role in developing trust in ecolabels. Finally, in light of the findings, the seafood industry should consider and evaluate consumers' trust when adopting an ecolabel.

China's rapid economic growth and its large size in global markets facilitates the use of economic sanctions as a means of projecting power in international relations. The findings in Paper 4 support the claim that China used NTBs as a means of applying an economic sanction on Norway's exports of fresh/chilled salmon to China, in response to its displeasure with Norwegian Nobel Committee's awarding of the 2010 Nobel Peace Prize to a Chinese dissident. Norway-China trade data for fresh/chilled salmon before and after 2011 show that the decline in Norway's total exports to and relative market share in China coincided with the NTBs that underpinned the sanction. Through newly established business relationships domestically and internationally, Chinese importers have been able to bust the salmon sanction by importing salmon through airports that are less controlled by the central government and through transshipment via Hong Kong and Vietnam.

Although not discussed in Paper 4, it also directly relates to the literature on consumer preference for country-of-origin attribute (e.g., Balabanis and Diamantopoulos 2004). Despite the difficulty from a powerful government, Norwegian exporters and Chinese importers have been making great efforts to get Norwegian salmon into China, and mislabeling salmon from other countries as salmon from Norway. All the efforts are made because of the strong consumer demand in China, which is originated from the strong consumer preference of the country-of-origin attribute of Norwegian salmon.

The sanction obtained an intended soft power effect in signaling China's displeasure of the award, because it successfully influenced Norway's foreign policy. The Norwegian government declined to meet with the Dalai Lama in May 2014, a gesture that is intended to please the Chinese government. However, the costs of sanction-busting have been incurred by Chinese consumers through higher prices for Norwegian salmon, mislabeled salmon and

degraded salmon, and by Chinese society from the bribery, corruption and illegal marketing activities that the NTBs have encouraged.

China has become more confident and more skilled in the statecraft of economic sanction, and this needs to be taken seriously. Several countries, including Norway, gave in upon receiving China's sanctions, suggesting that the sanctions have been successful and effective. So far only Japan has fought against China's sanction at WTO. It is difficult for a foreign country to counteract China's economic sanctions. First, it is intimidating to fight China at WTO, considering that such a complaint may result in China's further retaliation. Second, the discrete manner of China's usages of NTBs makes it hard to gather evidences.

The thesis also have some methodological contributions. In Paper 1, although all four models fit the data well, the GMNL model in preference space fits slightly better than the other three models. Furthermore, the estimated WTP values from the four models are close for wild cod, farmed cod, farmed salmon, and wild monkfish. Examining the 95% confidence intervals (CIs) of the corresponding WTP values for the other three models, the four models produce quite similar results for the two types of ecolabels included in the experiment. Researchers who apply advanced discrete choice models will benefit from these findings, particularly when choosing between the GMNL model, the MMNL model, estimation in WTP space, and estimation in preference space.

Paper 3 applies a simple and intuitive calibration method for market share prediction that may be useful in the field of agricultural economics. Predicting markets is very important for academic research, and policy and business analysis. Calibration is necessary due to various biases that exist in experiments, which need to be corrected by using additional data sources. The validation suggests that the calibrated model performs quite well when predicting French seafood market shares in 2005, 2006, and 2007. Comparing three different methods of predicting market shares, predictions made by using the

calibrated ASCs in general are of smaller error and hence more accurate. Furthermore, three market simulation exercises are demonstrated, involving changes in price or consumer preference.

The results and the contributions of the thesis must be examined for the limitations, for which future research is required. For Paper 1, the sample size is relative small (2,300 choice observations from 144 participants), which may potentially result in a Type II error. Moreover, since this is the first study on comparing WTP estimates from the MMNL and the GMNL models in WTP space, further research is required to confirm whether the observed similarities in WTP estimates can be generalized.

For Paper 3, future research is required in two directions. First, this paper has validated the calibrated model when predicting "out of sample". The logit model, after being calibrated with 2008 market share data, predicts market shares in 2005, 2006, and 2007 quite well. However, future research is required to investigate whether this finding is general or dataset specific. Second, application of calibration on more advanced discrete choice models, for example the MMNL model, may potentially be useful.

For Paper 4, the salmon trade statistics could have been analyzed in an econometric model, so that the NTBs' effects can be quantified, which will be helpful for policy debates. Moreover, the present study lacks statements and opinions from Chinese officials, which may potentially bias the findings and conclusions. Such interviews in a future study will likely facilitate our understanding of the salmon sanction and contribute to the literature. Finally, future research on the role of Scotland (UK) and Faroe Islands, which have gained significant market access during the salmon sanction, would also be useful.

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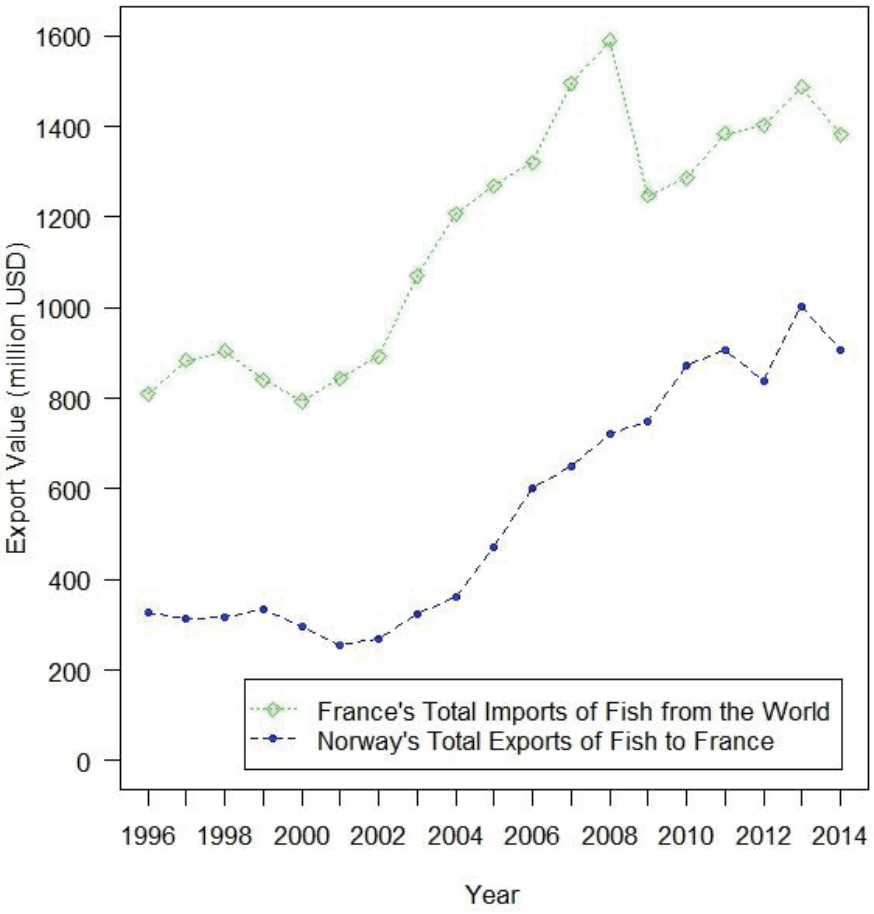
Figures



Source: UN Comtrade (2015).

Figure 1. France's Total Imports of Fish from the World, and Norway's Total Exports of Fish to France (1996—2014; unit: million USD)

Figure 2. Example of the Choice Experiment Setting in Dijon, France in 2008

Box 1 I choose (check ✓one)	Alternative 1	Alternative 2	Alternative 3
	€	€	€
	☐	☐	☐
	None of these three alternatives		☐

Box 2 I choose (check ✓one)	Alternative 1	Alternative 2	Alternative 3
	€	€	€
	☐	☐	☐
	None of these three alternatives		☐

Figure 3. Two Example Choice Situations in the Choice Experiment in Dijon, France in 2008

Paper I

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The Generalized Multinomial Logit Model in Willingness to Pay Space:

The Case of Ecolabeled Fish[1]

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The Generalized Multinomial Logit Model in Willingness to Pay Space: The Case of Ecolabeled Fish

ABSTRACT

French consumers' willingness to pay (WTP) for ecolabeled wild and farmed fish is investigated by using data from a stated choice experiment with real fish. The results of the generalized multinomial logit (GMNL) model are compared with the results of the mixed multinomial logit (MMNL) model in preference and WTP space. The GMNL model in preference space has the best fit, but the differences in fit between the four models are small. With one exception, the 95% confidence intervals of the estimated WTP values from the four models overlap. The estimated price premium for ecolabeled fish is about 10%.

Key words: choice experiment, ecolabel, fish, generalized multinomial logit model, mixed multinomial logit model, willingness to pay space.
JEL codes: C91, D12, Q22, Q51.

I. INTRODUCTION

During the last decade, the mixed multinomial logit (MMNL) model, which also is known as the random parameter logit (RPL) model or the random coefficient logit (RCL) model, has become the standard model for estimating choice data (McFadden and Train 2000; McFadden 2001; Hensher and Greene 2003). The commonly used panel-data specification with normally distributed random parameters was first estimated by Revelt and Train (1998). The random parameters in the MMNL model capture taste heterogeneities among individuals (Train 1998). Another important heterogeneity in choice analysis is the scale heterogeneity, which roots in the variance in utility over different choice situations (Halvorsen and Sœlensminde 1998; Hensher, Louviere, and Swait 1999; Louviere et al. 1999; Breffle and Morey 2000; Louviere et al. 2002; Louviere and Eagle 2006; Louviere et al. 2008; Fiebig et al. 2010; Greene and Hensher 2010; Hess, Rose, and Bain 2010). For reviews on the development of the scale heterogeneous models, see Louviere et al. (1999); Hensher, Louviere, and Swait (1999); Louviere et al. (2002); and Fiebig et al. (2010). The investigation of scale heterogeneity remains an active area in discrete choice research (e.g., Czajkowski, Giergiczny, and Greene 2014 in the May 2014 issue of this journal).

The recently developed generalized multinomial logit (GMNL) model (Fiebig et al. 2010; Greene and Hensher 2010) allows for separate estimation of taste and scale heterogeneity. It nests Revelt and Train (1998) specification of the MMNL model, as well as a number of other commonly used multinomial logit models including scaled multinomial logit model (SMNL) and the multinomial logit model (MNL). Researchers in marketing (e.g., Fiebig et al. 2010), transportation (e.g., Greene and Hensher 2010; Hensher and Greene 2011; Hensher, Rose, and Li 2012; Hess and Rose 2012), environmental economics (e.g., Rose et al. 2012; Czajkowski, Giergiczny, and Greene 2014; Li et al. 2014;

Czajkowski, Hanley, and LaRiviere 2015), health economics (e.g., Knox et al. 2013; Pedersen et al. 2014; Michaels-Igbokwe et al. 2015), and agricultural economics (e.g., Pancras and Dey 2011; Escobar, Kallas, and Gil 2015) have concluded that the full GMNL model frequently fits the data better than Revelt and Train's (1998) specification of the MMNL model. However, a consensus has yet to be reached whether the GMNL model should replace the MMNL model.

MMNL and GMNL models are usually estimated in preference space, in which the parameters represent the utility weights of the attributes. Train and Weeks (2005) and Sonnier, Ainslie, and Otter (2007) showed that by rescaling the utility function in the MMNL model by setting the utility weight of the price parameter to –1, the parameter estimate of each product attribute equals the marginal willingness to pay (WTP) for that attribute and name such parametrization as estimation in WTP space.[1] However, this rescaling results in a utility model that is nonlinear in the random parameters. Fiebig et al. (2010) showed that under a specific set of parameter restrictions, the GMNL model can be parameterized and estimated in WTP space. Train and Weeks (2005) and Hole and Kolstad (2012) found that estimation of the MMNL model in WTP space gave a small reductions in the likelihood function value (LLFV) as compared with estimation in preference space, although Scarpa, Thiene, and Train (2008) reached the opposite conclusion.[2]

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[1] In health economic literature, estimation in WTP space is sometimes termed as estimation in QALY (quality-adjusted life year) space (Gu, Norman, and Viney 2014) when the normalization is on the QALY variable instead of the monetary variable (e.g. price).

[2] Train and Weeks (2005) found that when parameters are specified to be uncorrelated, the loglikelihood function value is reduced by 65 points (from -6,297.81 to -6,362.13), when the MMNL model was estimated in

In a model in preference space, distributions of the parameters are specified in the utility unit (utils). Because the distribution of a WTP value is estimated as the ratio of the distribution of a non-price attribute parameter to the distribution of the price parameter, the resulting WTP distribution may have a large variance and may not have finite moments (Daly, Hess, and Train 2012). In a model in WTP space, the price parameter is set to –1 and the distributions of the WTP values are in the monetary unit (e.g. US dollar) and hence estimated directly (Train and Weeks 2005). Consequently, there is no need to use the Delta or Krinsky–Robb method to obtain the WTP estimates and their associated standard errors (Greene 2012). This simplification in the estimation of the WTP assures finite moments (Train and Weeks 2005) and represents an advantage for the applied researcher.

Although the MMNL model estimated in preference space is the standard model for analyzing choice data in applied studies (e.g., Hensher and Greene 2003; Alfnes et al. 2006; Scarpa, Thiene, and Train 2008; Bliemer and Rose 2010), estimation in WTP space has become an attractive alternative since the GMNL model was incorporated into econometric programs such as NLOGIT (Greene 2012) and STATA (Gu, Hole, and Knox 2013).[3] Both NLOGIT and STATA can estimate the GMNL model in preference space and in WTP

WTP space compared to estimation in preference space; when parameters are specified to be correlated, the reduction due to estimation in WTP space was 50 points (from -6,178.82 to -6,228.31). Scarpa, Thiene, and Train (2008) found that the loglikelihood function values were improved by estimating MMNL model in WTP space by 303 points (from -20,773.59 to -20,470.89) and by 58 points (from -20,383.65 to -20,325.55), when parameters are specified to be uncorrelated and correlated, respectively.

[3] To our knowledge, NLOGIT and STATA are the only two software that can estimate such models in WTP space. It is possible to use another software, but then users have to either modify the existing codes or program the entire routine from scratch by themselves, which is likely daunting for an applied researcher.

space. Our objective is to compare estimation results from the GMNL model and the MMNL model, and both models are estimated in preference space and estimated in WTP space. We compare the confidence intervals (CIs) for the WTP estimates from the four models, which to our knowledge, have not previously been compared. Furthermore, this is one of the first applications of the GMNL model and one of the first applications of the estimation in WTP space technique in food economics.

The models are estimated by using data from a stated choice experiment conducted in a sensory lab. In this experiment, French consumers' WTP for ecolabeled wild and farmed fish was investigated, and we provide new estimates for the WTP for ecolabels for wild and farmed fish products.

II. ECOLABELS IN SEAFOOD MARKETS

Fisheries management policy has focused on developing and enforcing management schemes related to the supply side of the seafood market. To a large extent, such schemes have been ineffective in conserving wild fish stocks (Beddington, Agnew, and Clark 2007). The Food and Agriculture Organization (FAO) estimated that 57.4% of the world's fish stocks were fully exploited in 2009, and 29.9% were overexploited (FAO 2011). A number of ecolabeling programs have been introduced following increased consumer concerns about overexploitation and because of concerns about seafood production issues such as safety (e.g., Wessells and Anderson 1995; Wessells, Kline, and Anderson 1996), quality (e.g., Verbeke et al. 2007; Brécard et al. 2009; Salladarré et al. 2010b), environmental effects (e.g., Jaffry et al. 2004; Verbeke et al. 2007), sustainability (e.g., Erskine and Collins 1997; Onozaka and Mcfadden 2011; Sogn-Grundvåg, Larsen, and Young 2013; Uchida et al. 2014), and animal welfare (Teisl, Roe, and Hicks 2002; Verbeke et al. 2007). The long-term success of these ecolabeling schemes depends on firms' compliance and consumers'

acceptance with them. The most important success measure is the premium consumers are willing to pay for the labeled products (Thøgersen 2000; Nilsson, Tunçer, and Thidell 2004; Lozano, Blanco, and Rey-Maquieira 2010).

Although there is no French national ecolabeling scheme for wild fish, several labels are used by retailers. As early as the spring of 2004, Carrefour launched its own ecolabel for wild cod products. Other large retailers and processors of seafood followed with their own private labels (Salladarré et al. 2010a). The certification program of the Marine Stewardship Council (MSC) is currently the most widely used and recognized sustainable wild fish labeling scheme in the world, and is also used in France (Gulbrandsen 2009; Thrane, Ziegler, and Sonesson 2009). As of April 2015, 255 fisheries had already been certified by the MSC program, and MSC labeled seafood is sold by leading retailers all over the world (Marine Stewardship Council 2015).

But it is difficult for the consumers to know which fish stocks are depleted. It may not be enough to know what type of fish is being purchased; in many cases, the consumer needs to know where and when the fish was caught. Take Norwegian cod for example. Cod from the North Sea and the Norwegian coast is considered to be under considerable pressure and has not been granted the MSC label, whereas the cod fishery in the Barents Sea is currently generating record landings and has been granted the MSC label. Even more perplexing is that the cod from the Barents Sea that comes to the shores of Northern Norway during the winter months to spawn can then be caught and MSC labeled. Hence, the environmentally concerned fish consumer must look for the MSC label to avoid buying wild fish from a depleted stock.

A few ecolabeling programs for farmed fish have been gaining international acceptance in recent years, although none of them has so far gained recognition at the level of the MSC label (Chen, Alfnes, and Rickertsen 2015). The Aquaculture Stewardship Council (ASC) is

the aquaculture version of the MSC. It was founded in 2009 by the World Wildlife Fund and the Dutch Sustainable Trade Initiative. The ASC aims to provide certification schemes for responsibly farmed fish. As of April 2015, the ASC certifies bivalve, pangasius, salmon, shrimp, tilapia, and trout from 18 countries (Aquaculture Stewardship Council 2015). The ASC has grown fast. Back in June 2013, only a few fish farms from six countries were certified. Marine Harvest, the world's biggest producer of salmon, announced in May 2013 that it will seek company-wide ASC certification by 2020. In their 2014 annual sustainability report, IKEA pledged to have all the seafood served in their restaurants or sold in their markets certified with the ASC or MSC label by the end of fiscal year 2015 (IKEA 2015). Another international ecolabel example is Global Aquaculture Alliance's Best Aquaculture Practices Certification. Nationally, the Agriculture Biologique (AB) label is the most widely used ecolabel for food in France, and it certifies food products with an organic content of at least 95%. Farmed fish can be labeled as organic, whereas wild fish cannot. However, we were unable to find any certified organic fish products in the French market.

From numerous studies of ecolabeling's effects on wild fish (e.g., Wessells, Johnston, and Donath 1999; Jaffry et al. 2004; Thrane, Ziegler, and Sonesson 2009; Salladarré et al. 2010a; Roheim, Asche, and Santos 2011) and farmed fish (e.g., Olesen et al. 2010; Roheim, Sudhakaran, and Durham 2012; Mauracher, Tempesta, and Vecchiato 2013; Uchida et al. 2014), labeling is generally found to have a positive effect. Jaffry et al. (2004) used a choice experiment and found that ecolabeled seafood from a sustainably managed fishery has up to a 7% higher probability of being chosen by participants. Roheim, Asche, and Santos (2011) analyzed scanner data of MSC-certified frozen processed Alaskan pollock products and found that UK consumers are willing to pay a 14% premium for the label. Olesen, Myhr, and Rosendal (2011) conducted a non-hypothetical choice experiment and found that the average Norwegian consumer is willing to pay a 15% premium for organic salmon.

Mauracher, Tempesta, and Vecchiato (2013) found a significant price premium for organically bred Mediterranean sea bass. Uchida et al. (2014) found that ecolabels have positive and significant effects on both wild and farmed fish. For more accessible information on ecolabels, see Consumer Reports (2013).

III. EXPERIMENTAL DESIGN AND IMPLEMENTATION

The experiment was carried out in the sensory laboratory of L'Institut National de la Recherche Agronomique (INRA) in Dijon in December 2008. Potential participants were randomly drawn from INRA's database of people who are willing to participate in food studies. Potential recruits were asked to complete a short survey about their consumption and purchasing frequencies of fish products. Only those who ate fish more than once a month or bought fresh fish more than every second month were recruited. Participants were paid €25 to participate.

The eight fish products used in the experiment are listed in table 1.[4] Salmon and cod are among the most frequently purchased fish species in France. Monkfish was included as an expensive substitute and pangasius was included as an inexpensive substitute. Wild cod was either unlabeled or MSC labeled, and farmed cod and farmed salmon were either

[4] In table 1, the area of origin is shown. We did not incorporate the area of origin attribute into the econometric analysis. Analyzing the effects of area of origin may, potentially, shed insights to consumer preference on seafood origin. However, identification of such effects is limited, in this case, due to the experimental design. Because only fish type, pangasius, is from Vietnam, it is not possible to separately identify the preference for pangasius and the preference for the area of origin of Vietnam. It is possible to estimate the differences in the effects of area of origin (between Norway and Vietnam, and between North Atlantic and Vietnam, between Norway and North Atlantic), but the differences are not of great importance.

unlabeled or labeled as organic. Monkfish and pangasius were not labeled. We labeled organic fish products with the French organic AB label.

(Insert table 1 about here)

The stated choice experiment consisted of 16 choice sets. To reduce the hypothetical nature of the experiment, the alternatives were presented in 300-gram packages of real fish. Each choice set included three packages that were displayed in a Styrofoam box filled with ice. The fish varied with respect to the species, whether it was wild or farmed, its price, the use of the ecolabel, and its area of origin.[5] A "none-of-these alternatives" was included as an option.[6]

Following the experiment, each participant was asked to complete a questionnaire that included questions about attitudes toward fish in general and those species included in the experiment, demographics, and attitudes toward labels. The final data set consisted of 2,300 choices made by 144 participants.[7]

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[5] Stated choice was used instead of real choice because ecolabeled farmed fish products were not available in France at the time of the experiment. To present the fish products as realistically as possible, we used real packages of conventional fish with ecolabels instead of descriptions or pictures, as is typically done in stated choice experiments.

[6] The choice experiment was based on a choice design constructed by the SAS macro MktEx with zero priors. The D-efficiency of the total design was 96.52. The design used 112 choice sets organized into seven blocks. The order of choice sets was randomized within each block. Each block of choice sets was used in two sessions and each participant was randomly assigned to one of the sessions.

[7] In this paper, we use only a subset of the data from the experiment, which was described in the Introduction of my PhD thesis. In the experiment, 78 new participants took part. Only choice observations from those who did not receive environmental information are used in this paper. All 116 experienced participants did their

IV. ECONOMETRIC MODELS

The GMNL and MMNL Models in Preference Space

The generalized multinomial logit (GMNL) model (Fiebig et al. (2010) encompasses several logit models including the mixed multinomial logit (MMNL) model, the scaled multinomial logit (SMNL) model, and the standard multinomial logit (MNL) model.

Let participant *n* choose alternative *j* in choice situation *t* to derive utility U_{njt} :

$$U_{njt} = \boldsymbol{\beta}_n' \mathbf{X}_{njt} + \varepsilon_{njt}, \tag{1}$$

where $\mathbf{X}_{njt}$ includes the price p_{njt} and a vector of non-price attributes $\mathbf{x}_{njt}$, $\boldsymbol{\beta}_n$ is the random parameter vector for participant n, and ε_{njt} is an idiosyncratic error term that is assumed to follow an extreme value distribution. The non-price attributes are specified as dummy variables. The dummy variables are used to specify the eight products in table 1, which were used in the experiment. There are five types of fish without ecolabels (farmed salmon, farmed cod, wild cod, monkfish, and farmed pangasius) and three types of fish with ecolabels (AB-labeled farmed salmon, AB-labeled farmed cod, and MSC-labeled wild cod).

In the GMNL model in preference space, the random parameter vector in equation (1) is specified as:

$$\boldsymbol{\beta}_n = \sigma_n \boldsymbol{\beta} + [\gamma + \sigma_n (1-\gamma)] \Gamma \mathbf{w}_n, \text{ where } \mathbf{w}_n \sim \mathrm{N}[0, \mathbf{I}] \text{ and } 0 \le \gamma \le 1, \tag{2}$$

and

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first round of choices without having received any environmental information. These choice observation are also used in this paper. In the second paper of the thesis, we use the whole dataset. To facilitate identification, we pool the choice observations from the new and the experienced participants together during estimation.

- $\sigma_n = \exp(\tau v_n - \tau^2/2)$ captures scale heterogeneity and follows a standard lognormal distribution such that $v_n \sim \text{N}[0,1]$,
- τ is the parameter on the unobserved scale heterogeneity,
- $\boldsymbol{\beta}$ is the vector that contains means of the distribution of $\boldsymbol{\beta}_n$,
- γ is the weighting parameter that indicates how variance in individual preference heterogeneity varies with scale such that $0 \le \gamma \le 1$,[8]
- Γ is the lower triangular Cholesky matrix,
- $\mathbf{w}_n$ is the vector of random variables with zero means and unit variances.

The GMNL model in equation (2) collapses into the MMNL model in preference space when τ is zero so $\sigma_n = 1$, and the random parameter vector in equation (2) becomes:

$$\boldsymbol{\beta}_n = \boldsymbol{\beta} + \Gamma \mathbf{w}_n. \tag{3}$$

Let α_n be the parameter associated with the price. From equation (1), we derive the WTP distributions for the non-price attributes as the marginal rate of substitution between the non-price attributes and the price, or:

$$\mathbf{WTP}_n^{np} = \boldsymbol{\beta}_n^{np} \Big/ -\alpha_n, \tag{4}$$

where $\mathbf{WTP}_n^{np}$ is the vector of the n^{th} participant's marginal WTP values for the seven non-price attributes and $\boldsymbol{\beta}_n^{np}$ is the vector of the seven non-price random parameters.

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[8] Keane and Wasi (2013) argue that γ does not have to be restricted between zero and one. Their argument is adopted by Gu, Hole, and Knox (2013) in their STATA implementation. We, however, follow Fiebig et al. (2010), Greene and Hensher (2010), and Greene (2012) and restrict γ between zero and one. Notice that this difference only affects the estimation of the GMNL in preference space, since the GMNL model in WTP space restricts γ to be zero.

The GMNL and MMNL Models in WTP Space

The MMNL model using a money metric utility function was first estimated by Train and Weeks (2005). The estimated parameters are the marginal WTP values for the corresponding attributes, and Train and Weeks (2005) described the model as a model estimated in WTP space.

Fiebig et al. (2010) showed that the GMNL also can be estimated in WTP space. They fixed the weighting parameter γ to be zero in equation (2), and the model collapses to the SMNL model:

$$\boldsymbol{\beta}_n = \sigma_n \left(\boldsymbol{\beta} + \Gamma \mathbf{w}_n \right). \tag{5}$$

As compared with the MMNL model in preference space given by equation (3), the SMNL model includes the multiplier of σ_n, which is the scale heterogeneity parameter.

Equation (5) can be parameterized to become the GMNL/SMNL model in WTP space by normalizing the price parameter to one inside the bracket, which results in:

$$\boldsymbol{\beta}_n = \sigma_n \alpha_n \left(\begin{array}{c} 1 \\ \left(\dfrac{1}{\alpha_n} \right) \left(\boldsymbol{\beta}^{np} + \boldsymbol{\Gamma}^{np} \mathbf{w}_n^{np} \right) \end{array} \right) = \sigma_n \alpha_n \left(\begin{array}{c} 1 \\ \left(\boldsymbol{\theta}^{np} + \boldsymbol{\Pi}_c^{np} \mathbf{w}_n^{np} \right) \end{array} \right), \tag{6}$$

where $\boldsymbol{\beta}^{np}$, Γ^{np}, and $\mathbf{w}_n^{np}$ are $\boldsymbol{\beta}$, Γ, and $\mathbf{w}$ excluding the price parameter α_n. Furthermore, $\boldsymbol{\theta}^{np} = \boldsymbol{\beta}^{np} \big/ \alpha_n$ and $\boldsymbol{\Pi}_c^{np} = \boldsymbol{\Gamma}^{np} \big/ \alpha_n$. As pointed out by Train and Weeks (2005), the common denominator in $\boldsymbol{\theta}^{np}$ and $\boldsymbol{\Gamma}_c^{np}$ induces correlation among all non-price parameters.

Similarly, we can parameterize the MMNL model in preference space given by equation (3) into the MMNL model in WTP space by normalizing the price parameter to one inside the bracket, which results in:

$$\boldsymbol{\beta}_n = \alpha_n \left(\frac{1}{\left(\frac{1}{\alpha_n}\right)\left(\boldsymbol{\beta}^{np} + \boldsymbol{\Gamma}^{np}\mathbf{w}_n^{np}\right)} \right) = \alpha_n \left(\frac{1}{\left(\boldsymbol{\theta}^{np} + \boldsymbol{\Pi}_c^{np}\mathbf{w}_n^{np}\right)} \right). \quad (7)$$

The only difference between the GMNL/SMNL model in WTP space and the MMNL model in WTP space is that the former model includes an additional scale heterogeneity multiplier σ_n as also is the case in preference space.

Specification and Estimation

The price parameter α_n can either be a non-random or random parameter, and we specify α_n as a random parameter to allow consumers to have different sensitivity to price changes (Hensher and Greene 2003). A normal distribution is commonly assumed for random parameters, but for the price parameter this assumption has been criticized (Hensher and Greene 2003; Hess, Bierlaire, and Polak 2005; Daly, Hess, and Train 2012). A normally distributed price parameter implies that there is a segment of consumers who receive positive utility from increasing prices, which is not behaviorally plausible.

