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Iranian Seafood Consumers' Willingness to Pay for Fresh Fish

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Contents

Abstract

An increasing interest and growth potential has emerged for Norwegian salmon in Iran's seafood market. Willingness to pay (WTP) for Norwegian salmon, Iranian rainbow trout, and Iranian narrow-barred Spanish mackerel is estimated for seafood consumers in Iran. Marginal effects of taste, convenience, nutrition, and demographic factors on WTP, are also estimated. A survey among 359 food shoppers was conducted in Tehran province, employing a Multiple Price List (MPL) and a stated preferences method. Based on this survey, estimated WTP for Norwegian salmon is $12.54, which is almost half of its current price in the market. The results indicate that WTP for Norwegian salmon is higher among high-income groups; and also taste, nutrition, and consumption frequency can increase this WTP up to $17.45. This implies that businesses can take advantage of the existing opportunities for Norwegian salmon among Iranian seafood consumers by increasing their WTP and balancing the prices accordingly. Differentiating Norwegian salmon with respect to its attributes, and using local seafood stores in wealthy regions as the distribution channel, are the suggested strategies for development of the consumption of Norwegian salmon among Iranian seafood consumers.

1. Introduction

Iran[1] is a large country that has been divested from trading with many other countries for years. With the nuclear sanctions being lifted Iran's economy is once again open, which makes it an interesting destination for many international businesses. However, due to years of political and economical isolation, there is a lack of information about the Iranian seafood market and seafood consumers. Knowledge about Iranian consumer market is of vital importance for businesses that are interested in trading with Iran. This thesis sheds light on Iranian seafood consumers' main characteristics, preferences, and WTP for Norwegian salmon, Iranian rainbow trout and Iranian narrow-barred Spanish mackerel.

Fisheries and aquaculture industry is important for Iran, and because of Iran's large coastal areas, there is a huge potential for further growth and development in this industry. The country has 2,440 km coastline along the Persian Gulf and Oman Sea, and a 740 km coastline in the north along the southern part of the Caspian Sea, in addition to a number of inland freshwater resources (FAO 2015). Iran is the largest fishery producer and a major exporter of seafood in Middle East (FAO 2015). Total fish catch and aquaculture production was reported 885,000 tons in 2013, containing 53% from southern water, 5% from northern water and 42% through inland water (Nergi 2014).

Aquaculture development started in the early 1980s in Iran, and its production has increased steadily from 27,000 tons in 1990 to 320,200 tons in 2014 (FAO 2015). Capture fisheries in the Persian Gulf and Oman Sea have more than doubled since 1998; reached 536,000 tons, and inland fisheries (including the Caspian Sea) were recently stabilized around 85,000

[1] For sake of brevity we refer to Islamic Republic of Iran, as Iran

tons per year (FAO 2015). Fish marketing, distribution and consumption have not been adequately developed, but in 1998 the Iranian Fisheries Organization created a unit to direct and improve fish marketing in Iran (FAO 2015). Ever since, marketing has become a priority, and its development results a major success, which yielded $4.2 billion GDP from fisheries, comprising 4% of Iran's agricultural GDP in the end of 2013 (FAO 2015).

In 2015, annual households' consumption expenditure on food and nonalcoholic beverages was on average $2,000 and more than $3,600 for the average and the above average income groups (Statistical Center of Iran 2015). Iranian households spend around 19.8% of their total food expenditure on meat and poultry, and only 2.6% on seafood (Central Bank of Iran 2016); indicating that fish and seafood is less important source of protein for Iranians. The preference of meat over fish is not only due to economical reasons. Even though, several fish species is available in market and consuming seafood is affordable by a majority of the population, the reported fish consumption of 9.2 kg per capita in 2014 is well below the world average; 18.9 kg (FAO 2015).

Consumption of seafood is necessary for health. It is one of the best sources of protein. World Health Organization (WHO) recommends regular fish consumption (once or twice per week) for a healthy diet to protect against coronary heart disease, malnutrition, as well as non-communicable diseases (NCDs), including diabetes (WHO 2015). Therefore, most governments promote seafood consumption. The world's population on the other hand, is predicted to increase by 34% till 2050 and to provide food for them; food production must increase by 70% (WHO 2009). This is while United Nations states that the earth is at threshold of agricultural production, meaning there is hardly more free space left on the land (Mongstad 2016). Even though around 75% of the world's surface is covered by water, less than 5% of the food production comes from

the sea (Mongstad 2016). Two major objectives of the national food policy in the Iran's sixth Five-Year Plan (2016-2020) is to increase annual per capita fish consumption to 14.8 kg/person in 2020; and to improve the balance between export and import in fish market (FAO 2015). This plan subsequently stimulates domestic fish production and aquaculture as well as fish imports to the country.

The lifting of the nuclear-related sanctions in January 2016 has attracted attentions towards the huge business potential of Iran, particularly for fast moving consumer goods, due to the popularity of international food and beverage brands. A growing number of businesses and countries, including Norway, are preparing to start business with Iran. Norway's Fisheries Minister, Per Sandberg, acknowledged: "With the repeal of sanctions, we are facing a unique opportunity. It's not every day a market with 80 million people opens overnight," (Tatone 2016). In September 2016 a seminar with the topic "Iran-Norway: Cooperation and Business Opportunities" were held in Tehran, in which a delegation of around 100 industry suppliers of aquaculture, seafood and maritime products from Norway participated. The purpose of this seminar, which was a collaboration of a number of Iranian and Norwegian state's organizations, was to learn more about the Iranian market and establish network between Norwegian exporters and Iranian companies who want to import seafood and aquaculture technology from Norway.

Norway is the world's second largest seafood exporter who supplies 35 million meals worldwide, each day (Norway Export 2017). The export value of Norwegian farmed salmon-fresh and frozen-in 2016 was about $5.34 billion (Statistics Norway, 2017). Norwegian Seafood Council wants to increase demand for Norwegian products in established markets as well as developing Norwegian seafood in new markets (Norwegian Seafood Council 2017). However, Norway's export of salmon to Iran has reached $3.7 million (Hjul 2016); about 0.07% of the

total seafood exports. The main reason has probably been the trade sanctions against Iran during the last decade.

Norwegian salmon is the only imported salmon in Iran and it can be considered a new product. It has been imported for only a few years, in relatively low quantity, and has not reached its potential in terms of market sales yet. This may be due to several reasons. First, former sanctions against Iran during the last decade had made the international trades impossible. Second, even after easing the sanctions, most of Norwegian companies hesitate to enter to this market (Oesterud 2016), probably due to extraterritorial effects of US sanctions and its associated challenges in the banking and finance sector. Finally, general uncertainties about entering a new market can be among concerns of starting business in Iran. For all these reasons, currently there are only a few Norwegian companies that are exporting seafood to Iran and as a result the competition among these exporting companies is close to zero. Subsequently, the salmon price is relatively high. Product novelty and high prices are the challenges ahead for developing Norwegian salmon in Iran's market, and as a consequence, consumers have not adopted the habit of consuming this specific type of fish yet.

However, for seafood exporters, who are willing to extend their business to a new market, the timing could not be any better. The sanctions were lifted and doors are opened. The government policy is to increase per capita consumption of seafood by approximately 5 kg; which can possibly yield up to 450,000 tons increase in total seafood consumption in Iran. Consumers are eager, and can afford, imported high quality goods to a reasonable extend. On the other hand, Iran holds a strong position in fisheries industry in the region. With Iran's interest in aquaculture development, they can greatly benefit from the technology and knowledge transfer from a country such as Norway who is an expert in aquaculture and fisheries. Hence, it is in both

countries' interest to increase trade with each other; Norway can accomplish a huge market, and Iran can import high quality nutritious fishes, as well as boosting development of the domestic aquaculture and fisheries industry.

In this thesis I will explore the Iranian seafood market. Who are the main seafood consumers? What are the important factors for them? What is their WTP for Norwegian salmon as compared with popular fish types? To my knowledge, no study had estimated seafood consumers' WTP for any type of fish in Iran. I aim to address the questions above by: (i) collecting relevant data based on the findings of previous associated literatures regarding fish attributes, economic and demographic factors; (ii) estimating the WTP of Iranian seafood consumers for Norwegian salmon, Iranian rainbow trout, and Iranian narrow-barred Spanish mackerel; and (iii) evaluating the effects of these variables on Iranian seafood consumers' WTP. The practical value of such information is evident. It deepens knowledge about preferences of Iranian seafood consumers and seafood market, which provides understanding about appropriate product development strategy and/or market segmentation. The study is built upon a consumer survey conducted during 3 weeks in February-March 2017. Food stores' customers in Tehran province, stated their preferences for fresh fish and multiple price list method was used to elucidate their WTP. The survey is included in the appendix.

The paper is organized as following: Section 2 is devoted to a review of several methods used to estimate WTP, as well as findings of previous studies about WTP for seafood. Section 3 explains the data collection method used in this study, the survey design, and introduces the under-study fish types. Thereafter, a summary of the sample and explanation of the statistical models is provided. Section 4 presents the results and discusses the implications and limitations. Finally, section 5 concludes.