We assume that α_n follows a one-sided triangular distribution (Hensher and Greene 2003; Brouwer et al. 2010; Dekker and Rose 2011; Hensher and Greene 2011; Dekker 2014).[10] All non-price parameters are assumed to follow normal distributions. In all four

[10] We have tried more common distributions before choosing one-sided triangular distribution. First, we used a lognormal distribution (Train 1998) for the price parameter. However, the GMNL model in preference space failed to converge, and the MMNL model in preference converged but with unstable standard error. We tried different numbers of draws per iteration, ranging from 100 to 2,000 draws per iteration. The mean and the standard error of the lognormal price parameter were still large and unstable. The standard error of the mean

models, the parameters are specified to be uncorrelated. However, all non-price parameters are still correlated due to the common denominator of the price parameter α_n in the WTP space (Train and Weeks 2005). The WTP estimates from the models in preference space are obtained by using the delta method (Greene 2012).

We estimate all models by maximum simulated likelihood using NLOGIT 5 (Chang and Lusk 2011; Greene 2012). We use 500 Halton draws in each iteration for the simulated probability, and specify a panel data structure. The models are set to converge when the gradient, change in the log-likelihood function value (LLFV), and changes in parameters are all smaller than 0.00001. All 2,300 choice observations are used.

V. RESULTS AND DISCUSSION

From left to right, table 2 reports estimation results of the GMNL and MMNL models in preference space and the GMNL and MMNL models in WTP space. The McFadden Pseudo R^2 values are well above 0.4 in all models (McFadden 1974), which indicates a good fit (Louviere, Hensher, and Swait 2000).

(Insert table 2 about here)

The GMNL models have better fit than the MMNL models but the improvements are marginal. In preference space, the GMNL model improves the LLFV of the MMNL model

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tends to be about one million times larger than standard errors of other means estimated in the model. Next, we estimated models with price parameters that followed an unconstrained triangular distribution. However, in some cases the resulted triangular distribution went over zero, which would be behaviorally implausible. By using one-sided triangular distribution, a constraint variation of the triangular distribution, we restrict the price parameter to be non-positive.

by 35 points (from -2,028.59 to -1,993.60). The improvement is 0.01 in term of the McFadden Pseudo R^2 value. In WTP space, the improvements are even smaller. The GMNL model improves the LLFV of the MMNL model by 4 points (from -2,096.60 to –2093.08) and the improvement in term of McFadden Pseudo R^2 is less than 0.01 (from 0.5851 to 0.5858).[12]

The marginal improvement in fit of the GMNL model as compared with the MMNL model in preference space, observed in this dataset, is consistent with previous findings. Fiebig et al. (2010) estimated MNL, MMNL, and GMNL models in preference space using nine datasets. The GMNL model had superior LLFVs as compared with the MMNL model in all nine datasets, but only for two datasets the GMNL model improved the LLFVs by more than 100 points. Greene and Hensher (2010) found that the GMNL model in preference space only improved LLFV by about 45 points as compared with the MMNL model in preference space. Czajkowski, Giergiczny, and Greene (2014) found that when the parameters were uncorrelated, the GMNL model in preference space improves the LLFV by 559 points as compared with the MMNL model in preference space. However, with the same dataset, the performance of the MMNL model in preference improved greatly when correlation was specified, and the difference in LLFVs was reduced to 101 points. Moreover, these four cases, in which the GMNL model improved LLFVs by more than 100 points, do not necessarily suggest that the GMNL model sometimes largely improves

[12] The same conclusion is reached if we compare improvements by using an alternative model fit statistic, for example Akaike Information Criterion (AIC) and Bayes Information Criterion (BIC).

LLFVs as compared to the MMNL model in preference space. In all four cases, the base LLFVs were large and the improvements relative to the base LLFVs were small.[13]

When the MMNL model was introduced, it improved model fits greatly compared to the standard MNL model. For example, compared to the MNL model, the MMNL model in preference space improves LLFVs by over 12,000 points in Czajkowski, Giergiczny, and Greene's (2014) study. In our dataset, the MMNL model in preference space improves LLFV by more than 500 points as compared with the MNL model.[14] To concluded, for models in preference space, the improvements from the MMNL model to the GMNL model, consistently shown from all the studies that we have surveyed, are much smaller than the improvements from MNL model to the MMNL model, in term of LLFV.

Compared to the estimation in preference space, estimation in WTP space reduces LLVFs in our case. For the GMNL model, the LLFV is reduced by 100 points (from -1,993.60 to -2,093.08) and McFadden Pseudo R^2 is reduced by 0.02. Reductions in model fit due to estimating the GMNL model in WTP have been reported in other studies. Hensher

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[13] The two datasets in Fiebig et al. (2010), in which the GMNL model in preference space improves LLFVs by more than 100 points, were the Pizza B and the Holiday B datasets. For these two datasets, the LLFVs of the MMNL models in preference space were over -5,500 and -11,000, respectively. In Czajkowski, Giergiczny, and Greene (2014), the LLFVs in the MMNL model in preference space with uncorrelated parameters and correlated parameters were -17,613 and -17,055, respectively. These LLFVs are much larger than commonly seen. For example, the MMNL models in preference space had LLFVs of around -1,400 and around -2,500 for the Pizza A and the Holiday A datasets in Fiebig et al. (2010), respectively. When base LLFVs are large, it is natural that the improvements by the GMNL models in preference space are large in absolute values, but compared to the sizes of the base LLFVs the improvements are still small.

[14] The LLFV of the MNL model is -2,546.17.

and Greene (2011) a reduction of 71 points in LLFV and 0.02 in 0.02 in McFadden Pseudo R^2. Michaels-Igbokwe et al. (2015) did not report 0.02 in McFadden Pseudo R^2 but a reduction of 53 points in LLFV. We did not find a case in the literature that the GMNL model estimation in WTP space increases model fit when compared to the GMNL model in preference space.[15]

For the MMNL model, in our case, the reductions in the two statistics due to estimation in WTP space are 68 points and 0.01, respectively. Similar reductions in model fit due to estimating the MMNL model in WTP space have also been observed in the literature (e.g., Train and Weeks 2005; Sonnier, Ainslie, and Otter 2007; Hole and Kolstad 2012). However, Scarpa, Thiene, and Train (2008), Scarpa, Thiene, and Hensher (2012), and Gu, Norman, and Viney (2014) found that the MMNL model in WTP space fits the data better than the MMNL model in the preference space.

The estimated WTP values are presented in table 3. The mean WTP values and the confidence intervals (CI) of the two models estimated in WTP space are directly given by the parameter estimates. The WTP values and the CIs of the two models in preference space are calculated by using the delta method (Hole 2007) on equation (4).

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[15] We have gone through all the publication on GMNL model and WTP space at Google Scholar as of May 20, 2015. We only found two papers that estimated their datasets in the GMNL model in both preference and WTP space (Hensher and Greene 2011; Michaels-Igbokwe et al. 2015). Other papers, which have used the GMNL model, either estimated the model only in preference space or only in WTP space. Here are a few examples. Scarpa, Thiene, and Hensher (2012) estimated the GMNL model in preference and the MMNL model in both preference and WTP space, but did not estimate the GMNL model in WTP space. Scott et al. (2013) and Czajkowski, Giergiczny, and Greene (2014) only estimated the GMNL model in preference space, while Pedersen et al. (2014) only estimated the GMNL model in WTP space.

No model has consistently higher or lower estimates than the other models. For example, the estimated WTP per kilogram of wild cod, farmed cod, farmed salmon, and wild monkfish are €16.43, €16.45, €18.62, and €19.49 according to the GMNL model in WTP space. For these four fish types the mean WTP estimates are significantly different from zero at the 1% level. For wild cod and farmed salmon, which are the most commonly purchased types in France, the estimated prices are within the range of prices charged by local stores at the time of the experiment. Farmed cod was not available in local stores, and monkfish was sold in small quantities at market prices significantly above our WTP estimates. Except for pangasius, the mean WTP values do not differ much across models.

Our estimated negative mean WTPs for farmed pangasius are outside the price range used in the experiment, and indicates that less than 50% of respondents were willing to pay anything for it. Pangasius was only chosen in 10% of the choice sets where it was included even though it was the cheapest alternative.[16] Moreover, the mean WTP for pangasius in the GMNL model in WTP space is negative and significant at 10% level. In three other models the mean WTP for pangasius is insignificant.

(Insert table 3 about here.)

The mean WTP estimates for the two labels are significantly different from zero at the 5% level of significance. The WTP for the MSC label ranges from €1.39 to €2.26 in the four models, and the WTP for the AB label ranges from €1.73 to €2.44. This corresponds to a premium of about 10%, which is consistent with previous estimates (Olesen et al. 2010; Roheim, Asche, and Santos 2011; Sogn-Grundvåg, Larsen, and Young 2013). The higher

[16] An alternative of pangasius is included in 816 choice situations. Only in 82 choice situations, pangasius was chosen.

WTP values for the AB label may be a result of its greater use in the experiment. Half of the wild cod was MSC labeled, while half of the farmed salmon and half of the farmed cod were AB labeled.

The CIs for the WTP estimates of the four models are also reported in table 3. The estimated mean WTP values from the GMNL model are within the 95% CIs of the corresponding WTP values for the MMNL model, and vice versa, with the only exception.[17] The CIs for farmed salmon from the GMNL model and the MMNL model in WTP space are close but do not overlap. However, the CIs for farmed salmon from the two models in WTP space overlapped, when we specified the price parameter to be non-random, to follow a normal distribution, and to follow an unconstrained triangular distribution. To conclude, the examination on CIs suggest that re-estimating MMNL models in preference space by using the GMNLin preference space, the MMNL model in WTP space, or the GMNL model in WTP space is unlikely to substantially affect the WTP estimates.

We also examined the distribution of the WTP estimates for the individual participants on the seven non-price attributes. Figure 1 shows the kernel distribution estimates (KDEs) for the WTP for the seven non-price attributes from the MMNL and the GMNL models. The KDEs from the four models are similar, which is not surprising given that most of the CIs overlap.

(Insert figure 1 about here.)

[17] Similar CIs were obtained based on the Krinsky–Robb method (Krinsky and Robb 1986, 1990).

VI. CONCLUSIONS

A stated choice experiment including ecolabeled and unlabeled farmed and wild fish was conducted in France. We estimated the MMNL and GMNL models in both preference and WTP space. The similarity of the results from the four models demonstrates a robustness to model specification, at least for our dataset. Although all four models fit the data well, the GMNL model in preference space fits slightly better than the other three models. The WTP values from the four models are close for wild cod, farmed cod, farmed salmon, and wild monkfish. The models also produce quite similar results for the two types of ecolabels included in the experiment. The estimated WTP values from one model are within the 95% confidence intervals (CIs) of the corresponding WTP values for the other three models, and vice versa, with only one exception. Moreover, all four models produce similar plots of the distributions of individual-specific WTP estimates across participants.

For many applied economists, availability and accessibility of easy-to-use software for estimation is essential. New models often are more complex and are not supported by current software. In our case, the new GMNL model and the estimation in WTP space technique are available in both NLOGIT and in STATA. However, for those who do not have access to neither of the two software, our results indicate that estimating dataset in a standard MMNL model in preference space will likely produce similar WTP estimates, both in terms of the mean, 95% CIs, and distribution of individual-specific WTP estimates. If feasible, applied researchers are encouraged to use the new GMNL model and/or estimation in WTP space. Our results as well as earlier studies show that the GMNL model in preference space fits the dataset best. Whilst the estimation of the GMNL in WTP space tend to slightly reduce model fit, gaining the assurance of finite moments of the WTP

distribution outweighs the small model fit loss (Train and Weeks 2005; Daly, Hess, and Train 2012).

French consumers are willing to pay significantly more for ecolabeled wild fish and organically labeled farmed salmon and cod than for their unlabeled counterparts. On average, both labels attract a premium of about 10%. The ecolabeling of farmed fish is likely to become increasingly important: the share of farmed fish increased from 13% of total production in 1990 to 47% in 2010 (FAO 2013). Our results suggest that the introduction of organic, and alternatively, ecolabeled farmed fish will be successful if their production costs are no more than 10% above those of their unlabeled counterparts. Otherwise, we would expect organic and ecolabeled farmed fish to be niche products in the French market.

Our sample size is relative small (2,300 choice observations from 144 participants), which may potentially result in a Type II error. Moreover, since this is the first study on comparing WTP estimates from the MMNL and the GMNL models in WTP space, further research is required to confirm whether the observed similarities in WTP estimates can be generalized.

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TABLES AND FIGURES

Table 1. The Products in the Experiment

Species	Wild or Farmed	Ecolabel	Area of Origin[a]	Price Range 300 Grams[b]
Salmon	Farmed	No	Norway	€1.95-5.45
Salmon	Farmed	Organic AB	Norway	€3.45-7.95
Cod	Farmed	No	Norway	€2.95-6.95
Cod	Farmed	Organic AB	Norway	€4.95-10.95
Cod	Wild	No	North Atlantic	€2.95-6.95
Cod	Wild	MSC	North Atlantic	€4.95-10.95
Monkfish	Wild	No	North Atlantic	€5.45-11.45
Pangasius	Farmed	No	Vietnam	€1.45-4.95

Notes:
[a] The origins of the different species are the origins that are most common in the French market. For the organic cod and salmon, we use the same origin as for the non-organic cod and salmon.
[b] An eight-point price scale was used for each product.

Table 2. Estimation Results

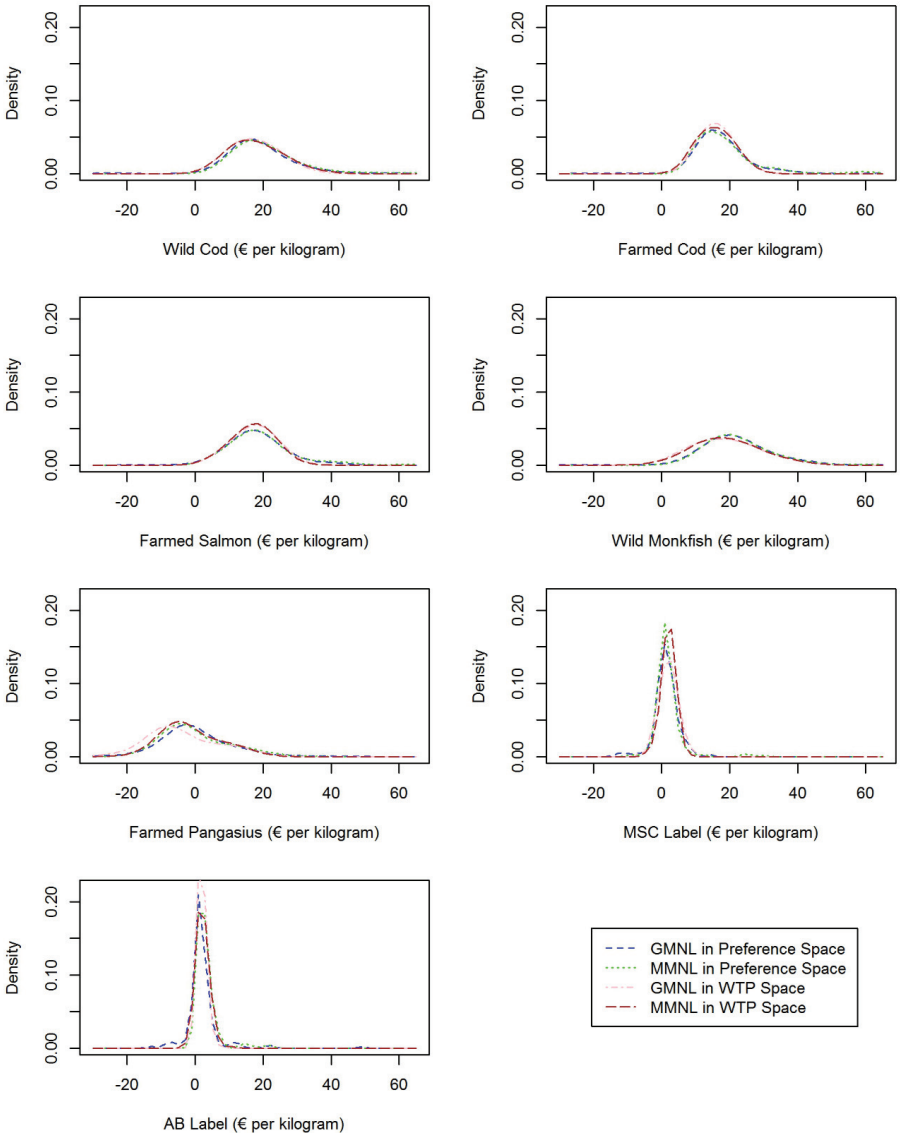
Attribute	Preference Space				WTP Space			
	GMNL		MMNL		GMNL		MMNL	
	Coef.	SD	Coef.	SD	Coef.	SD	Coef.	SD
Price in € per kilogram	-0.40***	0.40***	-0.31***	0.31***	-0.47***	0.47***	-0.34***	0.34***
	(0.03)	(0.03)	(0.01)	(0.01)	(0.04)	(0.04)	(0.02)	(0.02)
Wild cod	7.36***	1.34***	5.91***	1.36***	16.43***	7.28***	17.81***	8.44***
	(0.54)	(0.20)	(0.31)	(0.21)	(0.73)	(0.57)	(0.69)	(0.59)
Farmed cod	7.11***	1.09***	5.06***	1.07***	16.45***	5.87***	16.16***	6.25***
	(0.51)	(0.22)	(0.29)	(0.19)	(0.46)	(0.47)	(0.53)	(0.67)
Farmed salmon	7.26***	1.88***	5.25***	2.15***	18.62***	6.94***	16.71***	6.42***
	(0.53)	(0.16)	(0.27)	(0.21)	(0.43)	(0.42)	(0.42)	(0.43)
Wild monkfish	8.52***	0.93***	6.58***	0.95***	19.49***	11.31***	20.26***	11.41***
	(0.61)	(0.29)	(0.32)	(0.25)	(0.82)	(1.10)	(0.84)	(0.94)
Farmed pangasius	-0.09	3.41***	-0.04	3.29***	-3.85*	13.18***	-0.91	10.22***
	(0.57)	(0.50)	(0.52)	(0.51)	(2.16)	(2.05)	(1.74)	(1.63)
MSC label	0.57***	1.17***	0.43**	0.91***	1.89***	4.18***	2.26***	3.13***
	(0.22)	(0.23)	(0.18)	(0.25)	(0.64)	(0.74)	(0.61)	(0.84)
Organic AB label	0.70***	0.87***	0.76***	0.59***	1.92***	1.70***	2.22***	2.67***
	(0.14)	(0.16)	(0.12)	(0.19)	(0.31)	(0.22)	(0.45)	(0.47)
τ	0.67***		0		0.62***		0	
	(0.06)				(0.08)			
σ_n	1.00	0.72	1		1.00	0.66	1	
γ	0.67***		0		0		0	
	(0.10)							
Log likelihood function	-1993.60		-2028.59		-2093.08		-2096.60	
Akaike Information Criterion	4021.20		4087.20		4218.20		4223.20	
Bayes Information Criterion	4118.80		4173.30		4310.00		4309.30	
McFadden Pseudo R^2	0.61		0.60		0.59		0.59	

Notes:
(1) The numbers in the parentheses are standard errors. GMNL and ML denotes the generalized multinomial logit and the mixed logit model, respectively. All non-price attributes are dummy variables. A parameter that is significant at the 0.10, 0.05, or 0.01 level of significance is marked with *, **, or ***, respectively. Numbers with underlines are fixed parameters that are not estimated.
(2) The price parameter follows a one-sided triangular distribution. For these price parameters, the numbers in the SD columns are the limits of the distributions.

Table 3. Mean WTP Estimates and 95% Confidence Intervals in € per Kilogram

	Preference Space		WTP Space	
Attribute	GMNL	MMNL	GMNL	MMNL
Wild cod	18.22***	19.08***	16.43***	17.81***
	[17.18,19.26]	[17.71,20.45]	[15.00,17.86]	[16.46, 19.16]
Farmed cod	17.58***	16.34***	16.45***	16.16***
	[16.70,18.46]	[15.04,17.64]	[15.54,17.35]	[15.11, 17.21]
Farmed salmon	17.95***	16.96***	18.62***	16.71***
	[17.00,18.90]	[15.64,18.28]	[17.78,19.46]	[15.89, 17.52]
Wild monkfish	21.09***	21.24***	19.49***	20.26***
	[20.04,22.13]	[19.86,22.62]	[17.89,21.10]	[18.61, 21.90]
Farmed pangasius	-0.22	-0.13	-3.85*	-0.91
	[-2.98 , 2.53]	[-3.42 , 3.15]	[-8.08 , 0.38]	[-4.33, 2.51]
MSC label	1.42***	1.39**	1.89***	2.26***
	[0.37 , 2.46]	[0.24 , 2.54]	[0.64 , 3.14]	[1.07, 3.46]
Organic AB label	1.73***	2.44***	1.92***	2.22***
	[1.05 , 2.41]	[1.70 , 3.18]	[1.31 , 2.53]	[1.33, 3.11]

Note: The numbers in the brackets are the 95% confidence intervals. MMNL and GMNL denote the mixed and generalized multinomial logit models, respectively. A parameter that is significant at the 0.10, 0.05 and 0.01 level of significance is marked with *, **and ***, respectively.



Note: Each plot is a comparison of the KDEs for an attribute from the MMNL and the GMNL models.

Figure 1. Distributions of WTP for Fish Types and Labels (in € per kilogram)

Paper ii

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Consumer Preferences, Ecolabels, and Effects of Negative Environmental Information

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Consumer Preferences, Ecolabels, and Effects of Negative Environmental Information

Consumers prefer ecolabeled products. However, little is known about the effects of ecolabels when consumers are simultaneously exposed to negative environmental information about the ecolabeled products. We conducted a stated choice experiment in France with eight types of fish that were either ecolabeled or unlabeled. Four treatments with different types of information concerning potential negative environmental effects of wild fisheries and/or fish farming were used. The results indicate a 4% premium for Marine Stewardship Council labeled wild cod, and a premium of about 11% for Agriculture Biologique labeled farmed salmon and farmed cod. However, negative environmental information reduces the WTP values with a higher amount than these premiums independently of whether the fish is labeled or not. This implies that the ecolabeling organizations need to improve consumers' trust in their labels. Public authorities can also play a more active role in developing trust in ecolabels.

Key words: discrete choice, ecolabels, environmental information, fish, stated preference.

Introduction

Labels that signal the presence or absence of specific attributes is one source of information about food products. Food labels can significantly change the purchasing behavior of consumers (e.g., Caswell & Anders, 2011). Ecolabeling is increasingly used by the seafood industry to meet consumers' concerns about the environmental impacts and sustainability of wild fisheries and aquaculture. Much of the focus on ecolabeling has been on the certification of wild fish types, such as the labeling activities of the Marine Stewardship Council (MSC). However, farmed fish has become increasingly important and ecolabels for farmed fish are in the process of gaining

global influence. Several studies using data from surveys, laboratory experiments, and retail trade find that consumers are willing to pay a premium for ecolabeled fish types (e.g., Wessells, Johnston, & Donath, 1999; Jaffry et al., 2004; Olesen et al., 2010; Roheim, Asche, & Santos, 2011; Mauracher, Tempesta, & Vecchiato, 2013).

Other sources of information also influence the preferences for food products as demonstrated in several studies (e.g., Fox, Hayes, & Shogren, 2002; Rousu et al., 2004; Rousu et al., 2007). Consumers receive information about wild fisheries and aquaculture from newspapers, TV as well as from trade and nongovernmental organizations. One example is the Eastern Baltic cod that was severely overexploited. This overexploitation was widely covered in Swedish media, and the World Wildlife Fund (WWF) listed the Eastern Baltic cod on its blacklist and advised consumers against buying it. As a result, many Swedish consumers stopped buying not only Baltic cod but also cod from healthy stocks.

In this study, total effects of labeling and information from other sources are investigated. We include four sets of environmental information and two labels. The labels are the MSC and the organic French Aqriculture Biologique (AB) labels. The AB label is the most widely used organic label in France. The environmental information is related to the potential damages to the environment from cod farming, salmon farming, and wild cod fisheries. In the presence of labeling, the effects of these types of information may be complex. First, there are direct effects on the willingness to pay (WTP) for the product, which the information is aimed at (e.g., farmed salmon). Since consumers may purchase both ecolabeled and unlabeled varieties of this product, there may be different direct effects for ecolabeled and unlabeled products. Second, there are indirect effects of information on the substitutes of the product, which the information is aimed at. These indirect effects may depend both on the production method of the substitutes (wild versus farmed) and whether they are ecolabeled or unlabeled. For example, let the negative

information be about farmed salmon. We can then differentiate between four groups of indirect effects: (i) effects on ecolabeled fish that is produced with the same production technology such as ecolabeled farmed cod; (ii) effects on ecolabeled fish that is produced with the other production technology such as ecolabeled wild cod; (iii) effects on unlabeled fish that is produced with the same technology such as unlabeled farmed cod; and (iv) effects on unlabeled fish that is produced with the other production technology such as unlabeled wild cod.

To our knowledge, the total effects of negative environmental information and ecolabels on the WTP for various fish types have previously not been investigated. Our objectives are: (i) to investigate the direct effects of negative information on the WTP for ecolabeled and unlabeled fish; and (ii) to investigate the indirect effects of negative information on the WTP for the substitutes to the fish type, which the information is aimed at.

To investigate these objectives, we designed and carried out a stated choice experiment with a focus on the WTP for Norwegian seafood in France. Norway is the second largest seafood exporter after China, and seafood exports generate about 7% of the Norwegian export value. The total Norwegian seafood export was about $10 billion in 2013. About 70% was from aquaculture (mainly salmon) and 30% from wild fisheries with cod and pelagic species as the most important fish types. France and Russia are the two most important markets for the Norwegian seafood export. In the French market, salmon and cod are the two most important species of fish, and we focus on them.

Ecolabels an Environmental Issues in Seafood Markets

Fishery management policies have focused on developing and enforcing management schemes related to the supply side of the seafood market. To a large extent, such schemes have been ineffective in conserving wild fish stocks (Beddington, Agnew, & Clark, 2007). The Food and

Agriculture Organization (FAO) of the United Nations estimated that almost 60% of the world's fish stocks were fully exploited in 2009, and almost 30% were overexploited (FAO, 2011).

The environmental information provided in the experiment was related to: (1) cod farming; (2) wild cod fisheries; (3) cod farming and wild cod fisheries; and (4) salmon farming. The information concerning fish farming focused on escape from breeding cages with associated genetic pollution of wild stocks, problems with parasites, problems with use of chemical to treat diseases, overexploitation of species used for feed, and pollution of the seabed. The information about wild fisheries focused on depleted stocks and discarding. An English translation of the four information treatments is included in the Appendix.

For consumers it is difficult to know if a fish stock is depleted, and ecolabeling is a way to convey this information. It may be insufficient to know the species of the fish, and information about where and when the fish was caught may be desirable. One example is Norwegian cod. Cod from the North Sea and the Norwegian coast is believed to be under considerable pressure and has not been granted the MSC label, whereas the cod fishery in the Barents Sea, which is currently generating record landings, does have the MSC label. To further increase the confusion, cod from the Barents Sea, which comes to the shores of Northern Norway during the winter months to spawn, can be caught during this period and MSC labeled.

A number of ecolabeling programs have been introduced following increased consumer concerns about overexploitation of wild fish stocks as well as other issues in seafood production. These issues include: (i) safety (e.g., Wessells & Anderson, 1995; Wessells, Kline, & Anderson, 1996), (ii) quality (e.g., Verbeke et al., 2007; Brécard et al., 2009; Salladarré et al., 2010), (iii) environmental effects (e.g., Jaffry et al., 2004; Verbeke et al., 2007), (iv) sustainability (e.g., Sogn-Grundvåg, Larsen, & Young, 2013), and (v) fish welfare (e.g., Teisl, Roe, & Hicks, 2002;

Aarset et al., 2004; Verbeke et al., 2007). For more information on ecolabels, see Consumer Reports (2013).

There is no French national ecolabeling scheme for wild fish, and several labels are used by retailers. As early as the spring of 2004, Carrefour launched its own ecolabel for wild cod products. Other large retailers and processors of seafood followed with their own private labels (Salladarré et al., 2010). The certification program of the MSC is currently the most widely used and recognized sustainable wild fish labeling scheme in the world, and it is also used in France (Gulbrandsen, 2009; Thrane, Ziegler, & Sonesson, 2009). As of November 2014, 243 fisheries have been certified by the MSC program, and another 102 fisheries were being assessed (Marine Stewardship Council, 2014). In this study, we use the MSC label for wild fish.

No ecolabeling program for farmed fish has so far gained wide international acceptance. The Aquaculture Stewardship Council (ASC) is the aquaculture counterpart to the MSC. It was founded in 2009 by the WWF and the Dutch Sustainable Trade Initiative. The ASC aims to provide certification schemes for responsibly farmed fish. As of June 2013, only a few fish farms from six countries were certified, although Marine Harvest, which is the world's biggest producer of salmon, announced in May 2013 that it would seek company wide ASC certification by 2020. In this study, we use the AB label for farmed fish. The AB label is the most widely used ecolabel for food in France, and it certifies food products with an organic content of at least 95%. Farmed fish can be labeled as organic, whereas wild fish cannot. At the time of the experiment, we were unable to find any certified organic fish in the French market.

The most important success measure for ecolabeling programs is the size of the premium that consumers are willing to pay for the labeled products (Thøgersen, 2000; Nilsson, Tunçer, & Thidell, 2004). Many studies suggest that labeling has a positive effect. Jaffry et al. (2004) used a choice experiment and found that ecolabeled seafood from a sustainably managed fishery had up

to a 7% higher probability of being chosen by participants. Roheim, Asche, & Santos (2011) analyzed scanner data of MSC-certified frozen processed Alaskan pollock products and found that UK consumers were willing to pay a 14% premium for the label. Olesen et al. (2010) conducted a nonhypothetical choice experiment and found that the average Norwegian participant was willing to pay a 15% premium for organic salmon. Mauracher, Tempesta, & Vecchiato (2013) found a significant price premium for organic Mediterranean sea bass. However, all these estimates were obtained by focusing on the effects of one label, and the values may change in a more realistic setting with several labels and additional information.