2. Review of the literature

2.1 Methods of estimating WTP

In the modern food markets, consumers expect high quality and customized products that match their preferences as much as possible (Alfnes and Rickertsen 2011). For several types of food, traditional demand analysis is not sufficient anymore because according to the assumptions behind demand models, the products should be homogeneous; with known, accurate prices and quantities demanded; and consumers should have full information about the products (Anderson and Bettencourt 1993). For most of the products in food and seafood markets, these assumptions are hardly ever met (Anderson and Bettencourt 1993). In addition, the traditional demand analysis assumes that consumption generates utility, and therefore, consumers' choice, which is based on their utility, can be analyzed by using price and budget constraint (Alfnes and Rickertsen 2011). While, it is the quality and other attributes of food that bring satisfaction to customers and ultimately increase utility (Alfnes and Rickertsen 2011).

Waugh (1928) introduced the idea of demonstrating price as a function of quality for agricultural products by his paper on the effects of product attributes on prices of asparagus, tomato and cucumber. He pointed that in addition to the time/seasonal effects that change commodity prices, products' physical characteristics; such as size, color, maturity, etc. affect prices too. In the same vein, Lancaster (1966, as cited in Bronnmann and Asche 2016) developed an approach, which treats the price of different fish products as a sum of their characteristics, where consumers maximize their utility based on product attributes rather than on the product themselves. This has led the literature to a new perspective of analyzing food consumptions and marketing. Hedonic price function relates the observed prices in the market to characteristic bundle of heterogeneous goods and identifies marginal characteristic's price (Kristofersson and

Rickertsen 2004).

Several other studies in the literature applied hedonic pricing method, using historical market data from auction markets or data sets that includes information on the products' prices and attributes to study how prices are determined by quality characteristics (e.g. Alfnes and Rickertsen 2007, Kristofersson and Rickertsen 2004, 2007). Consumers' WTP for a product is defined as the price at which consumers become indifferent between buying that product or not (Olesen *et al.* 2010). Whenever high-quality historical data is available, estimating consumers' WTP based on market data is the preferred approach (Alfnes and Rickertsen 2011) because it reflects the true actual relation between the price and characteristics of that product.

However, historical market data might not be available for the under-study product (Breidert, Hahsler and Reutterer 2006), and not applicable for a new product or a nonexistent product attributes, such as GM products (Alfnes and Rickersten 2007). Even if proper market data is available it does not provide any information about consumers' socio-demographic background (Alfnes and Rickersten 2011). Non-market valuation methods are better suited when market data are not available. These methods are based on either individual's stated preferences using surveys with non-consequential questions, or they are based on mimicked market situation by incentive compatible experiments (Alfnes and Rickersten 2011).

Stated preferences methods evaluate the value of a good according to individuals stated behavior in a hypothetical setting (Carlsson 2011); therefore, they are not incentive compatible. Approaches to exploit stated preferences are conjoint analysis, contingent valuations, or choice experiments (Breidert, Hahsler and Reutterer 2006). Conjoint analysis is an indirect surveying technique, which measures individuals' preferences by systematically varying the product attributes in an experimental design (Breidert, Hahsler and Reutterer 2006). Contingent valuation

techniques are widely used to determine respondents' WTP, or the minimum acceptable compensation for a real or hypothetical good or service (Mitchell and Carson 1989, as cited in Anderson and Bettencourt 1993). In this approach, respondents are asked directly about their preferences for a product, and whether they are willing to pay a certain amount of money for a change or for an improvement in the product (Alfnes and Rickerstsen 2011). In choice experiments consumers are asked to make choices in a series of choice scenarios or submit bids (Alfnes and Rickerstsen 2007).

Since stated preferences are not incentive compatible, they are faced with the hypothetical bias issue. Hypothetical bias is defined as the difference between a hypothetical and actual stated value; i.e., actual stated value based on real economic commitments (List and Gallet 2001). Biases have been observed in both directions. In some cases individuals tend to understate their WTP because of uncertainties about how the results of the survey may affect them. This is what that is referred to as respondents' strategic behavior (Anderson and Bettencourt 1993, Breidert, Hahsler and Reutterer 2006). List and Gallet (2001) on the other hand, claim that most of the works in the literature suggest overstating of the WTP. Authors found out that on average subjects overstate their preferences by a factor of about 3 in hypothetical settings. Some studies indicate that overstating of WTP is due to what they call prestige effect (Anderson and Bettencourt 1993, Breidert, Hahsler and Reutterer 2006).