Experimental Design

The experiment was carried out in the sensory laboratory of l'Institut National de la Recherche Agronomique (INRA) in Dijon in December, 2008. Potential participants were randomly drawn from INRA's consumer panel.[1] In the recruitment process, they were asked to answer a short survey on their consumption and purchasing frequencies of fish. Only those who ate fish at home more than once a month and bought fresh fish themselves at least every second month were recruited. Each participant was paid €25 to participate in the experiment.

As shown in Table 1, there were five unlabeled and three ecolabeled fish types included in the experiment. Each fish type was labeled with species, area of origin, and price. Furthermore, the farmed fish types were labeled as such. Monkfish and pangasius were included as an expensive and an inexpensive substitute for cod and salmon. Both fish types were always

[1] The consumer panel is a database of participants who volunteer to participate in sensory experiments. The volunteers have been recruited in several ways: random selection of phone numbers in representative districts of all socioeconomic classes of Dijon and the suburbs, advertisements in the local press, and during exhibitions. Dijon is a city with about 150,000 inhabitants and is located 300 km southeast of Paris. The city is representative of France in terms of household disposable income and socio-demographic composition. Fresh fish consumption in Dijon is slightly below the average consumption in France, but representative of the noncoastal regions.

unlabeled. The price range of the unlabeled fish was based on market prices in Dijon at the time of the experiment. In the market, the prices varied considerably, and the price variation reflect factors such as size, quality, cut, outlet, day, and promotions. The price ranges used in the experiment covered the minimum and maximum prices in the market. For the ecolabeled products, the price ranges were set €1.50 – 2.00 above the price ranges of the corresponding unlabeled products.

To reduce the hypothetical nature of the experiment, we used real fish that were professionally packed in 300 grams packages of fish loins. Loins are the best cuts of the fish, which explains the relatively high prices shown in Table 1. No ecolabeled farmed fish types were available in France at the time of the experiment, and unlabeled fish was ecolabeled for use in the experiment. To avoid selling these products to the participants, a stated choice format was selected.

We constructed 112 choice sets that were divided into seven blocks with 16 choice sets in each block. We had 14 sessions and each block was used in two sessions. In each choice set, three products were presented in a Styrofoam box filled with ice, and a none-of-these alternative was included as an additional alternative. To avoid systematic ordering effects, the participants could start at any of the 16 choice sets.[2]

One hundred and sixteen participants had previously taken part in one or more fish experiments, and we refer to them as experienced participants while the remaining 78 participants are referred to as new participants. There were six sessions with new participants and eight sessions with experienced participants. The experienced participants conducted two rounds of choices with an information treatment between the rounds, while the new participants only

[2] The choice design with eight products sold at varying prices was constructed by the SAS macro MktEx with zero priors, and the D-efficiency of the total design was 96.52.

completed one round of choices with information given before the choices. In two of the sessions with new participants no information was provided, while each of the four information treatments was used in one of the other four sessions with new participants. In the sessions with experienced participants, each information treatment was used in two sessions. The distribution of choice blocks and information treatments across sessions was determined before the experiment. At the time of recruitment, the participant were given a choice between available sessions he or she would participate in, but did not know any details about the choice experiment.

Each of the 78 new participants made 16 choices resulting in a total of 1,248 choices (1,246 useable choices). The 116 experienced participants made 16 choices, then received the information treatment allocated to the session and made the same 16 choices again. This resulted in a total of 3,712 choices (3,709 useable choices).[3]

(Insert Table 1 about here)

Econometric Model

A mixed logit model (McFadden & Train, 2000) was used to estimate the model for all the participants. We let p denote price, and group the other variables in three vectors of dummy variables. The vector **Fish** includes five dummy variables that correspond to the five fish types: wild cod, farmed cod, farmed salmon, wild monkfish, and farmed pangasius. These dummy variables are coded as 1 if we observe the specified fish type and 0 otherwise. The vector **Ecolabel** includes two dummy variables that are coded as 1 if the fish was labeled with the MSC or the AB label, respectively, and 0 otherwise. The vector **Information** includes six dummy

[3] By this procedure, we created between-subject variation among new participants and within-subject variation among experienced participants. However, to obtain a sufficiently large sample size, we pooled data from both groups for estimating the econometric model.

variables that take account of the two direct and the four indirect effects of information. The first variable is coded as 1 if the participant received information aimed at the chosen and unlabeled fish type. The second variable is coded as 1 if the participant received information aimed at the chosen and ecolabeled fish type.[4] The third variable is coded as 1 if the participant received information about a different fish type (e.g., salmon) than the chosen and labeled fish type (e.g., labeled cod) and both fish types were produced by using the same production technology (i.e., farmed). The fourth variable is coded as 1 if the participant received information about a different fish type (e.g., salmon) than the chosen and labeled fish type (e.g., labeled cod) and the two fish types were produced by using different technologies (farmed and wild). The fifth variable is coded as 1 if the participant received information about a different fish type (e.g., salmon) than the chosen and unlabeled fish type (e.g., unlabeled cod) and both fish types were produced by using the same production technology (i.e., farmed). The sixth variable is coded as 1 if the participant received information about a different fish type (e.g., salmon) than the chosen and unlabeled fish type (e.g., unlabeled cod) and the two fish types were produced by using different technologies (farmed and wild).

When participant *n* chooses alternative *j* in choice situation *t*, the participant obtains utility U_{njt}:

$$U_{njt} = \alpha_n p_{njt} + \boldsymbol{\beta_n}\mathbf{Fish_{njt}} + \boldsymbol{\gamma_n}\mathbf{Ecolabel_{njt}} + \boldsymbol{\delta_n}\mathbf{Information_{njt}} + \varepsilon_{njt}, \qquad (1)$$

where α_n is the individual-specific coefficient for price, $\boldsymbol{\beta_n}$, $\boldsymbol{\gamma_n}$, and $\boldsymbol{\delta_n}$ are individual-specific coefficient vectors, and ε_{njt} is an error term that is assumed to have extreme value distribution and to be independent and identically distributed across observations. All individual specific coefficients are specified to follow normal distributed.

[4] We did not distinguish between the MSC and the AB label to facilitate estimation of the model.

Equation (1) was estimated by maximizing the simulated log likelihood function using NLOGIT 5 (Greene, 2012). We specified 2,000 Halton draws per iteration, used the panel structure of the data, and allowed for free correlation among the random coefficients. We estimated the WTP values by calculating the negative ratio between the coefficient of a nonprice variable and the price coefficient. The standard errors of the WTP estimates were estimated by the delta method (e.g., Hole, 2007).[5]

Results and Discussion

The estimated coefficients, the standard deviations of the coefficients, the corresponding WTP estimates, and the standard errors associated with these parameter estimates are presented in Table 2. Furthermore, the 95% confidence intervals of the WTP values and some measures of the goodness of fit of the model are shown. The standard deviations are significant for all the coefficients, which imply that the participants have heterogeneous preferences for all the evaluated attributes.

The coefficient for farmed pangasius is positive but insignificant, and the standard deviation is highly significant. These results indicate that pangasius on average is weakly preferred to the none-of-these alternative, while the preferences among participants are quite heterogeneous. The same pattern is evident for the MSC label, which also has a positive but insignificant coefficient and a significant standard deviation. The McFadden pseudo R^2 (McFadden, 1974) is 0.65, indicating a good fit of the model (Louviere, Hensher, & Swait, 2000: 54).

The participants were, on average, willing to pay €20.44 per kg of wild monkfish, €18.14 per kg of wild cod, €16.46 per kg of farmed cod, €17.78 per kg of farmed salmon, but only €0.29 per

[5] The standard errors were also estimated by the Krinsky–Robb method (Krinsky & Robb, 1986; 1990), and the standard errors of the two methods were close.

kg of farmed pangasius. For monkfish, salmon, and cod, these prices are in line with the market prices for fish of similar quality at the time of the experiment. The average WTP for pangasius is insignificantly different from zero, which may be explained by the few participants who chose pangasius.

(Insert Table 2 about here)

The participants were willing to pay an additional €0.80 per kg of MSC-labeled fish and an additional €1.84 per kg of AB-labeled fish. The premium for the MSC label is about 4% for wild cod and the premium for the AB label is about 11% for farmed cod. The WTP value for the AB label is significant at the 1% level of significance, while the WTP value for the MSC label is only significant at the 10% level of significance.[6] The higher premium for the AB label may be explained by a higher degree of familiarity with this label. While 61% of the participants claimed to have seen the AB label often only 10% of the participants claimed to have seen the MSC label often before the experiment. These premiums are somewhat below the premiums found for Alaskan pollock in the UK (Roheim, Asche, & Santos, 2011) and salmon in Norway (Olesen et al., 2010).

Negative environmental information reduces the WTP with about €2.2 per kg of fish regardless of labeling. This reduction suggests that the MSC and AB labels do not fully mitigate the effects of negative environmental information. Furthermore, the negative effects of information is larger than the positive effects of the labels. These results indicate that the labeling organizations have yet to better inform consumers about their labels and their credibility. The WTP values for wild cod, farmed cod, and farmed salmon when the fish is unlabeled or ecolabeled and without or with the provision of the information are summarized in Figure 1.

[6] Because the model already contains a large number of parameters, we do not estimate the specific effects of ecolabels for farmed cod and farmed salmon.

(Insert Figure 1 about here)

We also find some indirect effects of labeling on the substitutes of the ecolabeled fish. As discussed above, these effects may be different for: (i) ecolabeled fish that is produced with the same production technology, (ii) ecolabeled fish that is produced with the other production technology, (iii) unlabeled fish that is produced with the same technology, and (iv) unlabeled fish that is produced with the other production technology. First, there is a positive effect on the WTP for fish that is produced with the same production technology as the fish that received the negative information. The effect is about €1 per kg and the magnitude is independent of the labeling of the substitute fish. It indicates that the participants do not generalize negative information concerning the production technology, which is used for one species, to other species produced by using the same technology. For example, negative information about salmon farming results in an increase of the WTP for farmed cod, and negative information about cod farming results in an increase of the WTP for farmed salmon. Rather surprisingly, the effect is only significant at the 10% level when the substitute is ecolabeled, while it is significant at the 5% level when the substitute is unlabeled.

Second, there is an unexpected negative and significant effect of information on the WTP for substitutes produced by the other production technology when the substitute is unlabeled, however, this effect becomes insignificant when the substitute is ecolabeled. The result seems to suggests that, for example, negative environmental information about salmon farming reduces the WTP for unlabeled wild cod while there is no significant effect on ecolabeled wild cod.

Conclusions

Ecolabels provide important information about ecological, environmental and sustainability aspects that consumers can use in their decision-making process. Consumers' preference and

WTP for ecolabeled fish is important for the adoption rate of ecolabels among fish producers and retailers. We find WTP premiums for ecolabeled wild and farmed cod and ecolabeled farmed salmon. The average participant is willing to pay a premium of about 4% for MSC-labeled wild cod and a premium of about 11% for AB-labeled farmed cod and farmed salmon. Such premiums encourage producers and retailers to implement and seek ecolabeling of their products, and thereby improve the ecological, environmental and sustainability aspects of fisheries and aquaculture. However, we also find that negative environmental information reduces the WTP with a larger amount than the premiums of the ecolabels regardless of whether the fish is ecolabeled or not. This suggests that the consumers' trust in the included ecolabels is limited. When consumers receive negative environmental information from other sources, the ecolabels have not the intended shielding effect. Instead of flocking to the ecolabeled products, the consumers become more skeptical about both unlabeled and labeled products.

The ecolabeling organizations need to improve consumers' trust in their ecolabeled products. Increased trust will be beneficial for consumers, the fishery and aquaculture sectors, retailers and the government. Consumers can trust that they have sustainable, ecological and environmental friendly products to choose from, even after receiving negative information about wild fisheries or aquaculture. This is likely to increase the fish consumption. Increased consumption of fish will benefit the producers and retailers as well as public policy goals related to the health benefits of increased fish consumption, sustainable resource management and rural settlement.

Building trust may be a costly activity for the labeling organizations. However, increased trust will result in higher WTP for the fish and increased fish sales. Some of the increased revenues will be paid back to the labeling organizations for their labeling services.

Public authorities can also play a more active role in developing trust in ecolabels. The ecolabels are mainly voluntary, and they are developed and owned by the producers or third-party non-governmental organization such as the Aquaculture Stewardship Council. By cooperation with ecolabeling organizations and the fish industry, public authorities can contribute towards increasing consumer knowledge and trust in the ecolabels. Such cooperation may also increase the credibility of the labeling organizations and their labels among many consumers. Furthermore, tension between some of the non-governmental organizations and the fish industry may be reduced. For example, the WWF advises consumers to boycott Atlantic farmed salmon due to environmental concerns. Given more cooperation, such boycotts could be avoided. Finally, if labeling efforts prove to be insufficient, public authorities may enforce stricter environmental standards in wild fisheries as well as aquaculture.

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Table 1. The products in the experiment.

Species	Wild or farmed	Ecolabel	Area of origin [a]	Price range [b]
Salmon	Farmed	None	Norway	€1.95–5.45
Salmon	Farmed	AB	Norway	€3.45–7.95
Cod	Farmed	None	Norway	€2.95–6.95
Cod	Farmed	AB	Norway	€4.95–10.95
Cod	Wild	None	North Atlantic	€2.95–6.95
Cod	Wild	MSC	North Atlantic	€4.95–10.95
Monkfish	Wild	None	North Atlantic	€5.45–11.45
Pangasius	Farmed	None	Vietnam	€1.45–4.95

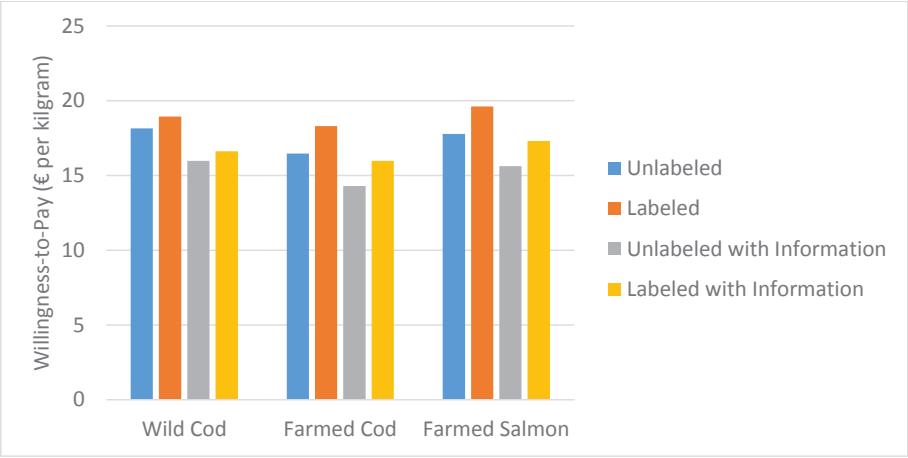
[a] The area of origin is the origin that is most common for the fish type in the French market. For the AB labeled cod and salmon, we use the same origin as for the conventional cod and salmon.
[b] Price range for a 300 grams package. An eight-point price scale was used for each product.

Table 2. Mixed logit results and willingness to pay estimates.

	Mixed logit		WTP estimate	
Attribute	**Coefficient** [a]	**Standard deviation** [a]	**Mean WTP** [a]	**95% CI** [b]
Wild cod	7.34***	3.80***	18.14***	[17.43, 18.86]
	(0.28)	(0.24)	(0.36)	
Farmed cod	6.66***	4.14***	16.46***	[15.76, 17.16]
	(0.28)	(0.23)	(0.36)	
Farmed salmon	7.19***	4.29***	17.78***	[17.17, 18.39]
	(0.26)	(0.17)	(0.31)	
Wild monkfish	8.26***	4.08***	20.44***	[19.63, 21.25]
	(0.31)	(0.23)	(0.41)	
Farmed pangasius	0.12	5.84***	0.29	[–1.63, 2.22]
	(0.40)	(0.44)	(0.98)	
MSC label	0.32	1.40***	0.80*	[–0.03, 1.62]
	(0.17)	(0.16)	(0.42)	
AB label	0.74***	0.94***	1.84***	[1.30, 2.24]
	(0.11)	(0.12)	(0.28)	
Direct effect unlabeled fish	–0.87***	1.36***	–2.16***	[–3.15, –1.18]
	(0.20)	(0.23)	(0.50)	
Direct effect labeled fish	–0.94***	0.94***	–2.32***	[–3.31, –1.33]
	(0.20)	(0.12)	(0.50)	
Indirect effect on labeled fish produced with the same technology [c]	0.38*	1.16***	0.95*	[-0.05, 1.95]
	(0.21)	(0.22)	(0.51)	
Indirect effect on labeled fish produced with different technology [c]	–0.17	1.00***	–0.41	[–1.32, 0.51]
	(0.19)	(0.16)	(0.47)	
Indirect effect on unlabeled fish produced with the same technology [c]	0.40**	1.17***	0.98**	[0.20, 1.76]
	(0.16)	(0.19)	(0.40)	
Indirect effect on unlabeled fish produced with different technology [c]	–0.31**	0.94***	–0.77**	[–1.53, –0.02]
	(0.15)	(0.17)	(0.38)	
Price (€ per kg)	–0.40***	0.24***	-	-
	(0.01)	(0.01)	-	-
Log likelihood function	–3786.05			
Bayes information criterion	8584.60			
Akaike information criterion	7810.10			
McFadden pseudo R^2	0.65			

[a] The numbers in parentheses are the standard errors. Significance at the 10%, 5%, and 1% level of significance are denoted with *, **, and ***, respectively.
[b] CI denotes confidence interval.
[c] The technologies are "wild fisheries" and "aquaculture". For example, when the environmental information concerns farmed salmon, then the indirect effect of the information on ecolabeled wild cod is denoted "indirect effect labeled fish produced with different technology."

Figure 1. Direct effect of negative information.



Appendix: The Information Treatments

English translation of the information treatments. The original transcript was written in French. The information is based on critical environmental information found on the web pages of various environmental groups.

Treatment 1: Negative information about cod farming

Cod is one of the favorite fish species among French consumers. The high demand for cod has led to intense exploitation where catches have exceeded the renewal rates, As a result, the stocks of cod declined severely in the late 1990s. Cod farming (aquaculture) appears to be a possible solution this problem. Nevertheless, cod farming conducted in its natural surroundings may have negative impacts on the environment and can lead to:

- Pollution of the sea and the seabed. This pollution can be caused by waste from farming, uneaten feed, parasites, diseases, and injuries that are a consequence of overpopulation in the breeding cages, and by therapeutic chemicals used to treat diseases.
- A risk of breeding between farmed cod that have escaped and wild cod. This may lead to uncontrolled genetic modifications of the wild cod with unknown consequences.
- Overexploitation of other species of fish. The feed of farmed cod is primarily made from small fishes. Three to five kg of fish are needed to produce one kg of cod. The species used for feed were considered to be inexhaustible; however, the strong growth of fish farming may put the sustainability of these species at risk.
- Damage to other species. Some fish farming is protected from birds and other predators by nets, but these nets can also capture protected species.
- Damage to the seabed. Farming can particularly damage the flora close to production sites.

Treatment 2: Negative information about wild cod fisheries

Cod is one of the favorite fish species among French consumers. The high demand for cod has led to intense exploitation where catches have exceeded the renewal rates. As a result, the stocks of cod declined severely in the late 1990s. Even though recent scientific observations of the stocks of cod are encouraging, industrial fisheries may have negative impacts on the environment and can lead to:

- A decrease of the fish resources. Industrial cod fisheries lead to the capture of other non-targeted (sometimes protected) species and of undersized fishes. These captures, without any market value, are often discarded (dead) at sea.
- The death of other animals. Secondary captures of mammals and sea birds (including dolphins, albatross, etc.) occur. These animals die trapped in the nets or on lines with fishhooks.
- An imbalance of the marine ecosystem caused by the decrease of other marine species.
- Damage to the seabed. Some fishing techniques damage the flora (including seaweeds and corals), disturb the seabed, and destroy habitats.
- Social and economic effects. Due to the decrease of marine resources, the number of people employed in fishing activities is continuously decreasing. Increasingly public subsidies try to support fishing activities, since some of the fishing activities are unprofitable.

Treatment 3: Negative information about cod farming and wild cod fisheries

Cod is one of the favorite fish species among French consumers. The high demand for cod has led to intense exploitation where catches have exceeded the renewal rates. As a result, the stocks of cod declined severely in the late 1990s. Even though recent scientific observations of the stocks

of cod are encouraging, industrial fisheries may have negative impacts on the environment and can lead to:

- A decrease of the fish resources. Industrial cod fisheries lead to the capture of other non-targeted (sometimes protected) species and of undersized fishes. These captures, without any market value, are often discarded (dead) at sea.
- The death of other animals. Secondary captures of mammals and sea birds (including dolphins, albatross, etc.) occur. These animals may die trapped in the nets or on lines with fishhooks.
- An imbalance of the marine ecosystem caused by the decrease of other marine species.
- Damage to the seabed. Some fishing techniques damage the flora (including seaweeds and corals), disturb the seabed, and destroy habitats.
- Social and economic effects. Because of the decrease of marine resources, the number of people employed in fishing activities is continuously decreasing. Increasingly public subsidies try to support fishing activities, since some of the fishing activities are unprofitable.

Cod farming (aquaculture) appears to be a possible solution to some of these problems. Nevertheless, cod farming conducted in its natural surroundings may have negative impacts on the environment and can lead to:

- Pollution of the sea and the seabed. This pollution can be caused by waste from farming, uneaten feed, parasites, diseases, and injuries that are a consequence of the overpopulation in the breeding cages and the therapeutic chemicals used to treat diseases.
- A risk of breeding between the farmed cod that have escaped and wild cod. This may lead to uncontrolled genetic modifications of the wild cod with unknown consequences.
- Overexploitation of other species of fish. The feed of farmed cod is primarily made from small fishes. Three to five kg of fish are needed to produce one kg of cod. The species used for feed

were considered to be inexhaustible; however, the strong growth of fish farming may put the sustainability of these species at risk

- Damage to other species. Some fish farming is protected from birds and other predators by nets, but these nets can also capture protected species.
- Damage to the seabed. Farming can particularly damage the flora close to production sites.

Treatment 4: Negative information about salmon farming

Salmon is one of the favorite fish species among French consumers. The stocks of wild salmon collapsed in the late 1980s after catches exceeding the renewal rates. Then, fishing was dramatically reduced and present catches are among the lowest ever registered. Salmon farming (aquaculture) appears as a possible solution to this problem. Nevertheless, salmon farming conducted in its natural surroundings may have negative impacts on the environment and can lead to:

- Pollution of the sea and the seabed. This pollution can be caused by waste from farming, uneaten feed, parasites, diseases, and injuries that are a consequence of overpopulation in the breeding cages and the therapeutic chemicals used to treat diseases.
- A risk of breeding between farmed salmon that have escaped and wild salmon. This may lead to uncontrolled genetic modifications of the wild cod with unknown consequences.
- Overexploitation of other species of fish. The feed of farmed salmon is primarily made from small fishes. Three to five kg of fish are needed to produce one kg of salmon. The species used for feed were considered to be inexhaustible; however, the strong growth of fish farming may put the sustainability of these species at risk.
- Damage to other species. Some fish farming is protected from birds and other predators by nets, but these nets can also capture protected species.

- Damage to the seabed. Farming can particularly damage the flora close to production sites.

Paper III

Stated Preference Model Calibration and Market Share Prediction

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Stated Preference Model Calibration and Market Share Prediction

Abstract

This paper presents the first application of the alternative-specific constant (ASC) calibration method for market share predictions in food economics. Without calibration, the choice experiment and the uncalibrated logit model predict market shares poorly. After calibrating the logit model using 2008 market shares, the calibrated model predicts (i) the exact market shares in 2008, and (ii) market shares in 2007, 2006, and 2005, in general, more accurately than the predictions made by the uncalibrated logit model. Robustness checks are made using additional balanced choice experiment designs. The calibrated model is used to predict changes in market shares for three market scenarios involving changes in either price or preference.

Key words: alternative specific constants, calibration, choice experiment, fish, market share prediction.

JEL codes: C81, D12, Q22.

"If the disaggregate multinomial logit model having the IIA property can be shown to fit calibration data sets well and to forecast accurately in a particular application, then it is a useful tool for the planner"

—Daniel L. McFadden (1978, p. 22)

1. Introduction

Choice experiments are widely used to investigate preferences and willingness to pay for food products and quality attributes (Alfnes et al. 2006; Carlsson, Frykblom and Lagerkvist 2007; Loureiro and Umberger 2007; Scarpa et al. 2012). In real markets, consumers face many different products and it is impossible to include all of them in a choice experiment. Markets continuously develop and new products are introduced while some existing products are withdrawn from the market. However, this complexity cannot be represented in a choice experiment. Therefore, a choice experiment can only include some products while the remaining products are excluded. The selection of a subset of products, although necessary, results in an experimental market that is different from the real market. This difference creates a bias that affects the results, when a researcher attemps to simulate and predict market changes and developments using choice experiments.

In general, to facilitate the estimation of preferences for attributes, a choice experiment must have variations in the attributes across choice tasks (Louviere, Hensher and Swait 2000). This makes choice experiments deviate from real markets, where attributes tend to be relatively stable and within narrow ranges (Hensher, Rose and Greene 2005). As a consequence, choices observed in choice experiment tend to deviate from choices observed in the real market.

Existing calibration exercises of choice experiments in agricultural economics have calibrated willingness to pay (WTP) values from survey data by using data from incentive-compatible experiments (e.g., Alfnes and Rickertsen 2007). Incentive-compatible methods, for example auctions, involve real monetary tradeoffs, therefore typically generate more accurate WTP estimates than hypothetical methods (e.g., Miller et al. 2011). WTP estimates from hypothetical methods tend to be over-stated, and hence need to be calibrated before being used in for example policy analysis (Fox, Hayes and Shogren 2002). Alfnes and Rickertsen (2007) calibrated the WTP from a choice experiment, which evaluated consumer preferences for country-of-origin and hormone-treated beef by using a Vickrey auction. However, their article does not discuss any effects on the market shares.

Existing literature on joint use of stated and revealed preference data focuses on the joint estimation of the utility function (e.g., Resano-Ezcaray, Sanjuán-López and Albisu-Aguado 2010). The stated preference data includes attributes that do not yet exist in the market, while the revealed preference data does not suffer from typical experimental biases. By combining the two data sources, improved estimates of consumer preference for different attributes are obtained. Resano-Ezcaray, Sanjuán-López and Albisu-Aguado (2010) jointly estimate stated preference and revealed preference data on dry-cured ham purchases in a nested logit model.[1] The stated preference data was from a choice experiment, in which participants were asked to rank choice alternatives, while the revealed

[1] The nested logit model in Resano-Ezcaray, Sanjuán-López and Albisu-Aguado (2010) later collapsed into a multinomial logit model, because scale parameters were found to be the same for the stated preference and the revealed preference data.

preference data is the scanner data from a major food distribution group in Spain. Moreover, they find that, without involving calibration, stated preference data cannot accurately predict market shares.

Several studies have reached the same conclusion as in Resano-Ezcaray, Sanjuán-López and Albisu-Aguado (2010), and pointed out that choice experiments cannot accurately predict market shares (Chang, Lusk and Norwood 2009; Hudson, Gallardo and Hanson 2012). Therefore, a method that can improve the predictive ability of choice experiments will be a contribution to the literature.

The alternative-specific constant (ASC) calibration method has been widely used for market share prediction in transportation economics (Manski and Lerman 1977; Cosslett 1981a, b; Manski and McFadden 1981; Ben-Akiva and Lerman 1985; Train 1986; Train 2009). ASC is also called alternative-specific dummy variable or alternative-specific dummy. It is the constant term in an utility function, which captures the average impact of unmeasured characteristics (McFadden 1978). In this paper, the ASC calibration method is described, compared with two other methods, tested against "out of sample" market share data, and applied to predict market shares in hypothetical scenarios.

Calibrating the ASCs using market share data is a re-estimation procedure to yield new ASC estimates accounting for the additional market shares data (Train 1986). The ASCs are the constant terms in the utility functions that capture the average values of the residuals, representing the average values of the characteristics that are not explicitly modeled, typically because they are not observed. Hence, to calibrate the ASCs is to adjust the average value of the characteristics that are not included in the model. The ASCs are

calibrated such that the calibrated model predicts exactly the market shares. The calibrated model includes the calibrated ASCs and keep all non-ASC estimates from the original regression. The calibrated model can then be used to predict market shares under different scenarios.

Calibration on the ASCs aligns the difference between two samples, namely the sample that is used to estimate the model (hereafter the estimation sample), and the sample that the model is used to predict (hereafter the prediction sample). The estimation sample may be a subsample of the prediction sample, hence different. The estimation sample may also be the same as the prediction sample in terms of the subjects, but different in other ways, such as time, location, or data elicitation method.

The ASC calibration method differs from other methods of calibrating stated preference results for example using data from incentive-compatible valuation experiment. First, part of the data used in the ASC calibration method is collected in a real market. Second, relative to the joint estimation approach, the ASC calibration focuses on simulating and predicting market shares.

This paper compares the ASC calibration method with two naive methods: prediction by using observed choice shares, and prediction by using the uncalibrated estimated coefficients. The French seafood market is used as an example. A multinomial logit (MNL) model (McFadden 1973) model is estimated using the choice experiment data. Then the ASCs in the MNL model is calibrated using the 2008 market share data. The calibrated MNL model, unsurprisingly, predicts the exact market shares of the French seafood market in 2008. To test the "out of sample" predictive power, the calibrated MNL

models, which are calibrated using the 2008 market share data, are used to predict market shares in 2005, 2006, and 2007. The calibrated MNL models predict market shares in three years, in general, better than the uncalibrated MNL model. To conclude, the calibrated MNL model out-performs observed market shares in the choice experiment and predictions made by the uncalibrated MNL model, both "within sample" and "out of sample". To illustrate the usage of calibration for market share predictions three market scenarios are designed. These scenarios correspond to three real-life cases: (i) ecolabeling of a fish type, (ii) overexploitation of a wild fish stock, and (iii) increased supply of a fish stock.

The organization of the paper is as following. In the next section, the MNL model and the ASC calibration method are presented. A data section is followed, describing the stated-preference data and the revealed-preference data that are used in the empirical study. In the preceding section, three empirical methods for market share prediction are presented, and their results are compared and discussed. Then, validation is performed by using the models to predict market shares of the four species in France in 2005, 2006, and 2007. Next, three designed scenarios are presented and predicted market shares under these scenarios are discussed. A discussion section concerning the ASC calibration method follows. Finally, I conclude.

2. The MNL Model and the ASC Calibration Method

When predicting market shares, calibration on the ASCs is a standard technique in transportation economics. It is include in the transportation economics textbooks (Ben-Akiva and Lerman 1985; Train 1986; Train 2009). The origin of the ASC calibration

method is unknown, but it seems to be a common knowledge within research group of Professor Daniel L. McFadden at University of California, Berkeley in mid 1970s.[2]

Throughout the paper, the MNL model is used, for two reasons. First, it is a simple model, which is desirable for the purpose of demonstrating the ASC calibration method. Second, the MNL model has special properties that facilitates the derivation and the proof of the ASC calibration method, which provides solid foundation for applied researchers.

The ASC calibration method has been previously derived in two important theoretical econometrics papers (Manski and Lerman 1977; Cosslett 1981b). Both papers are concerned with choice-based sampling. For data from a purely choice-based sample, Manski and Lerman (1977) prove that consistent estimates will be obtained if the researcher first estimates the data using the maximum-likelihood estimator for a random sample, and then adjust the ASCs using the calibration method. Cosslett (1981b) extends Manski and Lerman's (1977) result, and proves that (i) the same procedure yields not only consistent but also efficient estimates, and (ii) the same procedure applies to data from a purely choice-based sample, and to data from a combination of one or several random sample(s) and choice-based sample(s).[3]

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[2] Professor Kenneth E. Train, who was a student of Professor Daniel L. McFadden, wrote in an email that he learned this technique through word of mouth when he was a graduate student at University of California, Berkeley in mid 1970s (K.E. Train, pers. comm. May 21, 2015).

[3] For more details, see Cosslett (1981a) and Manski and McFadden (1981).

The ASC calibration method is applicable for choice experiment data too, which in general do not use the choice-based sampling method. Train (2009, p. 33) notes that "alternative-specific constants are often included in a model to capture the average effect of unobserved factors. In forecasting, it is often useful to adjust these constants, to reflect the fact that unobserved factors are different for the forecast area or year compared to the estimation sample. Market-share data from the forecast area can be used to recalibrate the constants appropriately. The recalibrated model can then be used to predict changes in market shares due to changes in explanatory factors."

2.1. The MNL Model

The notation of the MNL model in this section is for a generic choice experiment. The choice experiment has N participants, J alternatives, and T choice situations. Each choice situation includes M choice alternatives ($M \leq J$).[4] The last alternative is an opt-out option, which is included in every choice situation. For all other alternatives, participant n, who chooses alternative j in choice situation t, obtains utility of U_{njt}:

$$U_{njt} = \alpha_j + \boldsymbol{B}\boldsymbol{X}_{njt} + \varepsilon_{njt} \; \forall \, j \neq J \text{ , and} \tag{1}$$

$$U_{njt} = 0 \, . \tag{2}$$

Equation (1) represents the utility of choosing an alternative that is not the opt-out option. In the equation, α_j is the ASC of alternative j, $\boldsymbol{X}_{njt}$ is a vector of the attributes of alternative j (for example, price, color, size), and $\boldsymbol{B}$ is the vector of coefficients corresponding to the

[4] M equals J when all choice alternatives are included in one choice situation.

attribute vector $\boldsymbol{X}_{njt}$, and ε_{njt} is the idiosyncratic error that follows i.i.d. extreme value distribution. The utility of choosing the opt-out option is normalized to zero, shown in equation (2).

The MNL model has the following choice probability:

$$P_{njt} = \frac{\exp(U_{njt})}{\sum_{i=1}^{M} \exp(U_{nit})}. \tag{3}$$

Let $\hat{\alpha}_j$ and $\widehat{\boldsymbol{B}}$ be the estimated coefficients.[5] The estimated MNL model is:

$$\widehat{U}_{njt} = \hat{\alpha}_j + \widehat{\boldsymbol{B}}\boldsymbol{X}_{njt}\,, \tag{4}$$

where $\widehat{U}_{njt}$ is the predicted utility of participant n choosing alternative j at choice situation t. Using the predicted utility $\widehat{U}_{njt}$, choice probability of choosing an alternative in each choice situation can be computed by:

$$\hat{P}_{njt} = \frac{\exp(\widehat{U}_{njt})}{\sum_{i=1}^{M} \exp(\widehat{U}_{nit})}, \tag{5}$$

where $\hat{P}_{njt}$ is the predicted probability of participant n choosing alternative j at choice situation t. Iterating through all choice situations and aggregating the predicted choice probabilities of every participant over each alternative yields predicted choice probability share:

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[5] The log-likelihood function of the multinomial logit model is $\mathrm{LL}(\mathbf{A}, \boldsymbol{B}) = \sum_{n=1}^{N}\sum_{t=1}^{T}\sum_{j=1}^{M} \delta_{njt} \ln\left(P_{njt}\right)$, where $\mathbf{A}$ is the vector that includes all ASCs, and δ_{njt} takes value of one when alternative j is chosen by participant n at choice situation t, and takes value of zero otherwise. Estimation of the MNL model (1) is typically done by maximizing the likelihood function (Ben-Akiva and Lerman 1985).

$$\hat{S}_j = \left(\sum_{n=1}^{N} \sum_{t=1}^{T} \hat{P}_{njt} \right) / N \,, \tag{6}$$

where $\hat{S}_j$ is the predicted probability share of alternative j. The sum of the predicted probability shares over all alternatives is one:

$$\sum_{j=1}^{J} \hat{S}_j = 1 \,. \tag{7}$$

The predicted probability share $\hat{S}_j$ is typically interpreted as the predicted market share (Train 1986; Train 2009).

2.2. The ASC Calibration Method for Predicting Market Shares

A MNL model, estimated using a choice experiment data set, predicts the exact market shares of the alternatives in that choice experiment, when all ASCs are specified (Train 1986; Train 2009). McFadden et al. (1977, p. 425) have sharply pointed out that:

> "A model, forecasting on the same data and sample on which it was estimated, predicts exactly by definition, as long as alternative-specific constants are allowed. Errors arise as it is transferred to new samples, with sample size, with changes in the environment, due to unobserved factors, not modeled over time and with different or erroneous data collection."

For a formal proof, see Train (2009, pp. 61-62).

To predict market shares outside the choice experiment, adjustment to the estimated model must be made. The ASC calibration method adjusts the $\hat{\alpha}_j$'s in the estimated model (4). The ASC calibration method is an iterative method (Train 1986; Train 2009). In the first iteration, the researcher, using the estimated MNL model (4) from the choice experiment data, predicts the market share of each choice alternative using formulas (5) and (6). Denote

the predicted market share for alternative j from the first iteration as $\hat{S}_j^1$. Denote the actual market share for alternative j in the population as S_j^*.

If the predicted market share $\hat{S}_j^1$ is higher than the actual market share S_j^*, the ASC for alternative j needs be reduced, and vice versa. This is because, following the logit probability formulation (4), a reduction in the ASC reduces the predicted utility from consuming alternative j, consequently the predicted probability of choosing alternative j, and consequently the predicted market share of alternative j.

After the first iteration, the iteration procedure is repeated in the follow way. Let r be the iteration number. In each iteration, the calibrated ASCs from the previous iteration, $\hat{S}_j^r$, and the estimated $\widehat{\boldsymbol{B}}$ coefficients from the estimated MNL model (4) from the choice experiment data:

$$\widehat{U}_{njt}^r = \hat{\alpha}_j^r + \widehat{\boldsymbol{B}}\boldsymbol{X}_{njt}, \tag{8}$$

where $\widehat{U}_{njt}^r$ is the predicted utility in the r^{th} round. In each iteration, new probabilities of participant n choosing alternative j in choice situation t, $\hat{P}_{njt}^r$, is predicted:

$$\hat{P}_{njt}^r = \frac{\exp(\widehat{U}_{njt}^r)}{\sum_{i=1}^{M} \exp(\widehat{U}_{nit}^r)}. \tag{9}$$

Following the new predicted probabilities, in each iteration, market shares of the each choice alternative are predicted:

$$\hat{S}_j^r = \left(\sum_{n=1}^{N} \sum_{t=1}^{T} \hat{P}_{njt}^r \right) / N. \tag{10}$$

For each iteration, the ASCs are calibrated using the following formula (Train 1986; Train 2009):

$$\alpha_j^{r+1} = \alpha_j^r + \ln(\tau), \text{where } \tau = \frac{S_j^*}{S_j^r}. \quad (11)$$

The algorithm (11), according to Train (2009, p. 33), is efficient.

The ASC calibration method adjust the ASC of alternative j in the $(r+1)^{\text{th}}$ iteration, α_j^{r+1}, by $\ln(\tau)$. The method utilizes the property of the logarithm operation that:

$$\ln(\tau) \begin{cases} > 0 \text{ if } \tau > 1 \\ = 0 \text{ if } \tau = 1. \\ < 0 \text{ if } \tau < 1 \end{cases} \quad (12)$$

The element inside the parentheses, τ, which is $\left(S_j^*/S_j^r\right)$, is the ratio between real market share S_j^* and the predicted market share S_j^r in the r^{th} iteration, both of the alternative j. When the predicted market share is smaller than the real market share, the ratio $\tau = \left(S_j^*/S_j^r\right)$ is greater than one. Hence $\ln(\tau)$ is positive, and the calibrated ASC in the next iteration, α_j^{r+1}, increases. Consequently, the predicted market share in the next iteration, S_j^{r+1}, increases. And vice versa.

The iteration procedure stops when the calibrated ASCs, $\alpha_j^{r^*}$'s, along with the other estimated coefficients, $\widehat{\boldsymbol{B}}$, predict the same market shares as in the market in the $r^{*\text{th}}$ iteration:

$$S_j^{r^*} = S_j^* \; \forall \; i \in J. \quad (13)$$

The calibrated ASCs and the other estimated coefficients can then be used for predicting market shares under different scenarios (Train 2009).

3. Data

The empirical application and examination of the ASC calibration method utilizes two sources of data. The stated-preference data is from a choice experiment of fish France in December 2008, using a sample of residents in the city of Dijon. The actual market shares in 2005, 2006, 2007, and 2008 are approximated by using a revealed-preference dataset, which records daily purchases of a representative sample of around 6,000 French households in the four years. A brief analysis on the representativeness of the choice experiment sample is given in the third subsection.

3.1. Experimental Design, Implementation, and Data

The experiment was carried out in the sensory laboratory of L'Institut National de la Recherche Agronomique (INRA) in Dijon in December 2008. Potential participants were randomly drawn from INRA's database of people who are willing to participate in food studies. Potential recruits were asked to complete a short survey about their consumption and purchasing frequencies of fish products. Only those who ate fish more than once a month or bought fresh fish more than every second month were recruited. We recruited the participants who bought or consumed fish at least once every second month, because we wanted to study the seafood market. Those people who did not buy or consumer fish at least once every second month were defined to be outside the seafood market. Each participants was paid €25 for participating the experiment.

The eight fish products used in the experiment are listed in Table 1.[6] Salmon and cod are among the most frequently purchased fish species in France. Monkfish was included as an expensive substitute and pangasius was included as an inexpensive substitute. Wild cod was either unlabeled or labeled with the Marine Stewardship Council's MSC label. The MSC label certifies wild fish from sustainably managed fisheries (MSC 2013). Farmed cod and farmed salmon were either unlabeled or labeled as organic. Monkfish and pangasius were not labeled. We labeled organic fish products with the organic AB label, which is a nationally recognized organic certification scheme in France (Willer, Yussefi and Sorensen 2010).

(Insert Table 1 here)

The stated choice experiment consisted of 16 choice sets. To present the fish products as realistically as possible and to reduce the hypothetical nature of the experiment, the alternatives were presented in 300-gram packages of real fish. Each choice set included three packages that were displayed in a Styrofoam box filled with ice (Figure 1). The fish varied with respect to the species, whether it was wild or farmed, its price, the use of the

[6] In table 1, the area of origin is shown. We did not incorporate the area of origin attribute into the econometric analysis. Analyzing the effects of area of origin may shed insights to consumer preference on seafood origin, which is important. However, identification of such effects is limited, in this case, due to the experimental design. Because only one fish product, pangasius, is from Vietnam, it is not possible to separately identify the preference for pangasius and the preference for the area of origin of Vietnam.

ecolabel, and its area of origin. A "none-of-these alternatives" option was included in all choice settings so that a participant could opt out. [7]

(Insert Figure 1 here)

The choice experiment was based on a choice design constructed by the SAS macro MktEx with zero priors. The D-efficiency of the total design was 96.52. The design used 112 choice sets organized into seven blocks. The order of choice sets was randomized within each block. Each block of choice sets was used in two sessions and each participant was randomly assigned to one of the sessions.

Following the experiment, each participant was asked to complete a questionnaire that included questions about attitudes toward fish in general and those species included in the experiment, demographics, and attitudes toward labels. The final data set consisted of 2,300 choices made by 144 participants.[8]

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[7] Stated choice was used instead of real choice because ecolabeled farmed fish products were not available in France at the time of the experiment. To present the fish products as realistically as possible, we used real packages of conventional fish with ecolabels instead of descriptions or pictures, as is typically done in stated choice experiments.

[8] Among the 2,300 choices made by 144 participants, "none-of-these alternatives" option was chosen 852 times. This alternative was chosen more times than any of the fish products in the experiment. A high rate of the "none-of-these alternatives" choice, suggests three possibilities. First, which is quite likely, is that even if they found the products quite different they would not have purchased any of them (maybe because they did not like any of the offered types, because of the price or for any other reason). Second, participants may have

3.2. Revealed Preference Data

The actually market shares are approximated by using the revealed preference data from the TNS Worldpanel.[9] The TNS Worldpanel has been used to study food purchases (e.g., Allais, Bertail and Nichèle 2010 on food purchases, which was published in this journal). A representative sample of around 6,000 households participate in the panel. [10] Each household register their daily purchases through a scanner. It is, however, not documented for how long the average household participates in the panel. This study uses the fish sub sample of the panel from 2005, 2006, 2007, and 2008. In the dataset, households recorded the types of fish purchased, the quantity purchased, and the prices; however, no additional information about the fish was recorded and this may account for the large price variation reported in Table 2. The revealed preference data from the TNS Worldpanel will be referred to as the scanner data in the rest of the paper.

(Insert Table 2 here)

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found the other three alternative fish products quite similar and they found it difficult to make a choice. Third, participants wanted to save time or did not want to put the effort into making a choice.

[9] The TNS Worldpanel data used in this study was assembled by INRA. In 2010, TNS Worldpanel was rebranded as Kantar Worldpanel.

[10] Take the age of the 2008 panel sample for example. The panel included 15,264 individuals from 6,174 households. In a household, the number of family members range from one to nine. On average, households in the panel had 2.47 members in 2008. The age of the family members of the households ranged from 0 month to 102 years old. The average age was 40.74 years old, which is close to the 2014 national median age of 40.9 years (CIA 2015).

3.3. Representativeness of the Choice Experiment Sample

The sample of the individuals in the choice experiment is approximately representative in gender and age of the French seafood market, but may not be representative in income. It is in theory possible to have a weighting procedure to adjust the non-representativeness in income. However, there are no income distribution statistics that use the income grouping that was used in the choice experiment: (a) less than €2,000, (b) between €2,000 and €3,000, and (c) more than €3,000, in terms of monthly income. It is possible to estimate the income distribution, but a weighting procedure using such estimates will produce misleading results, because (i) the estimated national income distribution of France in 2008 is fragile and sensitive to assumptions and computation method, and (ii) due to the strong assumptions that must be made, large errors have been inevitably introduced into the estimates. Hence, although large amount of efforts have been made to find and estimate national income distribution of France in 2008, I have decided not to conduct a weighting procedure. For more details, see Appendix A1.

4. Empirical Methods, Specifications, and Results

This section presents the empirical methods, specifications, and results, which concern (i) the approximation of the market shares of the four fish species in France in 2005, 2006, 2007, and 2008, using the scanner data, (ii) the computation of the predicted market shares in France in 2008 using the observed market shares in the choice experiment, (iii) the specifications of the MNL models and computation of the predicted market shares in France in 2008 using the estimated MNL model without calibration, and (iv) the ASC calibration on the estimated MNL model and computation of the predicted market shares in France in 2008 using the calibrated MNL model.

4.1. Approximation of the Actual Market Shares in France Using the Scanner Data

The scanner data is the revealed preference data of around 6,000 representative households of France. Salmon, cod, monkfish, and pangasius were included in the choice experiment. Hence only these four species are selected when calculating aggregate market shares. The shares of the four fish species in 2005, 2006, 2007, and 2008, purchased by the 6,000 households in the scanner data, are used to approximate the actual shares of the four fish species in France in each of the four years. The aggregated shares of the four fish species are calculated according to the volumes sold.

The ranges of prices (€ per kilogram) for the four species in 2008 in the scanner data are described in Table 2. The price ranges in the scanner data were much wider than the price ranges of fish products in the choice experiment (Table 2), which implies that the fish products in the scanner data are much more heterogeneous than in the choice experiment. The frequencies of the 2008 prices in the scanner data are depicted in the kernel density estimations (KDEs) in Figure 2. The longer right tails in the KDEs (Figure 2) suggest that the fish prices in the French market in 2008 are more heterogeneous in the high-end (luxurious) segments than in the low-end segments. After removing the 1% of the cheapest prices and 1% of the most expensive prices, the price ranges observed in the scanner data become closer to the price ranges used in the choice experiment in Dijon, France in 2008 (Table 2).

(Insert Figure 2 here)

Salmon and cod are the two most important fish species in the French market. The scanner data shows that the four species made up 38.53% of the market in France in 2008.

Within the almost 40% of the market, salmon, cod, pangasius, and monkfish had 61%, 22%, 8%, and 9% of the market shares in 2008, respectively. The market shares in 2008 are listed in Table 3. Market shares from 2005, 2006, and 2007, which are listed in Table 4, are used for validation.

(Insert Table 3 and Table 4 here)

4.2. Observed Choice Shares in the Choice Experiment

For the empirical analyses and market share predictions, the eight fish products in Table 1 are aggregated by species. The scanner data does not record whether a fish is certified with label, for example the MSC label or the organic AB label. Hence this aggregation is an essential step to make the choice experiment data comparable with the scanner data.

In the transportation literature, market shares are typically computed from purchase frequencies. However, for food, purchases quantities matter too. The sales volumes are aggregated to calculate market shares. The price ranges of the four species in the choice experiment, after aggregation, are reported in Table 2. The observed choice shares are reported in Table 3, under the column of "Choice Experiment".

In Table 3, the average root sum of squared error (ARSSE) is also reported. The root of the sum of squared errors of the real market shares and predicted market shares indicate the size of the error. Average root sum is chosen, because for 2007 and 2008 predictions of four species are made, while for 2005 and 2006 predictions of only three species are made. Hence, by taking average, ARSSE is the suitable statistic to compare prediction performance across models and across years.

4.3. Multinomial Logit Regression, Results, and Prediction without Calibration

The choice experiment data is analyzed in the MNL model. Using common notation, participant n who chooses alternative j in choice situation t obtains utility of U_{njt}. The obtained utility U_{njt} is the difference between the utility gain from consuming the fish α_j and the utility loss[11] from paying the price p_{njt}, such that:

$$U_{njt} = \alpha_j + \beta \times p_{njt} + \varepsilon_{njt}, \quad (14)$$

where α_j is also known as alternative-specific dummy, alternative-specific dummy variable, or alternative-specific constant, and ε_{njt} is an idiosyncratic error term. According to Cosslett (1981a, p. 56), ASCs "are always necessary in practice, to allow for the effects of unobserved attributes". As noted earlier, participants had the option to choose "none of these alternatives'". When this alternative is chosen, it is specified in the model that the participant receives a utility of zero. The MNL model is estimated using the Newtow-Raphson method (Ben-Akiva and Lerman 1985; Train 2009).

The results are reported in Table 5, under the column of "Regression Results". The ASCs indicate a preference ranking of participants in the order of monkfish, salmon, cod, and pangasius. Notice that the preference differences among monkfish, salmon, and cod are small. While the ASCs for the first three fish species are significant at 0.01 level, the ASC for pangasius is insignificant. The scanner data shows that there was no recorded purchase of pangasius in 2005 and 2006 in France, suggesting that pangasius was a relatively new fish for French consumers in 2008, when the choice experiment was conducted.

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[11] The price coefficient β is assumed to be negative.

(Insert Table 5 here)

With the estimated preferences for the four fish types and the sensitivity to price (i.e. estimated ASCs and the price coefficient), the market shares of the four fish types are predicted by enumerating through all choice situations (Ben-Akiva and Lerman 1985; Alfnes 2004; Train 2009), following equations (5) and (6). The underlying assumption in equation (3) is that the four fish types are perfect substitutes of each other.[12] The predicted market shares are the same as the observed market shares. These predicted market shares are listed under the sub-column "Original" of the column "Uncalibrated" in Table 6.

(Insert Table 6 here)

4.4. Prediction with Calibration on the ASCs

Following the procedure described in equation (11), the ASCs are calibrated. The calibration results are shown in Table 5, under the sub-column of "Original" under the column of calibrated ASC. The four calibrated ASCs, together with the price coefficient, predict the exact real market shares in France in 2008, shown under the sub-column of "Original" under the "Calibrated" column in Table 6. It is not surprising that the calibrated

[12] In reality, the four species are not perfect substitutes. However, such simplification is common in the literature on predicting market share using choice probabilities (Alfnes and Rickertsen 2007; Train 2009). This assumption can be relaxed by using a nested multinomial logit structure or a mixed multinomial logit model with correlations.

model predicts the 2008 market shares of the four fish in France accurately, since the calibration is performed by fitting the logit model into the 2008 market share data.

5. Robustness Check with New and Balanced Choice Experiment Design

The 2008 Dijon experiment contained a balanced design of eight fish products: four cod products, two salmon products, one monkfish product, and one pangasius product. In the analysis, the four cod products are treated as one species (cod), and the two salmon products are treated as one species (salmon). Due to this cod and salmon are overly represented in the choice situations. Because the choice experiment does not have a balanced design in terms of the four fish species, it is important to check for robustness with respect to the choice experiment design.

The over representation of salmon and cod is likely to have contributed to the poor predictions using the observed market shares in the choice experiment, and the predictions using the MNL model without calibration. However, it is uncertain how much the over representation contributed to the poor predictions. It is possible that the over representation of salmon and cod is the sole cause of the poor predictions of these two naive methods. To confirm or rule out this possibility, a new and balanced choice experiment in terms of the four fish species is created.

The new choice experiment adopts an orthogonal design. It includes 64 choice situations. Each choice situation contains the four fish species. This represents the market situation in France in 2008 when all four fish species were available. Each fish species has eight price levels, corresponding to the 1st, 15th, 29th, 43rd, 57th, 71st, 85th, and 99th percentile

of the recorded prices of that species in the scanner data in 2008, to approximate the price structure in the French market in 2008.

According to the ARSSE statistic, the new balanced choice experiment does not improve the predicted market shares. Market shares are predicted using the estimates from the MNL regression, in the same procedure as in Section 4.3. The predictions are listed in Table 6, under the sub-column of "New 1" of the column of "Uncalibrated". To conclude, it was not the over representation of salmon and cod that impeded the predictions by the uncalibrated MNL model.

As in Section 4.4, the ASCs are recalibrated using the new balanced choice experiment design. The calibrated ASCs are presented in Table 5, under the sub-column of "New 1", which are different from the calibrated ASCs using the original choice experiment design. This is because the calibration method depends on the choice situations that it enumerates through.

6. Validation

In this section, three validations are conducted using market share data from 2005, 2006, and 2007, respectively. In each validation, the uncalibrated and three calibrated MNL models are used. Two the three calibrated MNL models have already been discussed. The third calibrated MNL model is based on a new balanced choice experiment design of three species: salmon, cod, and pangasius. In the uncalibrated MNL model, the coefficients, estimated from the MNL regression, are used. In the three calibrated MNL models, the price coefficient is from the MNL regression, while the ASCs are the calibrated ASCs using the 2008 market share data, enumerated through the original choice experiment design, the new

balanced choice experiment design of four species, and the new choice experiment design of three species, respectively.

Since the calibrated MNL model is calibrated using the 2008 market share data, and the calibrated MNL model is going to be validated against observed market shares in 2005, 2006, and 2007, these validations are essentially testing the "out of sample" predictive power of the calibrated MNL models. The uncalibrated and the calibrated models are used to estimate the choice probability of each participant in each choice situation, and these choice probabilities are aggregated according to equation (6), to yield the predicted market shares.

When iterating through all choice situations of the choice experiment, the prices are adjusted according to average price changes relative to the average prices in 2008. For example, salmon in 2007 is 0.58% cheaper in 2007 than in 2008 (Table 4). When predicting market shares in 2007, all salmon prices in the choice experiment are decreased by 0.58%. Table 4 summarizes the market shares and price changes in 2005, 2006, 2007, and 2008.

The market shares of the four species in 2007 as predicted by using the uncalibrated and the calibrated ASCs, enumerated through the original choice experiment design (under sub-columns of "Original") and the new balanced choice experiment design (under sub-columns of "New 1"), are presented in Table 6. Judging from the ARSSE statistics, the calibrated model produces smaller errors and hence better predictions of the observed market shares. Compared with using the original choice experiment design, the new balanced choice experiment design increases (from 0.0470 to 0.0915) the ARSSE when using the uncalibrated ASCs. However, the predictions are slightly improved (from 0.0136

to 0.0116) when the new balanced choice experiment design is used with the calibrated ASCs.

In the scanner data, there was no recorded purchase of pangasius in 2005 or 2006 suggesting that only small quantities of pangasius was available in the market. Hence, pangasius is not included when simulating and predicting market shares in 2005 and 2006. An additional balanced choice experiment design with three species (salmon, cod, and monkfish) is created to reflect the market in France in 2005 and 2006. As previously, ASCs for these three fish types are calibrated using the 2008 market share data as shown in Table 5, under the column of "New 2". The predicted market shares of the four species in 2006 using the uncalibrated and the calibrated ASCs, enumerated through the original choice experiment design and the two new choice experiment designs, are presented in Table 6. In terms of ARSSE, the predictions using the calibrated ASCs are better than the predictions using the uncalibrated ASCs using all three choice experiment designs.

The predicted market shares of the four species in 2005 using the uncalibrated and the calibrated ASCs, enumerated through the original choice experiment design and the two new choice experiment designs, are presented in Table 6. In general, the predicted market shares using the calibrated ASCs have smaller ARSSE than the predicted market shares using the uncalibrated ASCs. However, the predicted market shares using the uncalibrated ASCs and enumerated through the original choice experiment design, have the smallest ARSSE. The predicted market shares using the calibrated ASCs and enumerated through the original choice experiment design have the second smallest ARSSE, and the difference is small (0.0428 and 0.0435).

To conclude, with only one exception, the calibrated ASCs produce market share predictions with smaller errors than the uncalibrated ASCs for 2005, 2006, and 2007, separately. The reductions by ARSSE are substantial, in general, when using the calibrated MNL models to predict market shares. For the only exception, the performance of the calibrated MNL models are almost identical to the performance of the uncalibrated MNL model using the original choice experiment design. Since the calibrated ASCs are computed using the market share data of 2008, this conclusion validates the predictive power of the ASC calibration method when predicting "out of sample". Finally, I note that this conclusion holds when (i) the prices in choice situations are adjusted, instead of nominal prices, using real prices adjusted by French consumer price index (CPI) from OECD (2015a), or (ii) instead of using the prices levels that correspond to the price frequency observed in the scanner data, the same price levels of the 2008 Dijon choice experiment design are used in the two new balanced choice experiment designs.[13]

7. Market Simulation and Prediction

In this section, the calibrated ASCs are used to predict the structure of French seafood market under different scenarios, enumerated through the new balanced choice experiment design of four fish species. The predictions using calibrated ASCs and enumerated through the new balanced choice experiment design of four fish species have the smallest errors for 2006 and for 2007, the third smallest error for 2005. Hence this choice experiment design is

[13] The resulted ARSSE are different. However, the conclusion is the same, that in general, the calibrated MNL models predict market shares that have smaller ARSSE.

chosen. Each scenario includes a change in price or consumer preference. The three scenarios are based on real events that have happened in seafood markets.