Incentive compatible valuations as another non-market mechanism are choice-based experiments, which are designed with real products and real bids; in a way that it is in participants' best interest to reveal their true WTP (Alfnes and Rickerstsen 2011). Auction mechanisms, are among incentive compatible methods in which participants submit sealed bids for a product, where the type of auction determines the winner and the price he/she has to pay

(Alfnes and Rickerstsen 2011). Popular auction methods such as Vickrey style sealed bid (endogenously determined market price) or Becker-DeGroot-Marschak (BDM) mechanisms, have frequently used in food valuation studies (Buhr *et al.* 1993, Noussair, Robin and Ruffieus 2002, Alfnes and Rickerstsen 2003, as cited in Alfnes and Rickertsen 2011). Auction mechanisms can truly reveal consumers' WTP, but they can be complicated to understand by participants and they do not actually mimic the situation a consumer faces in a food store (Breidert, Hahsler and Reutterer 2006).

Other incentive compatible mechanisms are real choice experiments, or price list experiments. In real choice experiments, which first introduced by Pessemier (1959, 1960, as cited in Alfnes and Rickertsen 2011), participants are supposed to shop at a normal shopping speed, from a sample of products based on a given budget (Alfnes and Rickertsen 2011) Price list experiment or Multiple Price List (MPL) is an extension of real dichotomous choice (RDC) method (Lusk, Roosen, and Shorgen 2011), and has been first used in pricing experiments by Kahneman, Knetsch and Thaler (1990, as cited in Harrison *et al.* 2005). However, there are evidences discussing that MPL had been used even before that in the elicitation of hypothetical valuation responses in contingent valuation survey settings (Mitchell and Carson 1989, as cited in Anderson and Bettencourt 1993).

MPL confronts the participant with a column of ordered prices in a table, one price per row, where he/she should answer "yes" or "no" for each price; the selected price indicates the maximum WTP of the respondent for that specific product (Andersen *et al*. 2006, Anderson *et al.* 2007). Experimenter then randomly draws one of the chosen prices, and respondents should buy the product at that price (Andersen *et al*. 2006, Anderson *et al.* 2007). The main advantage of MPL is that it is transparent to subjects, simulates the situation a consumer faces in the store, and

provides simple incentives for truthful revelation (Andersen *et al*. 2006, Anderson *et al.* 2007). In addition to WTP, MPL has been used to elicit risks and individual's discount rate as well (Andersen *et al*. 2006)

However, MPL has been criticized of several disadvantages. Some point that even if economic incentives implied and respondents revealed their true valuations of a good, this valuation does not necessarily translate intro real purchasing behavior (Nessim and Dodge 1995, as cited in Breidert, Hahsler and Reutterer 2006). Moreover, this method only elicits interval responses rather than point valuations; subjects can switch back and forth between payment options, which might cause inconsistent preferences; and it can be susceptible to framing effects, because subjects are drawn to choose a price from the middle of the ordered table irrespective of their true values (Andersen *et al*. 2006, Anderson *et al*. 2007, Harrison *et al*. 2005).

Anderson *et al*., (2007) explained that by using appropriate statistical methods that recognize the interval-censored nature of the response, MPL could elicit relatively precise valuations for products. Furthermore, since eliciting precise point valuations for individuals' WTP is controversial, the best one can do anyway is to elicit interval responses (Harrison *et al.* 2005). Authors also concluded that results of valuations from MPL are robust to possible framing effects, and in case they are not, these effects can be estimated and controlled for.

2.2 Brief review of studies on seafood WTP

Chen, Alfnes and Rickertsen (2015b) explain that consumers' expected quality from a product depends on extrinsic and intrinsic quality signals. According to these authors, for seafood in particular, extrinsic quality signals are labeling of the area of origin, production and obtaining methods, while intrinsic quality signals are physical characteristics including color,

odor, and texture. Researchers have practiced several methods to measure WTP for seafood according to its quality attributes. The choice of method mainly depends on the availability of data, time and budget for the project.

Irrespective of the chosen method, several studies have estimated WTP to investigate consumers' attitudes towards food safety (Holland and Wessells 1998, Grunert 2005), genetically modified (GM) products (Boccaletti and Moro 2000, Chern *et al.* 2002, Corrigan *et al.* 2009), organic food and/or welfare-labeled food (Krystallis and Chryssohoidis 2005, Olesen *et al.* 2010, Chen, Alfnes and Rickertsen 2015a), farmed vs. wild fishes (Holland and Wessells 1998, Claret *et al.* 2012, Davidson *et al.* 2012, Bronnmann and Asche 2016, Rickerstsen *et al.* 2017), production process and obtaining methods (Holland and Wessells 1998, Claret *et al.* 2012), fish species (Bronnmann and Asche 2016), size, processing, storage time, information, and auction methods (Kristofersson and Rickertsen 2004, 2007), the color of salmon (Alfnes *et al.* 2006), Country of the origin, fresh vs. frozen seafish (Claret *et al.* 2012), and others.

Several studies focused on the factors that affect seafood consumption and WTP for seafood. Verbeke and Vackier (2005) claim that fish consumption is strongly habituated. Gempesaw *et al.* (1995) also found out that consumption frequency has a strong and significant positive effect on favoring salmon. Among the economic and socio-demographic factors; income, gender, age, and education are found to significantly affect consumers' WTP for seafood (Govindasamy and Italia 1999, as cited in Krystallis and Chryssohoidis 2005).

Studies showed that people with higher income levels are willing to pay more for seafood in general and salmon in particular (Engle and Kouka 1995, Sylvia and Graham 1992, Rickertsen *et al*. 2017). Dadgar *et al.* (2015) showed that in the urban and rural areas of Markazi Province in Iran, people with higher income consume seafood more often than those with lower

income. However, it seems that in other countries income does not directly affect frequency of seafood and salmon consumption (Sylvia and Graham 1992, Myrland *et al.* 2000). Age is positively related to the frequency of seafood consumption in most studies (Myrland *et al.* 2000, Olsen 2003, RezaeiPandari and Mohammadi 2015, Verbeke and Vackier 2005). Engle and Kouka (1995) showed that as the age increases, WTP is higher. Clonan *et al.* (2012) shows that older consumers most likely purchase fish for health reasons. However, Rickertsen *et al.* (2017) showed that young people (less than 47 years old) are willing to pay more for farmed salmon.

Results on the relationship between gender and seafood consumption frequency and WTP have been quite contradictory. Rickertsen *et al.* (2017) found out that female bid less for all types of fishes in their study. On the consumption frequency on the other hand, women were shown to consume more seafood than men (Verbeke and Vackier 2005, RezaeiPandari and Mohammadi 2015); while some other studies found out that there is no significant difference between men and women in frequency of seafood consumption in Norway and US (Myrland 1998, Nayga and Capps 1995, as cited in Myrland *et al*. 2000).

Rickertsen *et al.* (2017), found that education had significant positive effect on consumption of some of the seafood of their study. Dadgar *et al.* (2015) showed positive relationship exists with consumption of seafood and level of education in Markazi province in Iran. While in a study by Myrland *et al*. (2000). there is a same positive relationship between seafood consumption and education level, Verbeke and Vackier (2005) found out that higher educated people have higher intention of consuming seafood, but this intention does not effect their consumption frequency. In addition, to the four main socio-demographic variables dicussed above, presence of school-aged kids in the household and size of the household affect seafood

consumption significantly (Myrland *et al.* 2000, Olsen 2003, Verbeke and Vackier 2005, Dadgar *et al.* 2015, RezaeiPandari and Mohammadi 2015).

Of the several food attributes, studies showed that safety, taste, price, convenience, and nutrition are among the most important factors affecting consumers' preferences, consumption, and WTP for food and seafood (Sylvia and Graham 1992, Engle and Kouka 1995, Gempesaw *et al.* 1995, Olsen 2004, Grunert 2005, Verbeke and Vackier 2005, Lusk and Briggeman 2009, Alinejad *et al.* 2015, RezaeiPandari and Mohammadi 2015, RezaeiPandari 2016, Rickertsen *et al.* 2017). Food safety, defined as the extent to which consumption of food will not cause illness, has shown to have the most value in food consumption (Lusk and Briggeman 2009). Lusk and Briggeman (2009) showed that after safety; taste, nutrition, and price are the most important factors in consumption of all food.

Grunert (2005) acknowledge that taste, health, and convenience are what many people refer to as quality; and consumers will be only willing to pay the price of a food if the perceived quality to them is high enough. Olsen (2004) showed that taste and nutrition are very important in forming consumers' decision towards seafood, while price and lack of convenience are among barriers against seafood consumption. Studies on the factors affecting seafood consumption in Iran have also shown that unpleasant taste and high prices are among the most important barriers against consumption Alinejad *et al.* 2015, RezaeiPandari and Mohammadi 2015, RezaeiPandari 2016).