7.1. Scenarios

Consumers are in general concerned with the unsustainability of seafood production (Jaffry et al. 2004; Verbeke et al. 2007; Hansen and Onozaka 2011; Sogn-Grundvåg, Larsen and Young 2013; Uchida et al. 2014; Asche et al. 2015). When a seafood is certified as ecological (eco-label), studies find that consumers are willing to pay about 10% premium (e.g., Roheim, Asche and Santos 2011; Chen, Alfnes and Rickertsen 2015). This is equivalent to a 10% increase in the utility from consuming fish, which implies a 10% increase in the alternative specific constant (ASC) of that fish. In the first scenario, the effects of ecolabeling of salmon on the market shares are investigated. It is assumed that all the salmon is ecolabeled in the market, and that the ecolabeling results in a 10% increase in the ASC, but no change in price.

On the other hand, when a fish stock is endangered, consumers develop a dislike and may even boycott that particular fish species.[14] For example, when learning that the Baltic cod stock was severely depleted under the advice of World Wildlife Fund (WWF), Swedish

[14] When some consumers boycott one wild fish type, the industry is likely to react by reducing catches. The fish's price will likely change. However, in this scenario, the price change of the fish type due to reduced catch is omitted for two reasons. First, it takes time for the industry to react to a consumer boycott and to reduce catches. Furthermore, it takes additional time before a reduction in catches affects the retail price. Second, the emphasis of this scenario is on the effects of consumers' dislike of a fish type and not on the effects of a price change.

consumers began to boycott not only the Baltic cod but cod in general, although biologists advised Swedish consumers that cod stocks in other European waters were healthy (The Fisheries Directorate 2009). The second scenario is based on this type of environmental information effect, and it is assumed that such negative information reduces the ASC for cod by 80%. The large reduction is set to mimic the boycott.

Whilst the first two scenarios deal with the effects of changing consumer preferences, the last scenario studies how the market responds to reduced price of one fish species. The price reduction may be, for example, due to increasing supply. This scenario is similar to the recent recovery of cod stocks in the Northern Atlantic. Due to abundance in stocks, catch quotas have been increased and, consequently the supply has increased while the price has fallen by 22.4% from the first two months of 2012 to the first two months of 2013 (FAO GLOBEFISH 2013). In the third scenario, it is assumed that the price of cod is reduced by 20%.

7.2. Predictions

The prediction results are presented in Table 7. The market share changes are in the expected directions, in all three scenarios. When salmon is ecolabeled, the market share increases by about 6%. In the cod crisis scenario, cod's market share falls from about 22% to less than 4%, demonstrating how consumers' care for healthy fish stock can lead to

commercial failure of a fish type in a market.[15] In the cod increased-supply scenario, when cod price drops by 20%, cod market share increases by a little over 9%.[16]

(Insert Table 7 here)

8. Discussion

The market shares observed in the choice experiment are very different from the shares observed in the real market. The differences in shares originate from the differences between the choice experiment's market setting and the real market. In the choice experiment, attributes (particularly price) vary so that preferences can be elicited. In the real fish market, attributes of commodities, in this case fish, are highly correlated with prices and tend to be more stable over choice settings. Such differences suggest that there are likely different "consumer" choices in the experiment and real market, which lead to differences in market shares.

The poor performance of using choice experiments to predict market shares roots in the discrepancy between the two samples. Data generated from a choice experiment is different from market data in a number of important aspects, ranging from sample, choice setting, time, and macro-environment. First, the participants of a choice experiment are

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[15] In the simulation, it is assumed that supply of fish is unconstrained. In reality, catch of monkfish is constrained by a quota. Therefore, it is unlikely for the industry to supply 50% more monkfish to the market.

[16] The supply increase and price change of cod started a few years after 2008, which is the last year that I have real market data on. Hence, the predicted market share under the cod supply increase scenario cannot be verified.

usually a subsample of a population. The subsample may be different from the population in important ways. Second, the setting of a choice experiment deviates from the real market. Third, there is miss-alignment of time when using choice experiment data, collected at one point of time, to predict market shares of a different point of time. Fourth, the macro-environment fluctuates in the market, for example, supply, demand, and prices. Such fluctuations are difficult to be incorporated into a choice experiment. The above mentioned differences reduce the predictive power of choice experiment data on predicting market shares.

The ASC calibration method uses the real market shares to adjust the discrete choice model. The calibrated model, fitted with the 2008 aggregated market shares, predicts the same 2008 market shares perfectly. Hence, a verification of the model's predictive capability was carried out by inserting market prices from 2005, 2006 and 2007 into the model and testing to what degree the models, calibrated on the 2008 data, were able to predict the market shares in 2005, 2006, and 2007. These "out of sample" predictions were well in line with the market shares observed in these years, which verifies the performance of the calibrated model for market share prediction. The ASC calibration method differs from the current calibration literature in food economics, which focuses on calibrating the estimates of consumer preferences and WTPs (e.g., Alfnes and Rickertsen 2007; Resano-Ezcaray, Sanjuán-López and Albisu-Aguado 2010).

Comparing the ARSSE statistics of the predictions that are made by the calibrated ASCs, the errors become larger when predicting years that are further away from the base year, which is 2008. The calibrated ASCs are adjusted by using the market share data of the base year, which reconcile the difference between the base year and the choice experiment

data, from which the MNL model is estimated. The further away a year is from the base year, the larger the difference between the year and the base year is likely be. Consequently, the error of the predictions increases, as shown in ARSSE.

It is unclear what the consequence of misspecification is to market prediction. When model is miss-specified, the prediction performance will likely be negatively affected. However, there is lack of econometric guide on how much reduction in prediction performance will be. It is likely that the researcher has to discuss and analyze the issue case by case. However, for the cases when the misspecification raises from misclassification of the response variable, which may not be common especially in a choice experiment, Ramalho (2002) has developed an estimator and a test.

Often choice experiments are used in situations where market shares are not available, for example, when a new product is introduced. If the new product is very different from existing products, for example, a new species of fish, then the calibration method can be used as following. The researcher can take the estimated and calibrated ASC of a similar product, use it for the new product, and then use these ASCs to predict market shares. For example, the ASCs for the BART alternatives were assumed to be identical to the corresponding ASCs for existing bus alternatives (McFadden 1978).

If the new product has a new attribute, for example, introduction of organic salmon into the market in which conventional salmon already existed, the calibration method can still be used. Two new choice experiment designs need to be created. The first choice experiment includes all attributes, both the existing ones and the new attribute. This choice experiment needs to be conducted, so that the preferences for existing attributes and the new

attribute can be estimated and identified. A second choice experiment does not contain the new attribute, and is only used for calibrating the ASCs. After the ASCs are calibrated, the first choice experiment is used to predict market shares with the new product that contains the new attribute.

9. Conclusions

This paper applies a simple and intuitive calibration method for market share prediction that is useful in predicting market shares. The calibration method introduced in this paper is simple to implement and potentially useful for a wide audience for example but not limited to applied researchers in academia and consultancy. Predicting market shares is very important for academic research as well as policy and business analysis. Calibration is necessary due to various biases that exist in experiments, for example, due to the use of very homogeneous food products in experiments, which need to be corrected by using additional data sources.

Three different methods of predicting market shares are compared in this paper: observed choice shares, predicting market shares using uncalibrated coefficients, and predicting market shares using calibrated coefficients. The calibration uses choice real market share data from the French seafood market. The results conclude that observed choice shares and predicted market shares directly using coefficients from an MNL regression cannot produce reasonable predictions of market shares. The calibrated model provides accurate predictions of current market shares. The validation suggests that the calibrated model, which is adjusted using 2008 market share data, performs quite well when predicting French seafood market shares in 2005, 2006, and 2007. Furthermore, results from

three market simulation exercises involving changes in price or consumer preference are presented.

Future research is required in three directions. First, this paper has validated the calibrated model when predicting "out of sample" that the model, after being calibrated with 2008 market share data, predicts market shares in 2005, 2006, and 2007 quite well. However, future research is required to investigate whether this finding is general or dataset specific. Second, application of calibration on more advanced discrete choice models, for example nested logit models (e.g., Koppelman and Garrow 2005) and random parameter logit models (e.g., Brownstone and Train 1999), may potentially be useful. These models can include more flexible substitution patterns than the MNL model, which will be advantageous for simulating and predicting market changes. However, the magnitude of complexity increases dramatically, and it may not be possible to propose a clean and general calibration method as shown in this paper. Finally, the calibration, numerically, is sensitive to the choice experimental design, as shown in Table 5 and Table 6. Future research is required to investigate optimal choice experiment design for market prediction.

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Tables

Table 1: Fish Products Used in the Choice Experiment

Species	Wild or Farmed	Ecolabel	Area of Origin[a]	Price Range (€/kg)[b]
Salmon	Farmed	No	Norway	€6.50 - 18.17
Salmon	Farmed	Organic AB	Norway	€11.50 - 26.50
Cod	Farmed	No	Norway	€9.83 - 23.17
Cod	Farmed	Organic AB	Norway	€16.50 - 36.50
Cod	Wild	No	North Atlantic	€9.83 - 23.17
Cod	Wild	MSC	North Atlantic	€16.50 - 36.50
Monkfish	Wild	No	North Atlantic	€18.17 - 38.17
Pangasius	Farmed	No	Vietnam	€4.83 - 16.50

Notes:

[a] The origins of the different species are the origins that are most common in the French market. For the organic cod and salmon, we use the same origin as for the non-organic cod and salmon.

[b] An eight-point price scale was used for each product.

Table 2: Price Ranges in the Choice Experiment and in the 2008 Scanner Data

Species	Price Range (€/kg)		
	Choice Experiment[a]	Scanner Data[b]	Scanner Data[c]
Salmon	€6.50 – 26.50	€1.21 – 112.00	€4.50 – 47.14
Cod	€9.83 – 36.50	€1.05 – 40.37	€5.00 – 31.16
Monkfish	€9.83 – 38.17	€3.08 – 64.13	€5.00 – 40.13
Pangasius	€4.83 – 16.50	€2.44 – 44.66	€3.94 – 14.80

Note:

[a] For the choice experiment, nonlabeled, labeled, farmed, and wild fish of the same species are aggregated together in this table.

[b] This column lists the price ranges of the four species in 2008 from consumption data of a representative sample of around 6,000 households in France in 2008 (source: TNS Worldpanel).

[c] This column lists the price ranges of the four species in 2008 from consumption data of a representative sample of around 6,000 households in France in 2008, after removing the 1% lowest prices and the 1% highest prices (source: TNS Worldpanel).

Table 3: Observed Market Shares for the Four Species in France in 2008 and in the Choice Experiment in Dijon, France in 2008

Species	Real Market[a]	Choice Experiment[b]
Salmon	60.77%	44.20%
Cod	21.96%	39.02%
Monkfish	7.87%	11.12%
Pangasius	9.40%	5.66%
ARSSE[c]		0.0607

Notes:

[a] The real market shares are computed from consumption data of a representative sample of around 6,000 households in France in 2008 (source: TNS Worldpanel).

[b] The market shares under the "Choice Experiment" column are the observed market shares in the choice experiment, which was conducted in Dijon, France in 2008.

[c] ARSSE stands for average root sum of squared errors. It is the average root sum of squared errors of the predicted market shares.

Table 4: Market Shares and Changes in Mean Prices of the Four Fish between 2005 and 2008[a]

Species	2005	2006	2007	2008
Salmon	55.55%	55.23%	60.28%	60.77%
	(-10.80%)	(4.55%)	(-0.58%)	(0.00%)
Cod	31.22%	34.78%	24.38%	21.96%
	(-6.72%)	(-3.41%)	(4.24%)	(0.00%)
Monkfish	13.22%	9.98%	8.90%	7.87%
	(-11.23%)	(-1.92%)	(-1.54%)	(0.00%)
Pangasius[b]	0.00%	0.00%	6.44%	9.40%
	(NA)	(NA)	(8.23%)	(0.00%)

Notes:

[a] The numbers in parentheses are the changes in mean price of a fish species, compared to the mean price of the same fish species in 2008.

[b] There were no recorded purchase of pangasius in 2005 or 2006 in TNS Worldpanel.

Table 5: Multinomial Logit Regression and Calibration Results

Attribute	Regression Results[a]	Calibrated ASC[b]		
		Original[c]	New 1[d]	New 2[e]
Price	-0.16***			
	(0.01)			
Salmon ASC	3.02***	3.49	3.77	3.84
	(0.14)			
Cod ASC	2.89***	2.05	2.54	2.49
	(0.16)			
Monkfish ASC	3.42***	2.88	1.58	1.41
	(0.19)			
Pangasius ASC	0.23	0.66	0.41	
	(0.14)			
No. of obs.	2,300			
Log-likelihood	-2580.33			
McFadden R^2	0.17			

Notes:

[a] Numbers in parentheses are standard errors. I use *, **, and *** to represent significance at the 0.10, 0.05, and 0.01 level, respectively.

[b] This column presents the calibrated ASCs, after using the ASC calibration method. ASC stands for alternative specific constants.

[c] "Original" refers to the choice experiment design that was used in Dijon, France in 2008.

[d] "New 1" refers to the new balanced choice experiment design of the four species.

[e] "New 2" refers to the new balanced choice experiment design of three species: salmon, cod, and monkfish.

Table 6: Observed and Predicted Market Shares for the Four Species in France in 2008, 2007, 2006, and 2005

Species	Real Market[a]	Uncalibrated[b]			Calibrated[c]		
		Original[d]	New 1[e]	New 2[f]	Original	New 1	New 2
2008							
Salmon	60.77%	44.20%	33.90%		60.77%	60.77%	
Cod	21.96%	39.02%	25.65%		21.96%	21.96%	
Monkfish	7.87%	11.12%	33.57%		7.87%	7.87%	
Pangasius	9.40%	5.66%	6.88%		9.40%	9.40%	
ARSSE[g]		0.0607	0.0936		0.0000	0.0000	
2007							
Salmon	60.28%	46.21%	34.58%		62.64%	61.95%	
Cod	24.38%	36.39%	24.04%		20.11%	20.84%	
Monkfish	8.90%	12.05%	34.97%		8.47%	8.32%	
Pangasius	6.44%	5.35%	6.41%		8.78%	8.89%	
ARSSE		0.0470	0.0915		0.0136	0.0116	
2006[h]							
Salmon	55.23%	43.02%	33.74%	33.72%	63.66%	64.48%	64.65%
Cod	34.78%	44.67%	29.15%	29.48%	27.00%	26.32%	26.24%
Monkfish	9.98%	12.31%	37.11%	36.80%	9.35%	9.20%	9.12%
ARSSE		0.0529	0.1169	0.1169	0.0383	0.0419	0.0425
2005[h]							
Salmon	55.55%	46.55%	36.32%	36.25%	65.98%	68.09%	68.54%
Cod	31.22%	40.37%	25.95%	26.32%	24.13%	22.99%	22.77%
Monkfish	13.22%	13.08%	37.73%	37.44%	9.89%	8.92%	8.70%
ARSSE		0.0428	0.1054	0.1053	0.0435	0.0520	0.0538

Notes:

[a] The real market shares are computed from consumption data of a representative sample of around 6,000 households in France in 2008, 2007, 2006, and 2005 (source: TNS Worldpanel).

[b] The market shares under the "Uncalibrated" column are predicted using the coefficients from the MNL regression, which is estimated using the choice experiment conducted in Dijon, France in 2008.

[c] The market shares under the "Calibrated" column are predicted using the price coefficient from the MNL regression and the calibrated ASCs. The calibrated ASCs are adjusted using the market share data of 2008 and a choice experiment design. Three choice experiment designs are used here: the 2008 Dijon choice experiment design, the new balanced choice experiment design of four species, and the new choice experiment design of three species.

[d] "Original" refers to the choice experiment design that was used in Dijon, France in 2008.

[e] "New 1" refers to the new balanced choice experiment design of the four species.

[f] "New 2" refers to the new balanced choice experiment design of three species: salmon, cod, and monkfish. This design is only used for 2006 and 2005, when pangasius was likely not available in the French market.

[g] ARSSE stands for average root sum of squared errors. It is the average root sum of squared errors of the predicted market shares.

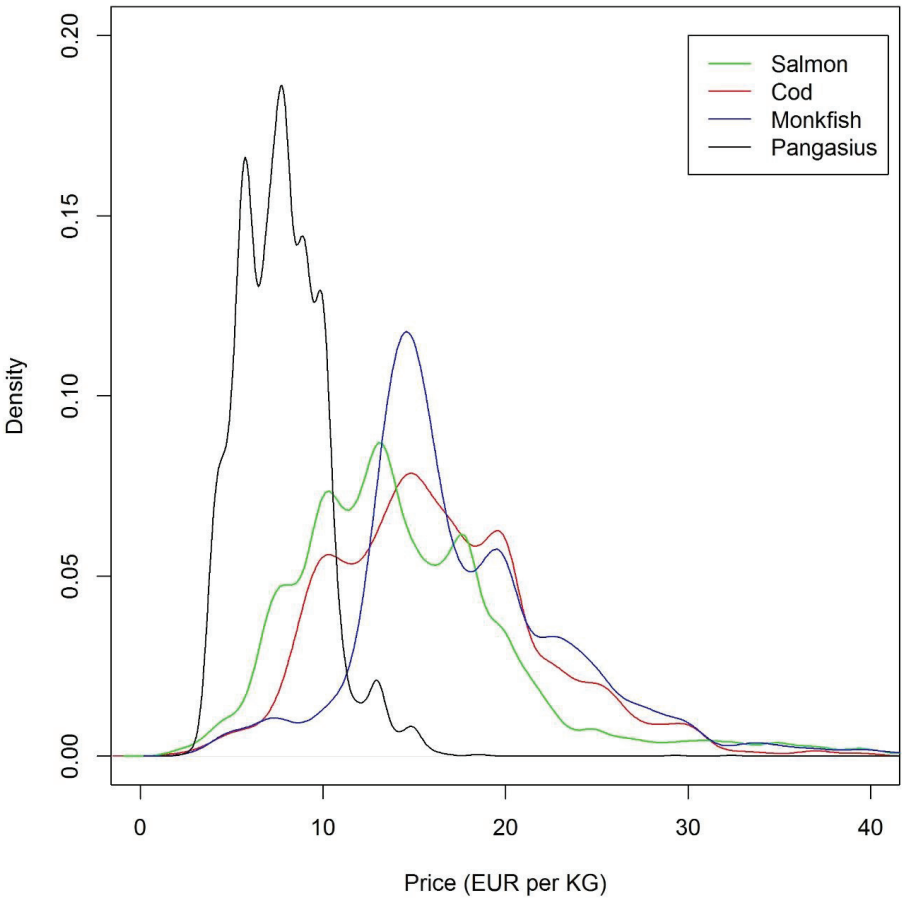
[h] No purchases of pangasius were recorded in the scanner data in 2006 or 2005. Hence, pangasius is not included when predicting market shares in 2006 and 2005.

Table 7: Real and Predicted Market Shares

Fish	Real Market Share	Predicted Market Shares		
		Ecolabeled Salmon	Cod Crisis	Cod Supply Increase
Salmon	60.77%	66.66%	73.06%	54.21%
Cod	21.96%	18.95%	3.68%	31.16%
Monkfish	7.87%	6.67 %	11.20%	6.68%
Pangasius	9.39%	7.72 %	12.06%	7.96%

Figures

Figure 1: Participants Were Looking at Real Fish Products in Styrofoam Boxes while Making Choices.



Source: TNS Worldpanel.

Figure 2. Kernel Density Distributions of the Prices of the Four Species in 2008 in the Scanner Data

Appendix

A1. Representativeness of the Choice Experiment Sample

The sample of the individuals in the choice experiment is approximately representative in gender and age of the French seafood market, but may not be representative in income. It is in theory possible to have a weighting procedure to adjust the non-representativeness in income. However, in reality, there are no income distribution statistics that use the income grouping criterion that the choice experiment has used: less than €2,000, between €2,000 and €3,000, or more than €3,000, in terms of monthly income. It is possible to estimate income distribution, as shown in the second subsection. But a weighting procedure using such estimates may produce misleading results, because (1) the estimated national income distribution of France in 2008 is fragile and sensitive to assumptions and computation method, and (2) due to the strong assumptions that must be made, large errors have been inevitably introduced into the estimates. Hence, although large amount of efforts have been made to find and estimate national income distribution of France in 2008, I have decided not to conduct a weighting procedure.

A1.1. Gender and Age

In terms of gender and age, the sample of the choice experiment participants is approximately representatives for the shoppers of the seafood market. The distribution in gender and in age that represented the buyers of foods. Among all the participants, 62 and 82 were male and female, respectively, giving a male-female ratio of 0.76 male / female. The national male-female ratio in France was 0.96 male / female in 2014 (CIA 2015). There is slightly higher percentage of females than the national average, because more

women shop for foods than men. The average male and female ages of our choice experiment sample were 49.37 and 46.72 years old, respectively. According to The World Factbook, in 2014, the national median ages for males and females were 39.30 and 42.40 years old, respectively (CIA 2015). The sample has a slightly higher average age, because shoppers of foods are typically at least 16 years old, and mostly over 20 years old.

A1.2. Income

The choice experiment sample, however, is not representative in terms of income. In the choice experiment, participants did not have to reveal their nominal income. Instead, low, middle, and high income groups of monthly income of (1) less than €2,000, (2) between €2,000 and €3,000, and (3) more than €3,000, respectively, are used in the choice experiment's peripheral survey as the income grouping criterion. A participant could choose to state his/her income level by selecting one of the three income groups, or choose not to reveal the income. Twenty-three participants declined to reveal their incomes. They are excluded when estimating the income group distribution in the choice experiment sample. Among the rest of the 121 participants, 34.65%, 38.61%, and 26.73% stated that their incomes were in low, middle, and high income groups, respectively.

Judging by the self-stated monthly income, the choice experiment sample had more middle and high income individuals than national statistics. According to OECD, the median equivalized net monthly income in France in 2008 was €1,575 (OECD 2015b). However, it is unclear whether the choice experiment sample really had a higher proportion of middle and high income individuals, or whether some of them overstated their income.

There is no national statistics on income distribution that divides the population by monthly incomes of less than €2,000, between €2,000 and €3,000, or more than €3,000, all in terms of monthly income, which is, again, the criterion used in the choice experiment. The World Bank uses a 5-group criterion that corresponds to each quintile of the income distribution, from lowest 20% to the highest 20%.

Efforts have been first made to convert the World Bank statistics into a national income distribution that conforms the income grouping criterion used in the choice experiment. The income shares by each quintile of the population from 2005 are used, which are the latest data available for France as of May 2015. Income shares by each quintile of the population have been stable in France between 2000 and 2005. The 2000 income shares, from the lowest quintile to the highest quintile, are 8.1%, 12.8%, 17.0%, 22.6%, and 39.5%. The corresponding numbers in 2005 are 7.8%, 12.8%, 17.0%, 22.6%, and 39.7%. Therefore, the 2005 income share distribution data is likely very close approximation of the 2008 income share distribution in France. After adjusting inflation and converting currency using data from Wolfram Alpha (2005), in France in 2008, the lowest 20% to the highest 20% of the population had a monthly income of €893, €1,465, €1,945, €2,586, and €4,543, in the unit of 2008 EUR. However, such data is not informative on how many percentages of the French earned less than €2,000, between €2,000 and €3,000, and more than €3,000 in 2008. Very strong and arbitrary assumptions must be made before an income distribution can be estimated using the choice experiment's income grouping criterion. Such estimates cannot be trusted.

I have also investigated the scanner data, since it is from a representative sample of households. Although compared to the World Bank statistics, the scanner data contains

more information as each household's income level is available, estimating income distribution using the scanner data is not straight forward, and despite the efforts, does not guarantee reliable estimates.

First, the scanner data uses an 18-group criterion, which is different from the choice experiment's 3-group criterion. Households self-reported whether their monthly household incomes were, divided into 18 groups, (1) between €0 and 299, (2) between €300 and 449, (3) between €450 and 599, (4) between €600 and 749, (5) between €750 and 899, (6) between €900 and 1,099, (7) between €1,100 and 1,199, (8) between €1,200 and 1,399, (9) between €1,400 and €1,499, (10) between €1,500 and 1,899, (11) between €1,900 and 2,299, (12) between €2,300 and 2,699, (13) between €2,700 and 2,999, (14) between €3,000 and 3,799, (15) between €3,800 and 4,499, (16) between €4,500 and 5,399, (17) between €5,400 and 6,999, and (18) between €7,000 and 1,0000. Households could chose not to report their income. For example, in the 2008 panel, 39 out of the 6,174 household chose not to declare their income.

The panelist of the scanner data estimates a household's monthly income by taking the average value of the span of the income group of the household. If a household stated to have a monthly income between €1,100 and 1,199, then the household's income is estimated to be €1,150. Moreover, the panelist suggests to estimate a household, which chose not to declare their income, have an income of €1,450. It is not clear how the number of €1,450 is estimated. This is the first assumption that has to be made. Then, for the households who stated have a monthly income of between €1,900 and 2,299, some of them belong to, according to the grouping criterion in the choice experiment, the group of having

less than €2,000 per month, while the rest belong to the group of having between €2,000 and €3,000.

Second, the scanner data's income variable is at household level, but the choice experiment data's income variable is at individual level. An equivalence scale method is used to estimate representative individual income of each household in the dataset (Atkinson, Rainwater and Smeeding 1995). As the number of family members in a household grows, the needed income to support the household grows but not linear to the number of family members. For example, when a family has four members, the needed income does not double from when the family had two members. Several equivalence scale methods are available. The square root scale method, which has been used in recent OECD publications (OECD 2008, 2011), is used. A household's income is divided by the square root of the number of family members, to estimate the household's representative individual income. The result shows that 72.34%, 22.64%, and 5.02% of the estimated representative individuals of the households in the scanner data have monthly income of less than €2,000, between €2,000 and €3,000, or more than €3,000.

Cautions must be made to infer this distribution as the national income distribution. The households in the scanner are representative. But this does not assure that the estimated representative individuals are representatives. An estimated representative individual only means that what if this household were one person, how much income would this person have to be able to live a similar life. Moreover, it is well known that the estimated income of a representative individual income is sensitive to the choice of the equivalence scale method (Burniaux et al. 1998).

I have also tried to estimate an average adult individual's income and the associated distribution, by dividing the estimated household income by the number of adult (≥ 18 years old). The resulted estimates suggest that 82.70%, 13.77%, and 3.52% of the adults in the scanner data in 2008, averaging on the household income, had monthly income of less than €2,000, between €2,000 and €3,000, or more than €3,000.

The above estimates show that (1) the estimates on income distributions, which have to be made to fit the 3-group income grouping criterion used in the 2008 Dijon choice experiment, are fragile and dramatically change when using different sources and techniques, (2) very strong assumptions and averaging techniques have to be used to estimate income distribution using the available data, and (3) the trustworthiness of such estimates are dubious. Moreover, as shown in the text, the choice experiment sample has higher self-stated income than national distribution, inferred from the national median equivalized net income, suggesting that the participants may have overstated their income in the survey. Considering all of these reasons, a weighting procedure on income, although mechanically viable, will produce market predictions with small improvement at best. In fact, the results will be likely unreliable and misleading. Hence, I have decided to not conduct a weighting procedure.

Paper iv

China's Sanction on Norwegian Salmon: Sanction-Busting Strategies, Market Distortion and Efficacy

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China's Sanction on Norwegian Salmon: Sanction-Busting Strategies, Market Distortion and Efficacy

Abstract

This paper confirms China's longest and on-going economic sanction on Norway by restricting salmon imports as a payback for the 2010 Nobel Peace Prize, which awarded to a Chinese dissident by the Norwegian Nobel Committee. By combining interviews with stakeholders in the Norway-China salmon trade and examination of trade data, personal accounts corroborate the evidence from trade data that non-tariff border measures have been disproportionately applied against Norwegian salmon. These measures have distorted China's fresh/chilled whole salmon market since 2011, and are likely to have long-term consequences in terms of trade patterns, re-routing and smuggling of salmon, and for quality concerns. Chinese and Norwegian firms, however, have successfully busted the sanction by using different counter-measures. Although Norway has increased its exports to mainland China's market, the Norwegian government's refusal to meet the Dalai Lama in May 2014 suggests that the full effect of China's salmon sanction has made its way upstream to affect Norway's policy. The newly signed agreement on health certificate in April 2015 signals that the Sino-Norway relation has warmed up.

Key words: China, economic sanction, import restriction, import licensing procedures, non-tariff barriers, sanctions-busting.

1. Introduction

Despite China's usual opposition to foreign governments' use of economic sanctions (经济制裁),[1] the Chinese government has increasingly turned to its own economic sanctions as an international relations tool.[2] [3] Starting in the 2000s, China exercised this option in the following instances: (1) when a country formally received the Dalai Lama;[4] [5] (2) in cases of maritime disputes or when support was offered to other countries' maritime claims in the East China Sea and the South China Sea;[6] [7] (3) following criticism of China's human rights record;[8] or (4) subsequent to foreign governments' arms sales to Taiwan. [9] [10]

China's economic sanctions have typically been intended as a threat rather than to affect serious actual damage. They are usually a signal of China's frustration and serve as a warning of stronger retaliation if a country does not reverse a certain action.[11] As a result its sanctions tend to be subtle, e.g. unilateral, undeclared, implemented without formally being passed into law, and limited in terms of sectoral application, economic scope and duration.[12] Its sanctions are underpinned by domestic regulations that adversely affect the target county's firms which have financial/commercial interests in China or those sectors that rely on trade with China. For example, China restricted exports of rare earth elements (REE) to Japan in 2010 following an incident occurring in disputed territorial waters, a move aimed at hitting advanced electronics-intensive manufacturing sectors; or the 2012 maritime dispute with the Philippines resulted in tighter regulatory measures on all Filipino fruit imported into China.[13]

However, economic sanctions through the use of trade restrictions can generate disputes

at the World Trade Organization, whose rules limit the use of trade restrictions as a political tool. China typically uses non-transparent political measures which are not passed into law, and non-tariff barriers (NTBs) which have not been notified or declared with multilateral bodies such as the United Nations or WTO. China's export restriction on REE to Japan resulted a trade dispute at the WTO which China eventually lost.[14] The Norwegian salmon sanction illustrates how China's use of subtle NTBs can disrupt trade interests.