Gempesaw *et al.* (1995) showed that taste and nutrition are important factor on decision to eat seafood and the type of seafood; and those who care about taste and nutrition are willing to pay 2 to 4 times more for their favorite seafood. Convenience, defined as time to prepare, serve, clean up, and other supplementary works, found to significantly effects consumption of food

and/or seafood (Gempesaw *et al.* 1995, Olsen 2003). In a detail study about consumers' preferences for fresh seafood, researchers found that ease of preparation affects consumer's purchasing decisions for shellfish significantly, while such a relationship for salmon wasn't observed, indicating salmon is perceived as a convenient fish by the consumers (Gempesaw *et al.* 1995). Verbeke and Vackier (2005) explain that taste and health are the two first factors affecting seafood consumption. These authors claim that while bones and prices are important negatively affecting attitudes; but they do not directly affect the consumption behavior. On the effect of seafood attributes on WTP directly; Engle and Kouka (1995) showed taste significantly affect WTP and Rickertsen *et al.* (2017) showed that taste, health and convenience affect WTP significantly.

3. Methodology

3.1 Theoretical method

This mater's thesis was not in collaboration with any institution; the choice of appropriate method was highly limited to the time and budget constraint. Moreover, Norwegian salmon, as the main focus of the study, is relatively a new product and market data is not properly available for it in Iran. Data therefore, is collected through a direct consumer survey based on stated preferences methodology including MPL. In a nutshell, respondents answered a set of socio-demographic questions, ranked specified fish attributes, and chose their maximum WTP from a price list. Consumers' responses were in the absence of a real purchasing obligation. As a consequence, the results are most probably imposed by hypothetical biases; as discussed in section 2.1. MPL was chosen to elicit WTP to keep the length of the survey short and simple.

MPL is a simple mechanism, and since it does not need much effort to be explained for the participants, it saves time.

Variables included in the survey for data collection were based on previous findings mentioned in section 2.2. Of the socio-demographic and economic factors, age, gender, household's income, education, size of households, and number of kids under 12 years old were collected. Among the fish attributes; respondents ranked taste, convenience, nutrition, and price for the under-study fishes. Worthy of notice, food safety was found to be the most important value for any kind of food. However, Verbeke (2005) explain that even though some uncertainties may always be present in cases such as GM products or food irradiation, under normal conditions, the majority of consumers are not anxious about food safety. Thus, no question in this regard was included in the questionnaire. Nevertheless, in an endeavor to mitigate the probable effects of it, questions were framed based on an assumption that food safety is already secured for the under-study fishes. More details are provided in the later section below.

3.2 Survey design

The survey took place during three weeks from February till March 2017, through a pen and paper questionnaire. The data were collected in a systematic random manner from a sample of 359 food shoppers of three retail chains located in different areas in Tehran. I, and a colleague of mine, approached respondents during their grocery shopping in three hypermarkets; 'Iran Hyperstar[2]' and two of the largest branches of 'Shahrvand Chain Stores[3]'. The choice of the stores was according to the size of the branch, number of customers, and their popularity that

[2] Hyperstar is an Iranian subsidiary of French multinational retailer Carrefour in Iran, located at the west part of the city.

[3] Shahrvand Chain Stores are an Iranian chain based in Tehran under control of the Municipality of Tehran and now has 17 branches in different locations.

attracts people from all over the city. A rule was set to interview every fifth customer passing by the cashier. The survey was four days per week (Sunday, Tuesday, Thursday, and Friday) and two sessions per day (10 a.m. till 1p.m. and 5 p.m. till 8 p.m.). In Iran, Friday is the only rest-day in the week, but the stores are open on this day. On Thursdays, offices work either half-day or they are closed. Sundays and Tuesdays are normal working days. Diversification of the days and timing of the survey was an attempt to cover a higher variety in the sample.

The defined population for this study is seafood consumers who are the main food-shopper and food decision-maker in their household. A four-page-long questionnaire[4] was designed. It was originally written in English and then translated to Persian. The interviewer was personally asking questions from participants and filling up the responses. The opening part of the questionnaire contained some general questions about the respondents' gender, age, family size, number of children, shopping and consumption frequency. To sample according to the defined population criteria, two stop rules were specified. The very first question was about whether or not the respondent regularly does the grocery shopping for their household. In case the answer was no, we did not include them in the survey at all. Another stop rule was according to average consumption of seafood. We did not proceed to the rest of the questions if the respondent indicated that they never consume seafood. In this way, respondents who were 'not regular shopper', and/or those who 'never' consume seafood were excluded from the sample.

The second page was allocated to the fish attributes. Respondents ranked each fish according to its taste, convenience, nutrition, and price; on a scale of 1 to 5, where 1 indicated the worst

[4] The full questionnaire is included in the appendix

score, and 5 was the best score. Respondents were given a laminated handout[5] with the picture of the fishes and a table where they could see and rank the fish attributes according to the defined scales. The third page contained a price list. A second laminated handout[6] was given with the price lists for all three fishes. The price list designed to offer five different prices for each fish, with the base price in the middle of the list. The base price reflected the cheapest prices found for that fish type in the market at the date in which survey was started[7]. The two higher prices in the price list were calculated with a 10% and 30% price mark-up, and the two lower prices, with a 20% and 50% price markdown. Respondents were not aware of market prices. All the prices in the applied questionnaire were in Iranian currency (IRR; i.e., Iranian Rial). Finally the last page contained the rest of demographic questions, such as education, income, occupation and their residential zone in Tehran.

For ranking food attributes and stating WTP, we drew the respondents' attention to safety of the fishes. In the hypothetical scenario that was explained to participants, they supposed to assume that the food store, in which they are buying the fish from, is 'reliable'. Meaning that they could trust the store regarding food safety, quality and prices. This was important because, in addition to food safety, it could reduce the affects of other factors that can influence rankings and WTPs but not included in the survey; such as over-pricing, which is somewhat common in Iran, or low quality. It was also explained to the respondents that all the fishes are whole fresh fish, gutted, and there is no reason to falsify their WTP for any of the fishes.

[5] Handout 1 in the appendix
[6] Handout 2 in the appendix
[7] Mid-February 2017

Socio-demographic questions were intentionally separated into two parts. The first part was allocated in the beginning of the questionnaire, to help smoothening the flow of the conversation. Income related questions were set as the last questions, because I did not want to disrupt the respondents' confidence by asking a relatively private question in the beginning. During the survey no further information-other than what had been written in the questionnaire-were given to the respondents, except for an explanation about income to make sure that intended income is the part of income that is spent for the family, and for example the income that is earned by any member and saved for him/herself is not of interest.

3.3 Fish types

Norwegian salmon[8], Iranian rainbow trout and Iranian narrow-barred Spanish mackerel are the focal fishes in this study. The primary objective is to evaluate the market potentials for Norwegian salmon in Iran and compare it to the most conventionally consumed fishes by Iranian seafood consumers. The two other fish types were chosen according to their price and the amount of catch/production corresponding to their popularity. These two fishes were chosen because they are the most common species consumed in Iran among cheap and expensive fishes respectively. The intention was to choose one fish as a cheap substitute and one as an expensive substitute for salmon.

There are eleven important commercial species in Iranian southern waters, which narrow-barred Spanish mackerel[9] (Scomberomorus commerson) is at the top of the list (Nergi 2014). Recognized locally as 'shir mahi' (Persian) and 'barred-mackerel' (English); is a wild-caught important pelagic species in the Persian Gulf in south of Iran (Niamaimandi *et al.* 2015). In

[8] For brevity's sake, I refer to 'Norwegian salmon' as 'salmon'
[9] For brevity's sake, I refer to 'narrow-barred Spanish mackerel' as 'barred-mackerel'

2015, total catch from southern waters was 549,750 tons, where 22,900 tons contained barred-mackerel (Ministry of Agriculture-Jahad 2015). This fish is popular for its rich flavor and limited bones, and it is categorized among relatively expensive fishes available in the market.

Rainbow trout[10] (Oncorhynchus mykiss), known as 'ghezel ala' (Persian) is a fresh water fish, native to rivers and lakes of North America, which nowadays is commercially farmed in many countries. Twenty eight out of thirty one provinces all over Iran, have farming of trout that had yielded 91,500 tons in 2010; 20% of the world production (Adeli and Baghaei 2013). Farmed and wild trout are both available in the market, albeit farmed trout has cheaper price. Farmed trout has had the most adoption among people and therefore the intended type in this study is farmed trout. Researchers showed that 60% of the first priority of purchasing aquatics among Tehran citizens, is farmed trout (Adeli and Baghaei 2013). Trout is somehow bony to compare with barred-mackerel but they both have relatively limited bones, to compare with typical bony fishes.

Market price for barred-mackerel is nearly two times higher than trout and it is a relatively expensive fish in the market. Therefore, barred-mackerel is assumed to be the expensive substitute for salmon, and trout as the cheap substitute. It is remarkable that even though barred-mackerel is among the expensive fishes, its price is almost half price of salmon in Iran's market. Anyhow, salmon price in Iran is higher than most of the expensive fishes. Among fish species in Iran other fishes could be chosen as the expensive substitute for salmon; such as white pomfret (Pampus argenteus) with a closer price to salmon, or Caspian salmon (Salmo trutta caspius) with nearly double the price of salmon. However, the purpose was to choose a fish that is well known among the consumers and is available across the stores all over the year.