In October 2010, the Norwegian Nobel Committee, which includes five members who are appointed by the Parliament of Norway, awarded the Peace Prize to a Chinese dissident, Liu Xiaobo.[15] The award angered the Chinese government.[16] China cancelled a ministerial trade delegation to Norway immediately following the Prize.[17] In addition, China is alleged to have taken political actions to impede bilateral trade, particularly on the salmon trade, a key Norwegian export and symbolic product of Norway.

Between 2000 and 2010, Norway dominated the Chinese fresh/chilled whole salmon market, exceeding 80% of the total share in several years. Since 2011, that share has fallen to as low as 25%. The notable changes in China's salmon import volume from Norway and shifting regional trade patterns coincide with the awarding of the prize. Moreover, the sudden reduction in Norway's market share is unexpected because Chinese consumers prefer Norwegian salmon.[18]

This paper studies China's alleged economic sanction through application of NTBs targeting Norway's exports of fresh/chilled whole salmon[19] to China after awarding the 2010 Noble Peace Prize.[20] In particular, the study sets out to: (1) determine whether the allegations

and widespread media reports on the sanction are supported by bilateral and regional trade data during 1990-2014 and stakeholder accounts obtained through interviews in 2014; (2) account for how NTBs may have been implemented to target Norwegian salmon as part of the sanction; and (3) to evaluate the efficacy of the sanction based on an analysis of the response of Chinese and Norwegian firms, and other regional players, to circumvent the NTBs through sanctions-busting countermeasures.

Despite the salmon sanction having been widely reported in the international media[21 22 23] and a number of studies[24 25 26 27] having cited the salmon case, there has been no formal investigation by the academic community to study the incident. However, the case has not yet been investigated in any detail. We confirm and investigate the salmon sanction through triangulation[28 29], combining semi-structured in-depth interviews with stakeholders in mainland China (herein referred to as China) and Hong Kong Special Administrative Region (herein referred to as Hong Kong) and the analysis of trade data.

2. Background

Figure 1 shows the dramatic change in the trend in China's imports of fresh/chilled whole salmon from Norway and the total from the world after 2010. A break in the trend occurs which coincides with the awarding the prize. In 2011, total imports into China decrease slightly before increasing at a faster growth trajectory during 2012-14. Norway's exports to China decreased in 2011 before rebounding in 2012. The decrease in 2011 is so abrupt that it is not observed in any other year since 1996. It is important to note that Norway has not experienced a reduction in productive capacity, nor any quality change over its salmon.

[Insert figure 1]

For most of 1996-2010, imports from Norway took the predominant share of China's total salmon imports, rarely accounting for less than 70%. The break in the trend in market shares is evident in figure 2. Between 1997 and 2010, whenever Norway's market share fell below 80% of the total, imports from the US took up the slack. Intriguingly, from 2011 it was imports from the UK and the Faroe Islands that filled the widening gap.

[Insert figure 2]

The media, both in Norway and in international sources, have reported that the awarding of the prize resulted in China implementing an economic sanction on Norway, particularly affecting Norwegian exports of fresh/chilled whole salmon to China.[30] [31] The economic sanction was affected through changes in customs practices and regulatory border measures in China. The changes in customs practices and border measures are argued to include stricter testing and inspection procedures (and longer customs-clearance time) on Norwegian salmon but not salmon from other countries.[32]

3. Theory and Literature Review

The theory defines three types of sanctions: boycotts, embargoes, and financial sanctions.[33] Boycotts restrict one or more goods from the target country (Norway in this case), attempting to reduce the target country's foreign exchange earnings and to reduce its ability to purchase imported goods. Embargoes restrict certain types of goods that can be exported to the target country. Financial sanctions restrict or suspend lending and investing into the target country,

impose additional restrictions on international payments, and/or freeze the target country's foreign assets.

The economic sanction on Norwegian imports of salmon is a boycott, restricted to one particular good for which there are reasonably close international substitutes. The instruments implemented to apply the sanction are customs measures and border practices that have targeted salmon originating from Norway. However, there is no good way for officials to restrict imports of salmon from firms located in another country which are owned in part or whole by Norwegian capital. Moreover, as with any sort of economic sanction, the measures applied give rise to potential strategic marketing responses by economic agents to bust the sanction.

Since the economic reform in 1978, China extensively used foreign policy as a tool to further its economic interests.[34] However, since the 2000s, China has reversed the strategy and begun to use its economic might to influence international relations.[35] [36] [37] [38] Two Chinese economists, Jianping Liu and Wei Liu, argued that China should prudently use sanctions against countries that hurt China's national interests and countries that damage world peace.[39]

When exercising sanctions, China tends to tread cautiously around international law, particularly with the WTO.[40] Unlike unilateral US sanctions that are formalized through US domestic law or a multilateral sanction backed by a UN resolution, China's sanctions are subtle and rarely publically declared. Instead, vague threats, cancellation of high-level visits, selective purchases and non-purchases, and other informal measures are the common methods that China uses to impose a sanction.[41] [42] Informal measures are preferred by China because it offers flexibility and credible deniability of their existence.[43] Moreover, informal measures are easily

reversible in a discrete, face-saving manner, minimizing diplomatic fallout or legal challenges in the WTO.

The WTO generally prohibits import restrictions as a policy instrument, with the exception for national security.[44] China has threatened the use of trade sanctions on US companies with commercial interests in China based on a national security argument whenever the US intends to sell arms to Taiwan.[45] If the national security argument is not applicable to a situation, China discretely imposes NTBs with equivalent effect as import or export restrictions, leveraging the size of its domestic market and/or its relative economic size in the trade of some key commodity, to signal China's frustration.

In general, an economic sanction is evaluated by the degree of success or failure.[46] [47] Unilateral economic sanctions are often ineffective due to transhipment from third countries.[48] [49] Daniel W. Drezner distinguishes two types of situations when the sender country cannot enforce a sanction due to: (1) rent-seeking actors in the private sector, and (2) defections by nation states.[50] The former is referred in the literature as sanctions-busting, while the latter is called backsliding.

Sanctions-busting has been extensively investigated in the literature.[51] This study on China's salmon sanction contributes to the literature profiling the motivations of sanctions busters. If there are strong consumer preferences for Norwegian salmon in China, any NTB that restricts salmon imports, and Norwegian salmon in particular, should encourage coping strategies by private sector agents to circumvent the restriction and to bust the sanction.

Preventing sanctions-busting requires a government's willingness to penalize any party that is involved in circumventing the sanction.[52] Sanctions-busting is always likely to occur because trade can be diverted by domestic and third-country companies through newly established relationships.[53] Multilateral co-operation in enforcing sanctions is essential to prevent sanctions-busting and backsliding, requiring significant diplomatic efforts.[54] For example, the Helms-Burton Act and the Iran/Libya Sanctions Act have explicit clauses aimed at preventing sanctions busting.[55] [56] First, any US company dealing economically with Cuba, Iran, and Libya will face legal actions from the US government. Second, for a non-US company dealing with these countries, the firm will be partly or entirely prohibited from exporting to the US.

The nature of China's sanctions makes it difficult to implement preventive measures against sanctions-busting.[57] Without a righteous cause it is difficult to find a foreign ally. Thus, it is not possible to prevent transhipment or smuggling through a third country. Second, China's practice of subtle and informal sanctions makes itself difficult to formally legislate such actions. This is the cost of having an informal, easily reversible and highly deniable sanction. Without a formal legislation, China can only effectively command official bureaus and state-owned firms, but not private firms or actors. Most of the Chinese salmon importers are private firms.

Sanctions-busting comes at a cost, usually borne by the target country. For economic sanction backed by UN resolutions, the target country can bust the sanction only through heavily discounted prices on its exports. For example, between 1975 and 1979 Rhodesia (present-day Zimbabwe) managed to bust a UN sanction by exporting at a 20% discount.[58] In

addition to the costs related to premiums or discounts in the price of tradable goods, there are other potential costs such as increased marketing costs related to hiring intermediaries, rerouting of goods, and smuggling, counterfeiting, bribery and other forms of corruption. In this study, one objective is to ascertain the types of costs from sanctions-busting and to assess efficacy of the sanction.

4. Research Methods and Data

We combine the qualitative research method of semi-structured in-depth interviews with stakeholders involved in China's salmon trade, with the quantitative research method that examines and analyses trade data, to triangulate and establish a link between the awarding of the 2010 Nobel Prize and the reversal of the trends in Norway-China trade patterns. Triangulation, which combines two or more methodologies to study a phenomenon,[59] is widely used in sociology research.[60]

4.1. Field Interviews

Three separate questionnaires were developed, corresponding to the three types of organizations to be interviewed: Norwegian salmon exporters with representatives in China, salmon importers in mainland China, and salmon importers based in Hong Kong. Each interview was semi-structured on one of the three pre-designed questionnaires.[61] There was no opportunity to pre-test the questionnaires.

A list of stakeholders involved in the Norway-China salmon trade was obtained from the Norwegian Seafood Council (挪威海产局, hereafter NSC), a corporation owned by the

Norwegian Ministry of Fisheries and Coastal Affairs. The stakeholders were first approached through emails, then through telephone if they did not reply the emails. Anonymity and confidentiality was promised regarding their identities. Conversations were not recorded. Notes were sketched down on sheets by the interviewer. All the interviews were carried out in Chinese, with the exception of the interview with the NSC which was in English. External translation was not required nor was interpretation necessary.

Of the five Norwegian firms that have Chinese representatives in China, four agreed beforehand to take the interview. The only representative who declined to take the survey acknowledged that "[There are] a lot of difficulties, and I am more inclined to not talk about these difficulties [or to talk about numbers such as sales figures which are confidential]". During the field trip, representatives of two of the four above mentioned Norwegian firms could not sit for an interview or take the survey, despite agreeing to do so earlier. This highlights the sensitivity of openly discussing China's discriminative practices in salmon imports.

There were 21 companies that took part in the survey and agreed to be interviewed. In addition, a representative from the NSC was interviewed. The participants were interviewed separately and in person during a field visit in January 2014 that covered Hong Kong, Beijing City, Shanghai City, Guangzhou City, and Shenzhen City (figure 3). Hong Kong has a market of its own. Each of the four other cities has a wholesale market that supplies salmon either regionally or nationally. The wholesale market in Beijing City mainly supplies northern China, the one in Shanghai City mainly supplies eastern China, and those in Guangzhou City and Shenzhen City supply both southern China and the wholesale markets in other parts of mainland

China, including Beijing City and Shanghai City.

[Insert figure 3]

Each interview, depending on where the firm is based, inquired on: (1) basic information of the firm; (2) the species, volumes, values, and shipment of fish being traded; (3) experiences and knowledge of China's or Hong Kong's customs practices in clearing imported salmon; (4) experiences and knowledge on transhipments; (5) experiences and knowledge on China's or Hong Kong's import licensing system; (6) experiences and knowledge on China's or Hong Kong's sanitation testing and veterinary inspection; and (7) the firm's market share in China or Hong Kong and anticipation of future market developments. The interview with the NSC was not pre-planned and only questions that are relevant to the Council were raised. During all interviews, out-of-questionnaire questions were always asked whenever it was deemed necessary.

4.2. Trade Data

The trade data for the analysis are compiled from three sources: the United Nations Commodity Trade Statistics Database (UN Comtrade),[62] the NSC,[63] and the Government of Hong Kong, Census and Statistics Department.[64] The UN Comtrade collects annual trade statistics that are reported by governments at a disaggregated product level and by country. As of May 2015, several countries, including Russia and the Netherlands, had not completed reporting for 2014. The missing trade statistics are collected from the NSC. In addition, monthly export data from January 2007 to April 2015 were provided by the NSC.

5. Findings and Discussion

Majority (78%) of the interviewed mainland China stakeholders acknowledge the changes in practices and procedures, and support the claim that they have been disproportionately applied on imports from Norway.

5.1. Implementation of China's Salmon Sanction

The process of imported salmon clearing customs occurs in two steps. First, imported salmon must pass sanitation tests and veterinary inspections. Second, the importer must present the required documentation and pay the tariff. For the purposes of this study, only the passing of sanitation tests and veterinary inspections is of interest because there were no allegations of the tariff regime being applied discriminatingly.

There was no central government decree or law which explicitly targeted Norwegian salmon. However, regionally, the Beijing Capital Airport Entry-Exit Inspection and Quarantine Bureau Service Centre (北京首都机场出入境检验检疫局机关服务中心, hereafter BCAEEIQBSC) issued an order, dated 8 December 2010, which required stricter and more through checks on, specifically, Norwegian fresh aquaculture products coming through Capital Airport.[65] NSC provided an English translation of the order. A copy of the original order in Chinese could not be obtained. Independent verification has not been possible.

The Chinese government might have realized that it could not issue a decree or law to explicitly restrict Norwegian salmon, due to its commitments to the WTO. Instead, China's General Administration of Quality Supervision, Inspection and Quarantine (国家质量监督检验

检疫总局, hereafter GAQSIQ) issued an order, “Public Notice on Strengthening Inspection and Quarantine of Imported Salmon” (关于加强进口三文鱼检验检疫的公告), Document No. 9 (2011 年第 9 号), dated 28 January 2011, calling for more stringent sanitation and veterinary testing of imports of chilled farmed salmon in general.[66]

Although required by WTO rules, there were no WTO notifications by China with an explanation for the changes in testing and inspection. From its legal content, Document No. 9 is a regulatory measure that could be applied in a non-discriminatory manner, but justification for why salmon was singled out for stricter testing and inspection is required. One of the interviewed Chinese importers suggested that the order was actually meant to restrict imports from Norway, since Norway was the largest and the dominant exporter (figure 1).

While Document No. 9 reads as a non-discriminating Sanitary and Phytosanitary (SPS)-related measure applied at the border, the practice is, according to more than three-quarters of the interviewed stakeholders, biased against Norwegian salmon. They claimed that shipments of Norwegian salmon are always checked and that testing and inspection took longer, up to 20 days, for Norwegian salmon. Salmon from other producing countries are only randomly checked; when checked, it only needs about three to four days to complete sanitation tests and veterinary inspections. The other 22% of the interviewed stakeholders either stated that they did not know or suggested that the practice in sanitation tests and veterinary inspections was the same for salmon from all producing countries. All interviewed participants suggested that once the sanitation testing and veterinary inspections were completed, it took the same amount of time to clear customs. Table 1 summarizes the delays that occur at the Chinese border.

[Insert table 1]

China's protocol on the issuance of import licenses, entitled "Import License of the People's Republic of China" (中华人民共和国进口许可证), requires the following information to be specified in an application: the quantity to be imported, the species of the seafood, the exporting country, and the port of entry into China. An approved license is quantity-specific, import-firm specific, export-country specific, and import-port specific. The WTO defines an import license as an "administrative procedure . . . requiring the submission of an application . . . to the relevant administrative body as a prior condition for importation . . . of goods".[67] The purpose of which, in this case, could be to ensure food safety, for the surveillance of transacted prices, and/or for maintaining of trade statistics.[68] An import license shall not be a means to administer any formal import quota, which China does not have the right to do under its WTO commitments.

The same 78% of stakeholders suggested that, with the undeclared changes after 2011, importers of Norwegian salmon started to experience a constraint on the approved volume of imports. Previously, traders usually obtained approval for the volumes for which they applied regardless of country of origin. The authority only approves an import license of Norwegian salmon when the requested volume is small (10 to 30 tons), a constraint that does not apply on salmon from other countries (up to 300 tons). The other 22% of the interviewed stakeholders either stated that they did not know or suggested that the practice was the same for salmon from all producing countries.

A new license application can be submitted once 75% of the already approved licence

volume has been imported. However, each application takes 20 to 25 days. While this condition applies to all exporting countries, this disproportionally affects an exporting country whose approved volumes are much smaller. By WTO rules, automatic licenses (e.g. those that are not in place to administer a quantitative restriction) should be issued within a maximum of 10 days after the receipt of applications.[69]

The 78% of the traders argued that the quantitative restriction was a larger obstacle than delays in the customs clearance associated with the more stringent food safety testing and veterinary inspection. Moreover, this is the only regulatory change that affects frozen salmon business. There was only one stakeholder, who imports frozen salmon. For his business delays in sanitation tests and veterinary inspections only increase costs slightly but did not affect quality; but now his business is constrained by the small volumes approved on the import license.

The import-licensing procedure, while technically not an import quota, might be considered an NTB with an equivalent effect of a quantitative restriction. It is applied in a manner inconsistent with the norms outlined in the WTO Agreement on Import Licensing Procedures, because its process is "more burdensome than absolutely necessary" to administer the licensing system.

5.2. Sanction-busting: stakeholders' marketing responses

The stakeholders, both Norwegian exporters and importers in China, have taken steps to circumvent the changes in customs practices and regulatory border measures that underpin

China's salmon sanction. Initial steps included communicating with the NSC and the Norwegian Embassy in Beijing to request a diplomatic gesture to improve Sino-Norway relation. Afterwards, several mitigation strategies involved adapting the transport and marketing channel through the following sorts of strategies: e.g., port-shifting, source-shifting, mislabelling, smuggling and transhipment. Through these efforts, the business sector has busted China's sanction on Norwegian salmon.

5.2.1. Selling rotting fish to salmon processors

The sanction was not announced and took stakeholders by surprise. Because air transport is expensive and is based on weight, exporters only pack enough ice to chill salmon and assure quality upon arrival in China. When suddenly it took up to 20 more days to clear customs because of the tests and inspections, the fish began to degrade soon after all the ice has melted. In some cases, the quality became so poor that the fish could no longer be sold as fresh salmon. To reduce loss, one interviewed importers admitted selling rotten Norwegian salmon to factories to make smoked salmon. This only happened at the start of the salmon sanction.

5.2.2.Source-shifting to non-Norwegian salmon

Some businessmen turned to importing salmon produced in other countries, notably the UK, the Faroe Islands, and Chile (figure 2), to avoid the obstacles of importing Norwegian salmon. Prior to 2010, China's salmon's market was a competition between Norway and US. This changed, as after 2010 the three above mentioned countries took over Norway's lost market shares. It is likely that a new agreement was reached between Norwegian suppliers and Chinese importers,

to supply salmon produced in farms in the above mentioned three countries, which are invested by Norwegian salmon companies. Marine Harvest admits that it has been exporting salmon to China from its farms in these three countries.[70]

5.2.3. Mislabelling country-of-origin in the retail market

Country-of-origin is an important attribute and an important label for agricultural products such as salmon.[71] During the field trip, we rarely saw salmon that is not labelled as Norwegian salmon in the wholesale and retail markets. Some merchants falsely claim that salmon originating from other countries is Norwegian, to boost sales and profits. This has been noted in the media.[72] Larger supermarket chains tend to behave in accordance with Chinese law, and the country-of-origin label tends to be genuine.

5.2.4. Legal transhipments

Among the interviewed stakeholders in China and Hong Kong, 62% confirmed that they had imported or they knew other firms had imported Norwegian salmon via Hong Kong. However, there is little evidence suggesting that re-exported Norwegian salmon undergoes less strict boarder measures. There is no officially reported (re-)exports from Vietnam to China, suggesting no salmon has been legally transhipped from Vietnam to China. The increase in re-exports from Hong Kong to China has been much smaller than the increase in exports from Norway to Hong Kong (figure 4), suggesting that legal transhipments only account a small fraction of the salmon that has been transhipped from Hong Kong to China.

[Insert figure 4]

5.2.5. Illegal transhipments

Another means of transhipping through legal channels involves the illegal practice of falsifying documents on country-of-origin. Chinese authorities only limit Norwegian salmon. When the country-of-origin label is changed to another country, e.g. Canada, then the fish is no longer Norwegian on the document. Lengthy sanitation tests and veterinary inspections are then avoided. One Hong Kong importers admitted that when reselling Norwegian salmon, the documents from Norway are often not required by Chinese buyers, suggesting that labels are changed during transhipping. The practice of altering a label is illegal, but the risk of being detected is relatively low.

Seven of the interviewed stakeholders admitted to having smuggled Norwegian salmon via Hong Kong and Vietnam. The increased difficulty of legitimately importing Norwegian salmon created the incentives. The upticks in monthly trade volumes from Norway to Hong Kong (figure 4) and to Vietnam (figure 5) support this claim. However, it is hard to precisely estimate how much salmon has been smuggled from Hong Kong to China.

[Insert figure 5]

For Vietnam, it is clear since Vietnam's domestic salmon market is small enough to be omitted, when compared with the abrupt increases after 2010. Smuggling between Vietnam and China has always been active.[73] One stakeholder, who is based in the province next to Hong Kong bordering Vietnam, suggested that transhipment of salmon through Vietnam was due to the increased difficulty and risk of smuggling salmon via waterways from Hong Kong, the then

common route for smuggling. Another stakeholder, who admitted smuggling through Vietnam, suggested that in early 2010, salmon importers began transhipping through Vietnam, although Vietnam by then was already a hub for expensive beef and other luxury seafood products.

5.2.6.Port-shifting within mainland China

In China, prior to the diplomatic row, most Norwegian fresh/chilled whole salmon, if not all, was shipped through airports located near the regional and national wholesale markets: Beijing City, Shanghai City, Guangzhou City, and Shenzhen City. Because shipments were concentrated in these four ports, initially the new regulatory measures might have been only implemented at these airports.

Importers have imported salmon through other airports where sanitation tests and veterinary inspections were less strictly implemented. In northern China, shipments started going through Tianjin Binhai International Airport in Tianjin City, Zhengzhou Xinzheng International Airport in Henan Province, and Dalian International Airport in Liaoning Province; in eastern China, shipments started going through Hangzhou International Airport in Zhejiang Province; in southern China, shipments started going through Chengdu Shuangliu International Airport in Sichuan Province and Chongqing Jiangbei International Airport in Chongqing City (figure 3).

Stakeholders suggested that some local Customs and Entry-Exit Inspection and Quarantine Bureaus welcomed the new salmon shipments, which brought revenues from import taxes and various fees. However, the interviewed stakeholders also suggested these airports

would eventually implement the strict sanitation tests and veterinary inspections once the central government noticed higher import volumes, which happened at Tianjin Binhai International Airport.

5.2.7. Synchronization of import license applications

Because an import license is port specific, some Chinese importers have started applying for licenses to import Norwegian salmon into multiple ports. When the volume for one port is almost used up, they re-apply for another license at that port, and continue to import from other ports where they have already obtained an import license with a volume allowance that is not yet used. Importers keep applying for licenses from different ports and shifting salmon shipments to different ports, as a workaround. Such manoeuvres incur additional costs and lose any cost advantage derived from scale.

5.3. Distortion to China's salmon market

China's salmon sanction was designed to punish Norway through its salmon products. However, the damages and costs, in the end, have mainly been to China's own salmon market and to Chinese consumers.

5.3.1.Corruption

Corruption due to bribery is suggested in several of the mitigation strategies, including port-shifting, transhipping, and smuggling. For port-shifting, with the increased costs of shipments from airports that are far away from the final market, importers now have larger stakes to lose.

Stakeholders admitted that they are working every channel to minimize delays from testing and inspections. One stakeholder admitted that the company would not order and import Norwegian salmon through an airport, if they did not "foresee" that the shipment would pass through testing and inspections quickly. Another stakeholder hinted that how fast a shipment cleared customs depended on "how passionate the customs broker was". However, because most of the brokering services are outsourced to specialized customs-brokering agencies, the importers either did not know or would not disclose the details of how customs clearing was facilitated or what share of the fee was a bribe. Similarly, because transhipping and smuggling are "outsourced" to third parties, stakeholders either did not know or would not disclose the details involving those transactions.

5.3.2. Quality degradation

Chilled/fresh whole salmon is best within 15 days after harvested from the sea. Table 1 documents the average number of days it takes to bring Norwegian salmon to an importer's storage facility. For fresh/chilled whole salmon, each day spent on the road results in additional quality degradation. Inadequate transportation facilities during transhipping and smuggling further degrade fish quality.

5.3.3. Increased costs for Chinese importers

For Norwegian salmon that passed through previously-unused airports in mainland China, or that were transhipped or smuggled, the importers bore higher costs to cover: (1) increased in-country transport costs from the distant airport to the importer's storage facility; (2) the costs of

hiring a third-party to tranship or to smuggle; (3) the costs of hiring specialized brokers who manage the application of licenses at multiple airports; and (4) the costs from implied bribery to facilitate the customs-clearing time. There are additional opportunity costs and efficiency losses from moving more, smaller shipments and/or because the delays degrade the quality of the fish. Finally, there is a potential legal cost for a stakeholder implicated in mislabelling of fish, bribing civil servants or customs officials, or smuggling.

5.3.4. "Bad" fish drives out "good" fish.

Chinese consumers are very sensitive to price. Even salmon of a low quality can be sold if the price is sufficiently discounted. Despite the increased transportation and smuggling-related costs, smuggled salmon evades delays and tariffs. Thus, smuggled salmon has a competitive edge relative to legitimately imported salmon in the price-sensitive market, according to the Chinese businessmen interviewed. As a consequence, some former legitimate importers, facing the obstacles at Chinese airports, have turned to buying from smugglers.

Smuggled salmon also distorts the high-end segment of China's salmon market, e.g., upscale restaurants and the larger supermarket chains, where high quality is desired. Smugglers are able to sell smuggled salmon with good enough quality by using official documents from another legal shipment, according to the interviewed stakeholders. It was not possible to ascertain to what extent this is done. Due to significant quality degradation during transportation in the hotter months, smuggled salmon can only supply the high-end market in winter. Thus, the high-end segment of the market is seasonally distorted.

5.3.5. Consumer welfare loss

The loss in salmon quality and increased costs due to various remedies and workarounds, in the end, are borne by China's consumers, although the consumers are largely unaware of the quality degradation. Furthermore, most Chinese consumers shop for food at traditional street markets, where salmon from other countries is sold as Norwegian. In such a case, the consumer might pay a premium for "Norwegian" salmon when it fact it is from another country.

5.3.6. Potential damage to Norwegian salmon's image and long-term implications

If allegations of degraded Norwegian salmon being sold in China are proven, this can damage the image of Norwegian salmon, forfeiting a significant part of Norway's investment in the Chinese market. For more than a decade China's fresh/chilled whole salmon market was once dominated by Norwegian salmon. China's market has continued to grow rapidly. The NSC has cultivated the demand for salmon in general and the image of high-quality salmon from Norway through marketing and awareness campaigns. The NSC spent NOK 15 million (USD 2.4 million) in 2012 and the budget in China in 2013 was around NOK 30 million.

When the border measures are removed, it is expected to be difficult for Norway to regain its pre-2011 dominance, because competitors have already established trade and relations with buyers that are likely to last. Since 2010, a number of new players have entered or are about to enter to the market. During the 18th China Seafood & Fisheries Exposition in 2013, which is China's largest seafood trade fair, there were more salmon exporters than ever, including firms from countries that do not produce salmon but which are interested in re-

exporting. Furthermore, Chinese consumers nowadays are becoming more aware of the salmon from other producing countries.

5.3.7.Long-term implications for China's salmon market

According to some interviewed stakeholders, initially only Norwegian salmon was smuggled from Vietnam to China, as a means around the Chinese government's discriminatory practices. Once smugglers earned profits learning their trade, they started smuggling salmon from other producing countries too. While this assertion seems reasonable and logical, it could not be substantiated or corroborated through UN Comtrade data. If true, then market distortion from smuggling is greater than what can be inferred from official trade statistics.

The transhipment/smuggling link via Hong Kong and Vietnam has operated for more than four years. The market distortion could continue after the Sino-Norwegian relationship normalizes.

5.4. Efficacy of the Sanction

When sanctioning Norway, only salmon has been affected. This is in line with China's strategy of imposing a sanction without affecting broader economic relationship. China has always chosen the details of a sanction carefully such that it will sufficiently signal its political will without greatly impeding China's economic interests. The choices of which commodity to sanction have been deliberate and careful. Agricultural products, bananas for the Philippines and salmon for Norway, are iconic agricultural products. Sanctions over such agricultural products can easily trigger farmers' responses in the target countries and hence create pressure to the

target countries' governments. China could have chosen to impose restrictions over Norway's oil and gas, which are the most important trade items for the Norwegian economy.[74] China is extremely concerned with its economic growth.[75] [76] It is not to China's interest to implement any economic measure that is too costly.[77] In fact, the total export from Norway to China has been steadily increasing.[78]

China has not been able to use public anger when sanctioning Norway, which is unusual. Chinese officials have often encouraged consumer boycotts as part of the sanction game.[79] This occurred in 2005 against Japanese goods during a political row over Japan's prime minister's visit to the Yasukuni Shrine (靖国神社), and in 2008 against Carrefour, a French retail chain, after protests over China's Tibet policy and human rights policy in Paris during the Olympic torch relay.[80] [81] However, in the salmon case the awarding of the prize was viewed as an extreme embarrassment and China has exerted media control, preventing the public from knowing the prize and the sanction.

Summing the indirect exports via Vietnam and the direct exports to China together shows that Norway increased its export of salmon to China. The popular misconception that Norway has lost its majority share in China's fresh/chilled whole salmon market is based on media reports and analysis using official trade data of direct exports from Norway to China. However, with the prevalence of transhipping coupled with falsified country-of-origin labels and of smuggling from Hong Kong and, particularly, Vietnam, the official trade data on direct exports are not a reliable source. The interviewed stakeholders believe that Norwegian salmon still accounts for between 50% and 70% of the total fresh/chilled whole salmon on China's

market. Figure 6 presents Norway's monthly direct exports to Vietnam and China, and the sum. Almost all the Norwegian salmon exported to Vietnam was transhipped to China's market.

[Insert figure 6]

Preventing sanctions-busting requires a government's willingness to penalize any party that is involved sanctions-busting. We, however, did not find such willingness in the salmon sanction case. One of the interviewed stakeholder believed that the government has been aware of the transhipments from Hong Kong and Vietnam, but the government simply does not care. China's goal is mainly political and the sanction is used to send a strong signal. Hence, China has not bothered to enforce effective boarder control for example between Vietnam and southern China, as long as the signal has been received by Norway.

Nevertheless, China's sanction seems to have achieved a desired effect. In May 2014, the government of Norway declined to meet the Dalai Lama.[82] Perhaps this initial gesture by Norway can be seen as China having gotten its message across. After all, the UK resumed its ministerial meetings and warmed up its relationship with China by declining and restraining its ministers from meeting the Dalai Lama in 2013.[83] Similarly, after France issued a statement recognizing Tibet as a part of China's integral territory in 2009, the diplomatic tension due to then president Sarkozy's meeting with the Dalai Lama in 2008 begun to defreeze and a Chinese trade delegation visited Paris soon thereafter.[84]

However, in September 2014 and March 2015, China announced the banning of imports of Norwegian salmon because of concerns that infectious salmon anemia or anaemia (ISA)

could greatly harm the domestic aquaculture industry.[85] ISA is a virus that causes disease and has affected farmed salmon in Europe, North America, and South America, but does not harm human health.[86] The ISA issue may be a component of the salmon sanction. While ISA is found in major salmon farming countries, only Norwegian salmon has been targeted. The ban was never implemented as of February 2015 nor was it notified at the WTO. In general, the seafood industry and Norwegian authorities view the ISA issue independent of the strict sanitation testing and veterinary inspections.[87]

In April 2015, almost one year after Norwegian government's May 2014 gesture and one month after China's March 2015 announced import ban, Norway and China negotiated a new health certificate for exports of fish and fish products from Norway.[88] This new agreement can be viewed from two perspectives. First, it addresses, partially, the ban over farmed salmon from Norway. The new agreement allows salmon from farms that are not infected by ISA to be issued with a health certificate by the Norwegian authority and to be imported in China.[89] Second, this agreement may be interpreted politically as a warm gesture from the Chinese government. The two countries' food safety authorities have resumed dialogue and reached an agreement, which is an important step towards full restoration of the bilateral relations.

6. Conclusion

China's rapid economic growth and large size in global markets facilitates the use of economic sanctions as a means of projecting power in international relations. The government of China is able to limit foreign firms' access to its lucrative and rapidly growing market as a means of signalling its foreign policy objectives. This study sets out to determine whether there is

sufficient evidence, through compiling trade data and corroborating accounts from stakeholders who were interviewed.

The findings support the claim that China used NTBs as a means of applying an economic sanction on Norway's exports of fresh/chilled salmon to China, in response to its displeasure with Norwegian Nobel Committee's awarding of the 2010 Nobel Peace Prize to a Chinese dissident. Norway-China trade data for fresh/chilled salmon before and after 2011 show that the decline in Norway's total exports to and relative market share in China coincided with the NTBs that underpinned the sanction. Through newly established business relationships domestically and internationally, Chinese importers have been able to bust the salmon sanction by importing salmon through airports that are less controlled by the central government and through transhipment via Hong Kong and Vietnam.

The sanction obtained an intended soft power effect in signalling China's displeasure of the award, because it successfully influenced Norway's foreign policy when the government declined to meet with the Dalai Lama. However, the costs of sanction-busting have been incurred by Chinese consumers in higher prices for Norwegian salmon, mislabelled salmon, and degraded salmon, and by Chinese society from the bribery, corruption and illegal marketing activities that the NTBs have encouraged.

It is difficult for a foreign country to counteract China's economic sanctions. So far only Japan has fought against China's sanction at WTO. First, it is intimidating to fight China at WTO, considering that such a complaint may result in China's further retaliation. Second, the discrete manner of China's usages of NTBs makes it hard to gather evidences.

China has become more confident and more skilled in the statecraft of economic sanction, and this needs to be taken seriously. Several countries, including Norway, gave in upon receiving China's sanctions, suggesting that the sanctions have been successful and effective. The sanction over Norway has lasted over four years. Despite Norway's warm gesture of refusing to meet the Dalai Lama, the sanction is still on-going. Is China using Norwegian salmon to set an example? Future research is required to answer this question.

The present study lacks statements and opinions from Chinese officials, which may potentially bias the findings and conclusions. Such interview in a future study will likely facilitate our understanding of the salmon sanction and could contribute greatly to the literature. Future research on the role of Scotland (UK) and Faroe Islands, which have gained significant market access during the salmon sanction, would also be useful. Finally, a formal statistical analysis on the trade data will also be helpful.

Notes

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Tables and Figures

Table 1. Time frame[a] for redistributing fresh/chilled whole Norwegian salmon

	Before 2011	Since 2011		
		Through normal channel[b]	Port-shifting[c]	Transhipment / smuggling
Harvest from the sea in Norway and transportation to destination airport[d]	2-3 days			
Pass sanitation tests and veterinary inspections	No delay[e]	Up to 20 days	No delay	Likely no delay[f]
Clear customs	No delay			Likely no delay[f]
Transport to importers' storage facility	No delay[g]	No delay[g]	Can take 2 days depending on the location of the airport	2 to 6 days[h]
Days left to redistribute from importers to consumers	12-13 days	Can be rotten upon arrival at the importer's storage facility	10-11 days	6-11 days

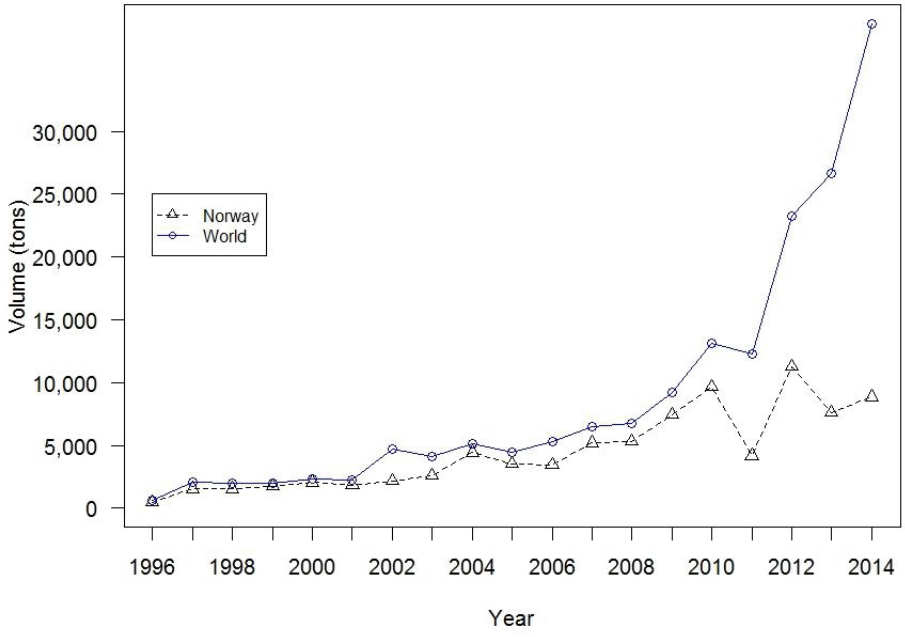
[a] Fresh/chilled salmon is best when consumed within 15 days after harvested from the sea.
[b] The normal channel refers to importing through a Chinese airport where the stringent sanitation tests and veterinary inspections on Norwegian salmon are implemented.
[c] Port-shifting refers to the practice of taking advantage of using a new port of entry where the stringent sanitation tests and veterinary inspections were not implemented or where the importers have brokers with good connections with customs officials (potentially involving corruption).
[d] The destination airport is in China, Hong Kong, or Vietnam.
[e] Before 2011, Norwegian salmon could clear customs immediately in China, while sanitation

tests and veterinary inspections would be conducted at the same time. The salmon, although very rare, would be recalled if a test or inspection failed.

[f] For shipments that are transhipped or smuggled via Hong Kong, there is no additional sanitation test or veterinary inspection nor delay at customs. It is not known how much time it takes in Vietnam, but no delay there is expected.

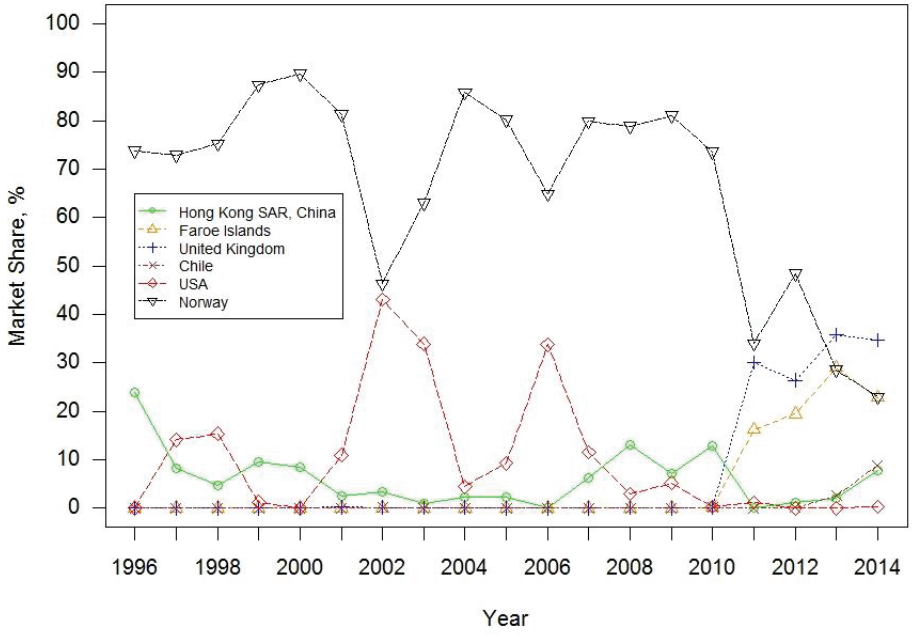
[g] The shipment is sent to the airport in the same city where the importer is based and where the wholesale market is located. It takes at most two hours to transport the shipment from the airport to the importer's storage facility.

[h] It takes some time to transport the salmon from a Vietnamese airport to the border, to cross the border into China, and finally to reach the importer's storage facility. Furthermore, each segment may involve unloading and loading of salmon onto a different vehicle, train, or plane, which takes additional time.



Source: UN Comtrade and Norwegian Seafood Council.

Figure 1. Mainland China's imports of fresh/chilled whole salmon from Norway and the world



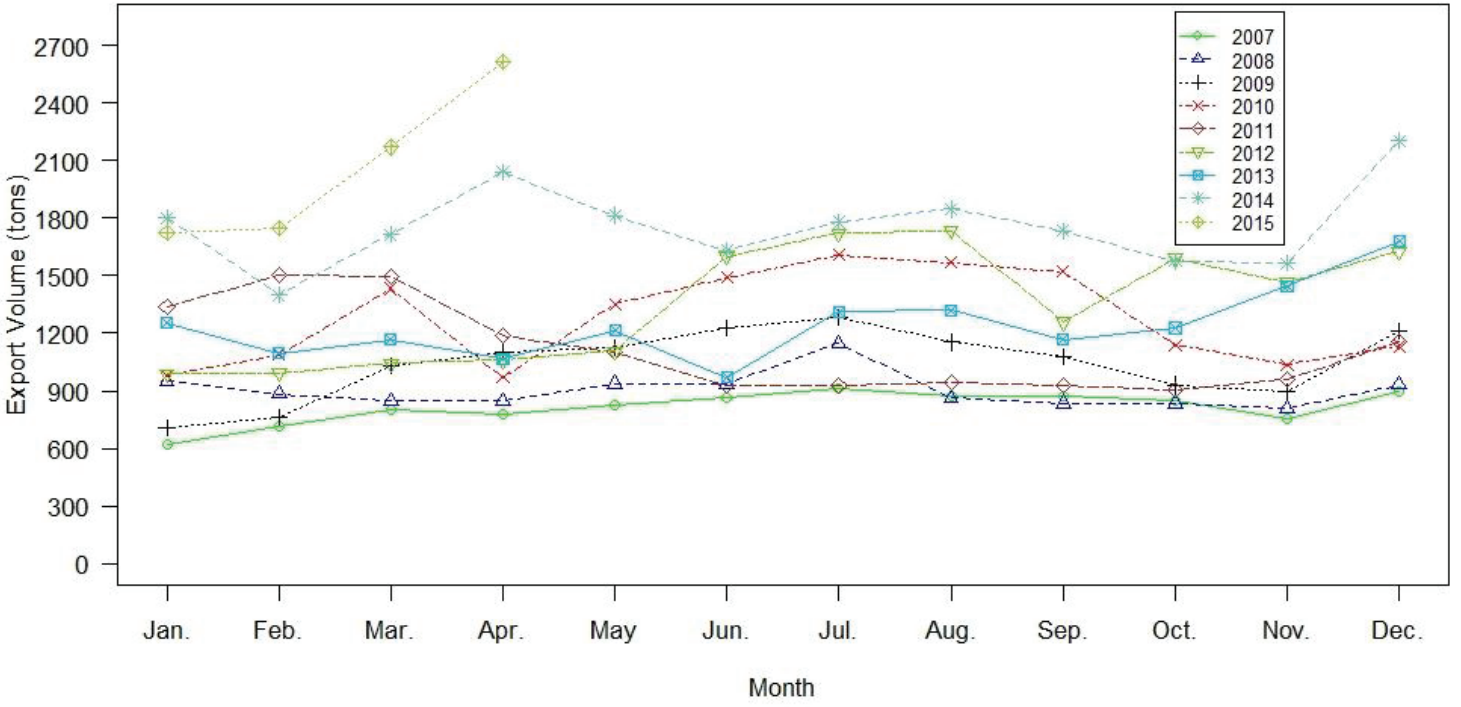
Source: UN Comtrade, Norwegian Seafood Council, and Government of Hong Kong, Census and Statistics Department.

Figure 2: Market shares in mainland China's fresh/chilled whole salmon market (1996 – 2014)

Note: Cities highlighted in green ovals denote China's four top-level wholesale salmon markets; blue ovals denote the airports used for port-shifting; Hong Kong and Vietnam are the transhipment points. Hanoi, the capital of Vietnam, and Hong Kong are covered in red oval.

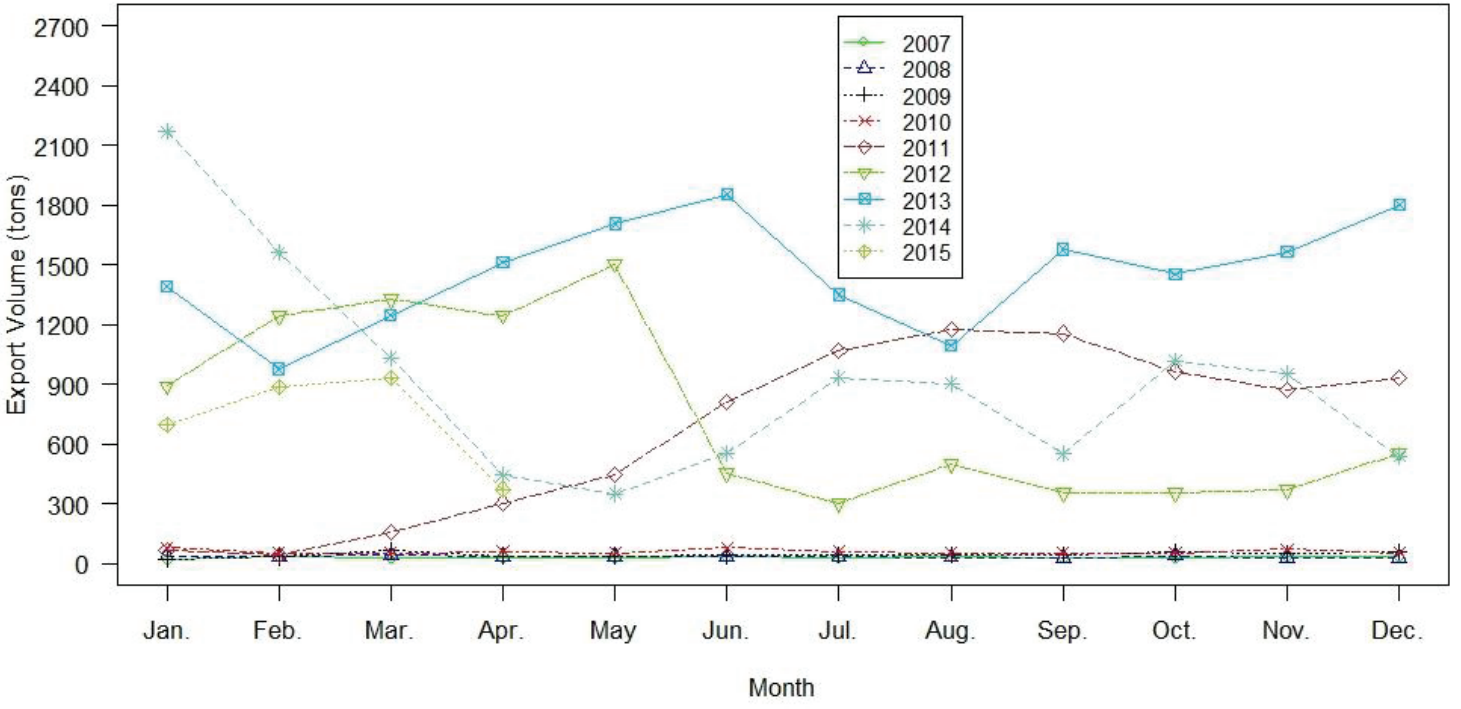
Source: The original map is from Google Maps. We manually edited the map in GIMP2.

Figure 3. Location of China's key airports and wholesale salmon markets



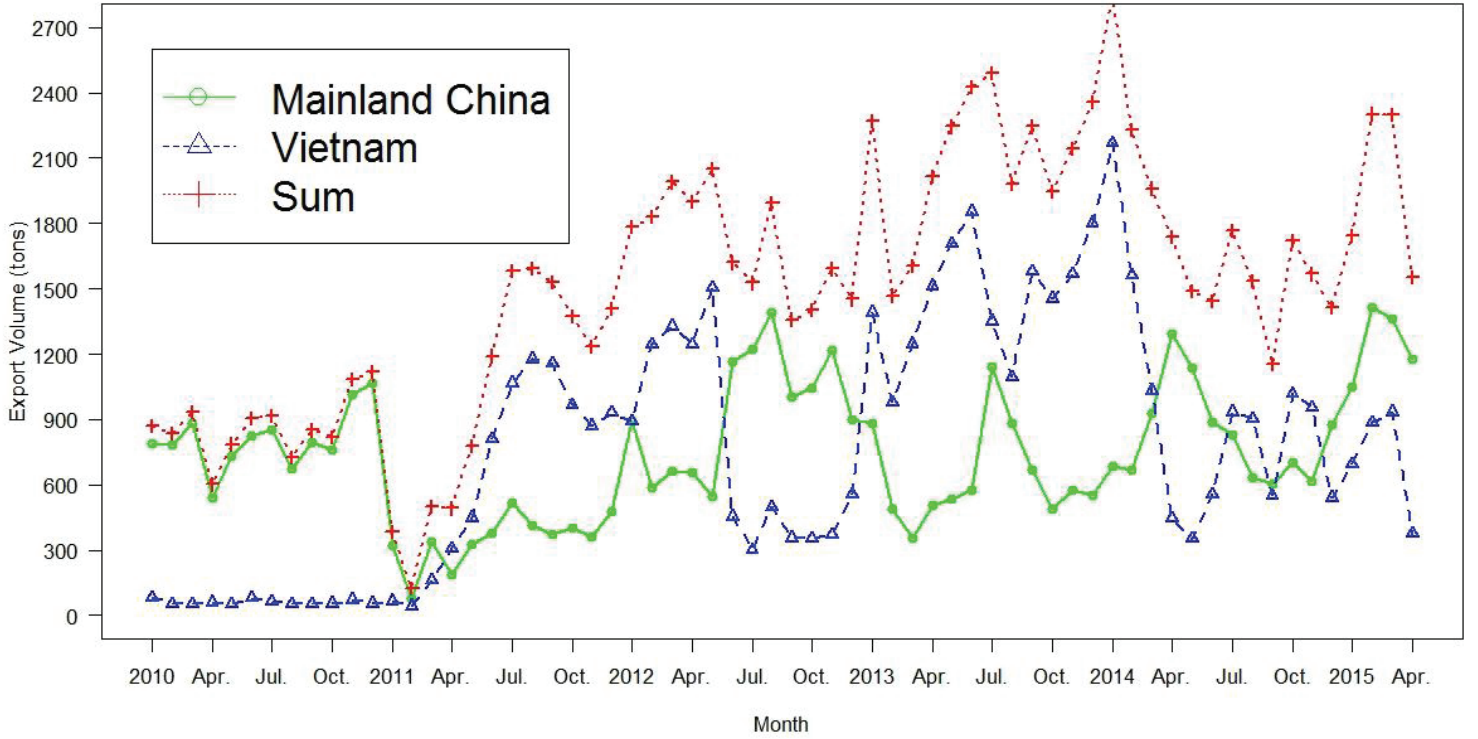
Source: Norwegian Seafood Council.

Figure 4. Hong Kong's monthly imports of Norwegian fresh/chilled whole salmon (January 2007 – April 2015)



Source: Norwegian Seafood Council.

Figure 5: Vietnam's monthly imports of Norwegian fresh/chilled whole salmon (January 2007 – April 2015)



Source: Norwegian Seafood Council.

Figure 6. Norway's monthly direct exports of fresh/chilled whole salmon to mainland China and Vietnam (January 2010 – April 2015)

Appendix A. Three Questionnaires That Were Used for Mainland China's Importers, Hong Kong's Importers, and Norwegian Salmon Firms' Representatives in China

Appendix A1. The Questionnaire for Mainland China's Importers

Survey on China's Salmon Market

中国大陆的三文鱼市场

Joint Survey by

联合问卷，来自

School of Economics and Business, Norwegian University of Life Sciences

挪威生命科学大学经济与商业学院

&

Department of International Economics, Norwegian Institute of International Affairs

挪威国际事务研究所国际经济部门

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二零一四年一月

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The Chinese salmon market, growing rapidly each year, has become an important market for salmon producers globally. This survey intends to gather knowledge on current status of salmon transactions with China, so that constructive recommendations can be made to stakeholders in the business.

中国的三文鱼市场，经过每年的快速增长，已成为全球范围内三文鱼生厂商的重要市场。我们的目标是通过调查中国的三文鱼贸易的现状，向从事三文鱼贸易的公司提供建设性的建议。

Part 1. Basic Information 基本问题

Question 1.1. Is your company part of a larger company?

请问你们的公司是否是另外一个公司的子公司？

Question 1.2. What is the percentage of foreign ownership?

请问你们的公司中，有多少的股份是来源于国外的投资？

Question 1.3. How long have you traded salmon and other seafood products with foreign countries?

请问你们从事三文鱼和其他水产品贸易多少年了？

Question 1.4. Which countries do you import salmon and other seafood products from? Have the shared changed in the last five years?

请问你们的三文鱼和其他水产品你是从哪些国家进口的？从不同国家进口的比重是否在最近五年有发生变化？

Question 1.5. What other seafood products do you import? What are the shares of different types? Have the share changed in the past five years?

请问除三文鱼以外，你们还进口哪些水产品？请问不同的水产品的比重各是多少？这些比重在过去五年是否发生了变化？

Question 1.6. How many employees do you have?

请问你们有多少雇员？

Question 1.7. What is the volume and the value of annual trade?

请问你们一年的贸易量和贸易额有多少？

Question 1.8. Has the business been growing, declining, stable, or no clear trend? What are the trends of country-specific trades, like trade with Norway, with Scotland, and with Faroe Islands?

请问你们公司的贸易生意是在增长、减退、还是比较稳定？你们公司和挪威、苏格兰、法罗群岛之间贸易的趋势是怎么样的？

Question 1.9. Do you import fresh fish, frozen, canned, or other types? If several types of fish are imported, what are the shares of different types? Have the shares changed in the past five years?

你们进口新鲜的鱼、冷冻的鱼、罐头、或者其他种类？如果你们进口不同类别的水产品，这些类别的比重格式多少？这些比重在过去五年有发生变化吗？

Question 1.10. What modes of transportation do you use: sea or air?

你们使用哪种运输方式：航空还是海运？

Question 1.11. What is the typical size of shipment (container, bulk, or part of mixed cargo)? What is the typical value of shipment?

通常一次货运有多大（集装箱、散伙、混合货物）？通常一次货运的价值有多大？

Question 1.12. What transporters do you use, in terms of percentage: Norwegian, Chinese,

or from another country?

你们用那些国家的货运商（挪威、中国、或者来自另外一个国家），他们的比重是多少？

Question 1.13. What type of firms do you sell to: producer, wholesaler or trading company, or retailer or retail chain?

你们销售进口的水产品到哪些公司：生厂商/加工商、批发商/贸易公司、或者零售商？

Question 1.13. Is there a middleman between exporter and importer? If yes, is it an agent, a related trading company, or an unrelated trading company?

你们在进口水产品的时候有中间商吗？如果有，这个中间商是一个个人、相关的贸易公司、或者不相关的贸易公司？

Part 2. Customs Clearance Time 过海关时间

Question 2.1. How long does Chinese custom take to clear a shipment of Norwegian salmon?

一般情况下，来自挪威的三文鱼需要多久才能通过中国海关？

Question 2.2. Do salmon shipments from other countries take less time to clear custom?

一般情况下，来自其他国家的三文鱼是否需要更短一些的时间来通过中国海关？

Question 2.3. So there is (or isn't, depending on answer to Question 2.2) a delay, which is only to Norwegian salmon?

所以和其他国家的三文鱼相比，挪威三文鱼需要更长一点的时间通过中国海关吗？

Question 2.4. If there is a delay, when did it start?

如果挪威三文鱼需要更长一点的时间通过中国海关，这个情况是从什么时候开始的？

Question 2.5. If there is a delay, how has the delay affected your company's business with Norway?

如果挪威的三文鱼需要更长一点的时间通过中国海关，这是否影响你们与挪威的生意？

Question 2.6. If there is a delay, what measures have your company taken towards the problem?

如果挪威的三文鱼需要更长一点的时间通过中国海关，你们采取了什么办法去应对这

个问题？

Part 3. Transshipments 转运

Question 3.1. Does your company import salmon from Norway indirectly through another region or country, such Hong Kong, Vietnam?

请问你们是否通过第三方区域或国际，例如香港、越南，来进口挪威三文鱼？

Question 3.2. If yes, what is the share of shipments that are transshipped?

如果是，请问占多少比重的挪威三文鱼是转运的？

Question 3.3. If yes, why did your company transship salmon?

如果是，请问你们为什么转运三文鱼？

Question 3.4. Are there companies, among Norwegian exporters and Chinese importers, indirect trade Norwegian salmon through another region or country, like Hong Kong, Vietnam?

请问是否有其他公司（包括挪威的出口商和中国的进口商）通过另外一个国家或者区域（例如香港、越南）进行间接的挪威三文鱼贸易？

Question 3.5. If yes, can you provide an example?

如果是，请问你们是否能够提供一个例子？

Part 4. Quota 配额

Question 4.1. When did the quota system begin to take effect?

进口配额是什么时候开始启用的？

Question 4.2. What is the process by which the quota is administered? Is it a one-stop shop process (one office with immediate approval of a license)? Are there any additional fees or steps required to obtain the license?

进口配额的管理程序是怎么样的？你们能够在一个部门里办理所有的手续吗？为了拿到配额，你们是否需要支付额外的费用、或者办理额外的手续？

Question 4.3. Does the quota system affect importers and distributors? If yes, in what kind of way?

进口配额影响进口商和分销商吗？如果是，是怎么样的影响？

The following questions will only be raised, if the quota system applies to this importer or distributor.

如果配额系统影响你们公司，请回答以下五个问题。

Question 4.4. How large was your quota in the first year? How large is it this year?

你们公司的第一年的配额是多少？今年的配额是多少？

Question 4.5. Did you apply for more quota?

你们是否申请了额外的配额？

Question 4.6. If yes, how long did it take for your company to get additional quota?

如果是，你们公司用了多久拿到额外的配额？

Question 4.7. How do your competitors react to the quota system?

你们的竞争对手是怎么应对配额系统的？

Question 4.8. Do your competitors have less, similar, or more quota than you? Why?

和你们相比，你们的竞争对手有少一些、差不多、或者更对配额吗？为什么？

Part 5. Sanitation 卫生

Question 5.1. Who's responsible for handling veterinary and health issues: the exporter, the intermediary, the transporter, or the importer?

谁对水产品的卫生负责：出口商、中间商、货运公司、还是进口商？

Question 5.2. To what extent is veterinary and health concerns an issue to your company:

对你们公司来说，健康和卫生：

(a) not a problem 不是问题

(b) a modest problem 一个普通问题

(c) a significant problem 一个大问题

(d) a huge problem 一个特别大的问题

Question 5.3. Has the new scheme lead to an increase, no change, or a decrease of export volume?

新的卫生认证导致了出口量的增加、没变化、或者减少？

Question 5.4. If yes, what caused it (check all that apply and rank them by importance from 1 to 5, with 1 being least important and 5 being most important):

如果贸易量因为因为新的卫生系统发生了变化，请问是什么导致了这个变化？请选择所有导致了这个变化的原因，并用 1 到 5 的数字表示每个原因对于贸易量变化的影响

（1 表示影响最小；5 表示影响最大）

(a) increased production costs due to veterinary issues 因为卫生问题，增了生产成本

(b) delays, quality degradation, and shipment loses 延误、质量的下降、和货运的损失

(c) cost of manpower to handle health issues 用于解决卫生问题的人力成本

(d) capital investment to address health and veterinary issues 用于解决健康和卫生问题的投资

(e) payment to external actors to solve or handle veterinary issues 支付第三方去解决或者处理卫生问题

(f) missed trade opportunities due to barriers or uncertainty 因为卫生问题或者关于卫生的不确定性，失去了贸易的机会

(g) others, please specify 其他原因（请写下来）

Question 5.5. What is your firm's strategy on this (check all that apply): 你的公司的应对测罗是什么（选择所有相关的）

(a) step up and work on health and veterinary issues 着手于健康和卫生问题

(b) switch to other exporters (from other countries) 换用其他国家的出口商

(c) switch to other products 更换贸易的商品类别

(d) more reserved approach to the market 观望

(e) other, please specify 其他（请写下来）

Question 5.6. What is your view on health and veterinary issues (check all that apply):

你对于健康和卫生问题的观点是什么（请选择所有相关的）：

(a) bureaucracy or incompetence in importing country 进口国的官僚主义或者无能

(b) corruption in importing country 进口国的腐败

(c) deliberate policies to protect domestic producers in importing country 进口国故意设置的政策，用于保护本国的产品

(d) struggles for market power in importing country 进口国在争取市场话语权

(e) quality degradation in transport 运输过程中质量的损失

(f) conflict between different national health and veterinary systems 因为不同国家质检的卫生、健康系统所产生的冲突

(g) inappropriate practices by Chinese authorities in the field 中国政府在这方面有不恰当的做法

(h) indirect measure to fight other trade problems (tax or tariff evasion etc.) 间接的、用来解决其他贸易问题（例如逃税等）的方法

(j) other, please specify 其他观点（请写下来）

Question 5.8. What are your firm's specific experiences on health and veterinary issues?

你们公司在健康和卫生相关的问题上有哪些经验？

Question 5.9. What are the difficulties when dealing with health and veterinary issues? What measure has your firm taken towards these difficulties?

在健康和卫生方面，你们公司有过哪些困难？你们采取了什么措施去解决这些问题？

Question 5.10. What are your views on policy and the role of various actors related to China's handling of health and veterinary issues?

你怎么看中国在水产品进口的卫生和健康方面的政策？哪些人或者机构影响了这些政策？

Question 5.11. Is there some evidence on corruption related to health and veterinary control and approval? How does it manifest itself?

是否有政府官员在卫生和健康的检查和通过上有腐败？如果是，这是怎么产生的？

Question 5.12. A new scheme on health and safety certificate has been effective since May 2013. How has that affected your business?

在 2013 年 5 月的时候，一个新的健康和安全的认证启用了。这个认证影响了你们的生意吗？

Question 5.13. Has the new scheme increased costs? If yes, how much in both percentage

and nominal value?

这个认证增加了你们的成本吗？如果是，增加了多少的成本？和原来的成本相比，这些增加的成本有多大的比重？

Question 5.14. In this system, are all companies treated in an identical way?

在这个新的健康、安全认证系统里，是否所有的公司都受到了平等的对待？

Part 6. Market Share

Question 6.1. Norwegian salmon had majority of the market share until recent years. Has your firm's market share changed?

挪威三文鱼曾经拥有大多数的市场份额，但这些年市场份额急剧下降。你们公司的市场份额是否发生了变化？

Question 6.2. How did your company react to this change?

你们公司是怎么应对这个变化的？

Question 6.3. Among all your imports of salmon, what are the shares of countries?

在你们公司进口的三文鱼中，不同国家的比重是怎么样的？

Question 6.4. What do you think about the future of the market share?

你怎么看未来的市场份额？

Part 7. Miscellaneous 其他问题

Question 7.1. We want to understand the current state of Chinese salmon trade. Are there something that you would like to tell me, in case I did not ask?

我们想要深入了解目前的中国的三文鱼贸易。如果我遗漏了一些重要问题，请问你是否可以补充？

Question 7.2. What do you think about the future of salmon business, particularly trade?

你怎么看未来的三文鱼生意，特别是贸易？

Question 7.3. Why did you take our survey?

为什么你接受这个问卷调查？

Question 7.4. Can I contact you again for another survey later this year?

我可以在今年晚些时候再找你做一次问卷调查吗？

Appendix A2. The Questionnaire for Hong Kong's Importers

Survey on Hong Kong's Salmon Market

香港的三文魚市場調查問卷

Joint Survey by

聯合問卷，來自

School of Economics and Business, Norwegian University of Life Sciences

挪威生命科學大學經濟與商業學院

&

Department of International Economics, Norwegian Institute of International Affairs

挪威國際事務研究所國際經濟部門

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The Chinese salmon market, growing rapidly each year, has become an important market for salmon producers globally. This survey intends to gather knowledge on current status of salmon transactions with China, so that constructive recommendations can be made to stakeholders in the business.

中國大陸和香港的三文魚市場，經過每年的快速增長，已成為全球範圍內三文魚生產商的重要市場。我們的目標是通過調查中國的三文魚貿易的現狀，向從事三文魚貿易的公司提供建設性的建議。

Part 1. Basic Information 基本問題

Question 1.1. Is your company part of a larger company?

請問你們的公司是否是另外一個公司的子公司？

Question 1.2. What is the percentage of foreign ownership?

請問你們的公司中，有多少的股份是來源於國外的投資？

Question 1.3. How long have you traded salmon and other seafood products with foreign countries?

請問你們從事三文魚和其他水產品國際貿易多少年了？

Question 1.4. Which countries do you import salmon and other seafood products from? Have the shares changed in the last five years?

請問你們的三文魚和其他水產品是從哪些國家進口的？從不同國家進口的比重是否在最近五年有發生變化？

Question 1.5. What other seafood products do you import? What are the shares of different types? Have the share changed in the past five years?

請問除三文魚以外，你們還進口哪些水產品？請問不同的水產品的比重各是多少？這些比重在過去五年是否發生了變化？

Question 1.6. Do you trade salmon or other seafood products with mainland China? If yes, how long have you been in business with mainland China?

請問你們是否和大陸有三文魚和其他水產品的貿易？如果是，請問你們和大陸做這些貿易有多少年了？

Question 1.7. How many employees do you have?

請問你們公司有多少僱員？

Question 1.8. What is the volume and the value of annual trade?

請問你們一年的貿易量和貿易額有多少？

Question 1.9. Has the business been growing, declining, stable, or no clear trend? What are the trends of country-specific trades, like trade with Norway, with Scotland, and with Faroe Islands?

請問你們公司的貿易生意是在增長、減退、還是比較穩定？你們公司和挪威、蘇格蘭、法羅群島之間貿易的趨勢是怎麼樣的？

Question 1.10. Do you import fresh fish, frozen, canned, or other types? If several types of fish are imported, what are the shares of different types? Have the shares changed in the past five years?

你們進口新鮮的魚、冷凍的魚、罐頭、或者其他種類？如果你們進口不同類別的水產品，這些類別的比重各是多少？這些比重在過去五年有發生變化嗎？

Question 1.11. What modes of transportation do you use: sea or air?

你們使用哪種運輸方式：航空還是海運？

Question 1.12. What is the typical size of shipment (container, bulk, or part of mixed cargo)? What is the typical value of shipment?

通常一次貨運有多大（集裝箱、散貨、混合貨物）？通常一次貨運的價值有多大？

Question 1.13. What transporters do you use, in terms of percentage: Norwegian, from mainland China, from Hong Kong or from another country?

你們用哪些國家的貨運商（挪威、大陸、香港、或者來自另一個國家），他們的比重是多少？

Question 1.14. What type of firms do you sell to: producer, wholesaler or trading company, or retailer or retail chain?

你們銷售進口的水產品到哪些公司：生產商/加工商、批發商/貿易公司、或者零售商？

Question 1.15. Is there a middleman between exporter and importer? If yes, is it an agent, a related trading company, or an unrelated trading company?

你們在進口水產品的時候有中間商嗎？如果有，這個中間商是一個個人、相關的貿易公司、或者不相關的貿易公司？

Part 2. Customs Clearance Time 過海關時間

Question 2.1. How long does Hong Kong's Custom take to clear a shipment of Norwegian salmon?

一般情況下，來自挪威的三文魚需要多久才能通過香港海關？

Question 2.2. Do salmon shipments from other countries take less time to clear custom?

一般情況下，來自其他國家的三文魚是否需要更短一些的時間來通過香港海關？

Question 2.3. So there is (or isn't, depending on answer to Question 2.2) a delay, which is only to Norwegian salmon?

所以和其他國家的三文魚相比，挪威三文魚需要更長一點的時間通過香港海關嗎？

Question 2.4. If there is a delay, when did it start?

如果挪威三文魚需要更長一點的時間通過香港海關，這個情況是從什麼時候開始的？

Question 2.5. If there is a delay, how has the delay affected your company's business with Norway?

如果挪威的三文魚需要更長一點的時間通過香港海關，這是否影響你們公司與挪威的生意？

Question 2.6. If there is a delay, what measures have your company taken towards the problem?

如果挪威的三文魚需要更長一點的時間通過香港海關，你們採取了什麼辦法去應對這

個問題？

Part 3. Transshipments 轉運

Question 3.1. Does your company re-export seafood products such as Norwegian salmon to mainland China?

請問你們是否出口水產品（比如挪威三文魚）到大陸？

Question 3.2. If yes, what is the share of shipments that are transshipped?

如果是，請問佔多少比重的水產品是出口到大陸的？

Question 3.3. If yes, do you change labels when re-exporting, for example country of origin?

如果是，請問你們在出口到大陸的時候是否更改貨物信息，比如水產品的產地？

Question 3.4. Are there companies, among Norwegian exporters and Chinese (Hong Kong and mainland) importers, indirect trade Norwegian salmon through another region or country, like Hong Kong, Vietnam?

請問是否有其他公司（包括挪威的出口商、香港和大陸的進口商）通過另外一個國家或者區域（例如香港、越南）銷售挪威三文魚到大陸？

Question 3.5. If yes, can you provide an example?

如果是，請問你們是否能夠提供一個例子？

Part 4. Quota 配額

Question 4.1. Does the quota system in mainland China affect importers and distributors in Hong Kong? If yes, in what kind of way?

大陸的三文魚進口配額是否影響到香港的進口商和出口商？如果有影響，請問是什麼樣的影響？

Question 4.2 When did the quota system in mainland China begin to take effect?

什麼時候大陸啟用了配額系統？

Question 4.2. What is the process by which the quota is administered? Is it a one-stop shop process (one office with immediate approval of a license)? Are there any additional fees or steps required to obtain the license?

請問配額的管理程序是怎麼樣的？你們能夠在一個部門裏辦理所有的手續嗎？爲了拿到配額，你們是否需要支付額外的費用、或者辦理額外的手續？

Question 4.3. If yes, in what kind of way?

如果是，這些額外的費用和手續是怎麼樣的？

The following questions will only be raised, if the quota system in mainland China applies to this importer or distributor.

如果大陸的配額系統影響你們公司，請回答以下五個問題。

Question 4.4. How large was your quota in the first year? How large is it this year?

你們公司的第一年的配額是多少？今年的配額有多少？

Question 4.5. Did you apply for more quota?

你們是否申請了額外的配額？

Question 4.6. If yes, how long did it take for your company to get additional quota?

如果是，你們公司用了多久拿到了額外的配額？

Question 4.7 How do your competitors react to the quota system?

你們的競爭對手是怎麼應對配額系統的？

Question 4.8. Do your competitors have less, similar, or more quota than you? Why?

和你們相比，你們的競爭對手有少一些、差不多、或者更多配額嗎？爲什麼？

Part 5. Sanitation 衛生

Question 5.1. Who's responsible for handling veterinary and health issues: the exporter, the intermediary, the transporter, or the importer?

誰對水產品的衛生負責：出口商、中間商、貨運公司、還是進口商？

Question 5.2. To which extent is veterinary and health issues an concern to your company:

對你們公司來說，衛生和健康：

(a) not a problem 不是問題

(b) a modest problem 一個普通問題

(c) a significant problem 一個大問題

(d) a huge problem 一個特別大的問題

Question 5.3. What is your firm's strategy on this (check all that apply):

你們公司對於這些問題的策略是什麼（請選擇所有相關的）：

(a) step up and work on health and veterinary issues 着手於健康和衛生問題

(b) switch to other exporters (from other countries) 換用其他國家的出口商

(c) switch to other products 更換貿易的產品類別

(d) more reserved approach to the market 觀望

(e) other, please specify 其他方式（請寫下來）

Question 5.4. What is your view on health and veterinary issues (check all that apply):

你對於健康和衛生問題的觀點是什麼（請選擇所有相關的）：

(a) bureaucracy or incompetence in importing country 進口國的官僚主義或者無能

(b) corruption in importing country 進口國的腐敗

(c) deliberate policies to protect domestic producers in importing country 進口國故意設置的政策，用於保護本國的產品

(d) struggles for market power in importing country 進口國在爭取市場話語權

(e) quality degradation in transport 運輸過程中質量的損失

(f) conflict between different national health and veterinary systems 因爲不同國家之間的衛生、健康系統所產生的衝突

(g) inappropriate practices by Hong Kong's authorities in the field 香港政府在這方面有不恰當的做法

(h) indirect measure to fight other trade problems (tax or tariff evasion etc.) 間接的、用來解決其他貿易問題（例如逃稅等）的方法

(j) other, please specify 其他觀點（請寫下來）

Question 5.5. What are your firm's specific experiences on health and veterinary issues?

你們公司在健康和衛生相關的問題上有哪些經驗？

Question 5.6. What are the difficulties when dealing with health and veterinary issues? What measure has your firm taken towards these difficulties?

在健康和衛生方面，你們公司有過哪些困難？你們採取了什麼措施去解決這些問題？

Question 5.7. What are your views on policy and the role of various actors related to Hong Kong's handling of health and veterinary issues? How does it manifest itself?

你怎麼看香港在水產品進口的衛生和健康方面的政策？哪些人或者機構影響了這些政策？這些影響是怎麼產生作用的？

Question 5.8. Is there some evidence on corruption related to health and veterinary control and approval?

是否有政府官員在衛生和健康的檢查和通過上有腐敗？

Question 5.9. A new scheme on health and safety certificate has been effective in mainland since May 2013. How has that affected your business?

大陸在 2013 年 5 月啓用了一個新的健康和安全的認證。這個認證影響了你們的生意嗎？

Question 5.10. Has the new scheme increased costs? If yes, how much in both percentage and nominal value?

這個認證增加了你們的成本嗎？如果是，增加了多少的成本？和原來的成本相比，這

些增加的成本有多大比重？

Question 5.11. In this system, are all companies treated in an identical way?

在大陸的新的健康、安全認證系統裏，是否所有的公司都受到了平等的對待？

Question 5.12. Has the new scheme lead to an increase, no change, or a decrease of export volume?

請問新的衛生系統導致了出口量的增加、沒變化、或者減少？

Question 5.13. If changed, what caused it (check all that apply and rank them by importance from 1 to 5, with 1 being least important and 5 being most important):

如果貿易量因爲新的衛生系統發生了變化，請問是什麼導致了這個變化？請選擇所有導致了這個變化的原因，並用 1 到 5 的數字表示每個原因對於貿易量變化的影響（1 表示影響最小；5 表示影響最大）：

(a) increased production costs due to veterinary issues 因爲衛生問題，增大了生產成本

(b) delays, quality degradation, and shipment loses 延誤、質量的下降、和貨運的損失

(c) cost of manpower to handle health issues 用於解決衛生問題的人力成本

(d) capital investment to address health and veterinary issues 用於解決健康和衛生問題的投資

(e) payment to external actors to solve or handle veterinary issues 支付第三方去解決或者

處理衛生問題

(f) missed trade opportunities due to barriers or uncertainty 因爲衛生問題或者關於衛生的不確定性，失去了貿易的機會

(g) other, please specify 其他原因（請寫下來）

Part 6. Market Share 市場份額

Question 6.1. Norwegian salmon had majority of the market share in mainland until recent years. Has Norwegian salmon's market share in Hong Kong declined as well?

挪威三文魚曾經在大陸擁有大多數的市場份額，但近些年市場份額急劇下降。請問挪威三文魚在香港的市場份額是否也降低了？

Question 6.2. Has your firm's market shared changed: increase or decrease? If yes, how did your company react to this change?

你們公司的市場份額是否發生了變化：增加、減少？如果發生了變化，你們公司是怎麼應對這個變化的？

Question 6.3. Among all your imports of salmon, what are the shares of countries?

在你們公司進口的三文魚中，不同國家的比重是怎麼樣的？

Question 6.4. What do you think about the future of the market share?

你怎麼看未來的市場份額？

Part 7. Miscellaneous 其他問題

Question 7.1. How have the salmon market changed in Hong Kong?

香港的三文魚市場發生了哪些變化？

Question 7.2. We want to understand the current state of salmon trade. Are there something that you would like to tell me, in case I did not ask?

我們想要深入瞭解目前的三文魚貿易。如果我遺漏了一些重要問題，請問你是否可以補充？

Question 7.3. What do you think about the future of salmon business, particularly trade?

你怎麼看未來的三文魚生意，特別是貿易？

Question 7.4. Why did you take our survey?

爲什麼你決定接受這個調查問卷？

Question 7.5. Can I contact you again for another survey later this year?

我可以在今年晚些時候再找你做一次調查問卷嗎？

Appendix A3. The Questionnaire for Norwegian Salmon Firms' Representatives in China

Survey on China's Salmon Market

中国三文鱼市场的调查问卷

Joint Survey by

联合问卷，来自

School of Economics and Business, Norwegian University of Life Sciences

挪威生命科學大學經濟與商業學院

&

Department of International Economics, Norwegian Institute of International Affairs

挪威國際事務研究所國際經濟部門

January 2014

二零一四年一月

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The Chinese salmon market, growing rapidly each year, has become an important market for salmon producers globally. This survey intends to gather knowledge on current status of salmon transactions with China, so that constructive recommendations can be made to stakeholders in the business.

中國的三文魚市場，經過每年的快速增長，已成為全球範圍內為三文魚生產商的重要市場。我們的目標是通過調查中國的三文魚貿易的現狀，向從事三文魚貿易的公司提供建設性的建議。

Part 1. Basic Information 基本問題

Question 1.1. Is your company part of a larger company?

請問你們的公司是否是另外一個公司的子公司？

Question 1.2. What is the percentage of foreign ownership?

請問你們的公司中，有多少的股份是來源於國外的投資？

Question 1.3. How long have you traded salmon and other products with China? What are the other products that you traded?

請問你們從事三文魚和其他水產品國際貿易多少年了？除了三文鱼，你们出口或者进口哪些其他的产品？

Question 1.4. What is the source of raw materials: own catch, fish farming, bought externally but own slaughtering or processing, or pure trading with no processing?

请问原材料（鱼）的来源是什么：自己捕捞的，自己养殖的，从其他公司买入并自己宰杀或者处理，还是没有任何处理完全从事贸易？

Question 1.5. How many employees do you have in China?

請問你們公司有多少僱員？

Question 1.6. What is the volume and the value of annual trade?

請問你們一年的貿易量和貿易額有多少？

Question 1.7. Has the export been growing, declining, stable, or no clear trend?

請問你們公司的貿易生意是在增長、減退、還是比較穩定？

Question 1.8. Do you export fresh fish, frozen, canned, or other types? If several types of fish are exported, what are the shares of different types? Have the share changed in the last 5 years?

你們出口新鮮的魚、冷凍的魚、罐頭，或者其他種類？如果你們出口不同類別的水產品，這些類別的比重各是多少？這些比重在過去五年有發生變化嗎？

Question 1.9. What modes of transportation do you use: sea or air?

你們使用哪種運輸方式：航空還是海運？

Question 1.10. What is the typical size of shipment (container, bulk, or part of mixed cargo)? What is the typical value of shipment?

通常一次貨運有多大（集裝箱、散貨、混合貨物）？通常一次貨運的價值有多大？

Question 1.11. What transporters do you use, in terms of percentage: Norwegian, Chinese, or from another country?

你們用哪些國家的貨運商（挪威、中国或者來自另一個國家），他們的比重是多少？

Question 1.12. What type of importers do you trade with: producer, wholesaler or trading company, or retailer or retail chain?

你們銷售進口的水產品到哪些公司：生產商/加工商、批發商/貿易公司、或者零售

商？

Question 1.13. Is there a middleman between exporter and importer? If yes, is it an agent, a related trading company, or an unrelated trading company?

你們在進口水產品的時候有中間商嗎？如果有，這個中間商是一個個人、相關的貿易公司、或者不相關的貿易公司？

Part 2. Customs Clearance Time 過海關時間

Question 2.1. How long does Chinese custom take to clear a shipment of Norwegian salmon?

一般情況下，來自挪威的三文魚需要多久才能通過中国海關？

Question 2.2. Do salmon shipments from other countries take less time to clear custom?

一般情況下，來自其他國家的三文魚是否需要更短一些的時間來通過中国海關？

Question 2.3. So there is (or isn't, depending on answer to Question 2.2) a delay, which is only to Norwegian salmon?

所以和其他國家的三文魚相比，挪威三文魚需要更長一點的時間通過中国海關嗎？

Question 2.4. If there is a delay, when did it start?

如果挪威三文魚需要更長一點的時間通過中国海關，這個情況是從什麼時候開始的？

Question 2.5. If there is a delay, how has the delay affected your company's business?

如果挪威的三文魚需要更長一點的時間通過中国海關，這是否影響你們公司的生意？

Question 2.6. If there is a delay, what measures have your company taken towards resolving the problem?

如果挪威的三文魚需要更長一點的時間通過中国海關，你們採取了什麼辦法去應對這個問題？

Part 3. Transshipments 轉運

Question 3.1. Does your company export salmon to China indirectly through another region or country, such as Hong Kong, Vietnam?

请问你们公司是否间接地通过第三方国家或者地区（例如香港、越南）往中国出口三文鱼？

Question 3.2. If yes, what is the share of shipments that are transshipped?

如果是，請問佔多少比重的水產品是转口到中国的？

Question 3.3. If yes, why did your company transship salmon?

如果是，请问你们为什么转口三文鱼？

Question 3.4. Are there companies, among Norwegian exporters and Chinese importers, indirect trade Norwegian salmon through another region or country, such as Hong Kong, Vietnam?

请问除了你们公司以外，是否有其他的挪威出口商或者中国进口商，间接地通过另外一个国家或者地区（例如香港和越南）出口或者进口挪威三文鱼？

Question 3.5. If yes, can you provide an example?

如果是，你能提供一个例子吗？

Part 4. Quota 配額

Question 4.1. When did the quota system begin to take effect?

什么时候配额系统开始生效的？

Question 4.2. What is the process by which the quota is administered? Is it a one-stop shop process (one office with immediate approval of license)? Are there any additional fees or steps required to obtain the license?

請問配額的管理程序是怎麼樣的？你們能夠在一個部門裏辦理所有的手續嗎？爲了拿到配額，你們是否需要支付額外的費用，或者辦理額外的手續？

Question 4.3. How does the quota system affect your company's business? Have you been able to fill your quota?

请问这个配额系统对你们公司有什么影响？你们的贸易额达到了你们的配额了吗？

Question 4.4. How large was your quota in the first year? How large is it this year?

你們公司的第一年的配額是多少？今年的配額有多少？

Question 4.5. Did you apply for more quotas? Is the that process automatic (applications accepted immediately or are there other considerations for obtaining approval)?

你是否申請了額外的配額？请问申请额外的配额的过程是自动化的吗（申请是否是立即被受理，还是有会其他方面的考虑因素？）

Question 4.6. If yes, how long did it take for your company to get additional quota?

如果是，你們公司用了多久拿到了額外的配額？

Question 4.7. How do your competitors react to the quota system?

你們的競爭對手是怎麼應對配額系統的？

Question 4.8. Do your competitors have less, similar, or more quota than you? Why?

和你們相比，你們的競爭對手有少一些、差不多、或者更多配額嗎？爲什麼？

Part 5. Sanitation 衛生

Question 5.1. Who's responsible for handling veterinary and health issues: the exporter, the intermediary, the transporter, or the importer?

誰對水產品的衛生負責：出口商、中間商、貨運公司、還是進口商？

Question 5.2. To which extent is veterinary and health concerns an issue for your company:

對你們公司來說，衛生和健康：

(a) not a problem 不是問題

(b) a modest problem 一個普通問題

(c) a significant problem 一個大問題

(d) a huge problem 一個特別大的問題

Question 5.3. Has the new scheme lead to an increase, no change, or a decrease of export volume?

请问新的卫生系统导致了贸易的增加、无影响还是减少？

Question 5.4. If yes, what caused it (check all that apply and rank them by importance from 1 5, with 1 being least important and 5 being most important):

如果是，有哪些作用因素（选择所有相关的，并用 1 到 5 表示重要程度：1 最不重要，5 最重要）：

(a) increased production costs due to veterinary issues 因为卫生方面的问题增加了成本

(b) delays, quality degradation, and shipment loses 延误、质量的下降、和运输过程中的损失

(c) cost of manpower to handle health issues 处理这些问题的人力成本

(d) capital investment to address health and veterinary issues 解决健康和卫生方面问题的资本投资

(e) payment to external actors to solve or handle veterinary issues 支付解决卫生问题的第三方公司

(f) missed trade opportunities due to barriers or uncertainty 因为卫生问题或者不确定性丧失了贸易的机会

(g) others, please specify 其他，请阐明

Question 5.5. What is your firm's strategy on this (check all that apply):

你們公司對於這些問題的策略是什麼（請選擇所有相關的）：

(a) step up and work on health and veterinary issues 着手於健康和衛生問題

(b) withdraw from export market 換用其他國家的出口商

(c) switch to other products 更換貿易的產品類別

(d) more reserved approach to the market 觀望

(e) other, please specify 其他方式（請寫下來）

Question 5.6. What is your view on health and veterinary issues (check all that apply):

你對於健康和衛生問題的觀點是什麼（請選擇所有相關的）：

(a) bureaucracy or incompetence in importing country 進口國的官僚主義或者無能

(b) corruption in importing country 進口國的腐敗

(c) deliberate policies to protect domestic producers in importing country 進口國故意設置的政策，用於保護本國的產品

(d) struggles for market power in importing country 進口國在爭取於市場話語權

(e) quality degradation in transport 運輸過程中質量的損失

(f) conflict between different national health and veterinary systems 因爲不同國家之間的衛生、健康系統所產生的衝突

(g) inappropriate practices by Norwegian authorities in the field 挪威政府在這方面有不恰當的做法

(h) inappropriate practices by Norwegian authorities in the field 中国政府在這方面有不恰當的做法

(i) indirect measure to fight other trade problems (tax or tariff evasion etc.) 間接的、用來解決其他貿易問題（例如逃稅等）的方法

(j) other, please specify 其他觀點（請寫下來）

Question 5.8. What are your firm's specific experiences on health and veterinary issues?

你們公司在健康和衛生相關的問題上有哪些經驗？

Question 5.9. What are the difficulties when dealing with health and veterinary issues? What measure has your firm taken towards these difficulties?

在健康和衛生方面，你們公司有過哪些困難？你們採取了什麼措施去解決這些問題？

Question 5.10. What are your views on policy and the role of various actors related to Norway's handling of health and veterinary issues?

你怎麼看挪威在水產品進口的衛生和健康訪問的政策？哪些人或者機構影響了這些政策？這些影響是怎麼產生作用的？

Question 5.11. What are your views on policy and the role of various actors related to China's handling of health and veterinary issues?

你怎麼看中国在水產品進口的衛生和健康訪問的政策？哪些人或者機構影響了這些政策？這些影響是怎麼產生作用的？

Question 5.12. Is there some evidence on corruption related to health and veterinary control and approval? How does it manifest itself?

是否有政府官員在衛生和健康的檢查和通過上有腐敗？如果有，这是怎么发生的？

Question 5.12. A new scheme on health and safety certificate has been effective since May 2013. How has that affected your business?

中国在 2013 年 5 月啓用了一個新的健康和安全的認證。這個認證影響了你們的生意嗎？

Question 5.13. Has the new scheme increased costs? If yes, how much in both percentage and nominal value?

這個認證增加了你們的成本嗎？如果是，增加了多少的成本？和原來的成本相比，這些增加的成本有多大比重？

Question 5.14. In this system, are all companies treated in an identicalmanner?

在大陸的新的健康、安全認證系統裏，是否所有的公司都受到了平等的對待？

Part 6. Market Share 市場份額

Question 6.1. Norwegian salmon had majority of the market share until recent years. Has your firm's share of the market changed?

挪威三文魚曾經在中国擁有大多數的市場份額，但近些年市場份額急劇下降。请问你们公司在中国的市场份额是否发生了变化？

Question 6.2. How did your company react to this change?

如果發生了變化，你們公司是怎麼應對這個變化的？

Question 6.3. Among all your exports of salmon, what are the shares of countries?

在你们出口的三文鱼中，不同国家的份额是怎么样的？

Question 6.4. What do you think about the future of the market share?

你怎麼看未來的市場份額？

Part 7. Miscellaneous 其他問題

Question 7.1. We want to understand the current state of Chinese salmon trade. Are there something that you would like to tell me, in case I did not ask?

我們想要深入瞭解目前的三文魚市場。如果我遺漏了一些重要問題，請問你是否可以補充？

Question 7.2. What do you think about the future of salmon business, particularly trade?

你怎麼看未來的三文魚生意，特別是貿易？

Question 7.3. Why did you take our survey?

爲什麼你決定接受這個調查問卷？

Question 7.4. Can I contact you again for another survey later this year?

我可以在今年晚些時候再找你做一次調查問卷嗎