[10] For brevity's sake, I refer to 'rainbow trout' as 'trout'

Whereas, neither of the fishes mentioned above meets such conditions. Since trout and barred-mackerel are popular among Iranian seafood consumers, it is expected that most of the Iranian have tasted these two fishes before and their taste are desirable for them. Furthermore, similar to salmon, their flesh has limited bones.

3.4 Sample summary

The raw data is a set of interval scales, nominal and ordinal categorical variables. The socio demographic variables should have been converted to several dummy variables; i.e., *N*-1 dummies for a *N*-category variable. To save the degree of freedom, for each variable I merged several categories into two, so that it would need only one dummy. More explanation is provided further down in this section and section 3.5. Table 1 provides the summary statistics for the sample data. Not all the variables presented in Table 1 are included in the estimated models; the reasons are given in section 4.1. Tables 2 and 3 present only the summary statistics of the transformed dummy variables used to estimate the models; general model and fish-specific models. General and fish-specific models are defined in section 3.5. In this section, I explain a summary of the sample data.

Overall, 359 people were approached, which according to the defined population criteria; i.e., seafood consumers and the main food shopper in the household, 338 of them were qualified for sample inclusion. Among the respondents 61% were female, which is natural considering that generally women are the main food purchasers and food decision-makers. The average age category is 3.64, which indicates that average age of the sample is somewhere in between thirty and forty age interval. Distribution of the age groups were as following: less than 1% under twenty years old, 18% between twenty and thirty, 29% between thirty and forty, the rest were also distributed between forty and fifty, and more than fifty years old. According to the

cumulative percentage of the first three categories, they accounted for almost half of the sample. So I merged the first three and the last two categories together, which resulted to 48% respondents being categorized as under forty years old.

Other dummy variables were as well generated with aggregation of the categories using the reasoning mentioned above. Those who earned less than $1,235 per month were categorized as low-income group; with contains 59% of the households. Respondents were asked about their highest level of education in terms of degree achieved. Results showed that around 65% had 16 or more years of education. Average household's size was 3.16. The largest family size in the sample had six members, and had only 1.5% frequency in the sample. Nearly 73% of the households had three or four members, and approximately 26% had one or two members. Almost third quarter of the respondents recorded no kids under twelve years old. Respondents were asked to indicate the occupation of the head of the family. Most of the respondents were either a white-collar employee or self-employed; around 68%, and the rest were either student, retired or unemployed. Around 20% of the respondents consume seafood maximum once or twice every three months; the rest reported seafood consumption of more than three times per month.

Around 70% of the respondents have tasted salmon before. Respondents, who had tasted the fish types before, were asked to report whether they have consumed it during the last month as well. The logic behind this question was to identify the frequent consumers of the fish type, in particular. Among those who had tasted salmon before, 25% indicated that they consumed salmon during the last month as well. In the sample, 97% have tasted trout before; amongst them 62% were frequent consumers. Finally, 88% of the respondents have tasted barred-mackerel and 24% of them were frequent users. It is worth mentioning that Tehran province has 22 zones and

according to the respondents' reported residential zone, the sample has covered all 22 zones; indicating that as predicted, the chosen branches have customers from all over the city.

Taste, on a scale of 1 to 5, where 1 indicates not delicious at all and 5 indicates very delicious, for salmon is ranked 3.81, on average. This means that salmon is recognized as a relatively delicious fish. Salmon is ranked as a very easy fish to cook and eat with the mean value of 4.18. It is also perceived a very nutritious fish as the mean value for ranking of the nutrition is 4.32. However, average ranking of salmon's price reveal that consumers believe that salmon is expensive. On a scale of 1 to 5, where 1 is very expensive and 5 is very cheap, salmon price is ranked 2. Trout's taste ranking is above the medium, 3.64; it is considered as a relatively easy fish to be cooked and eat, i.e., mean value of the ranking is 3.95, and consumers believe it is somewhat nutritious as well; i.e., mean value is equal to 3.63. Trout's price on average is ranked 3.43, indicating that trout is perceived as relatively cheap fish among the sample. Finally barred-mackerel on average is ranked relatively delicious, 3.7; more or less easy to eat and cook, 3.98; and almost very nutritious, 4.15. They also perceive barred-mackerel as somewhat expensive, 2.58.

3.5 Statistical model

Corresponding to the survey design and application of MPL; WTP, which is the dependent variable, is censored above or below some thresholds. It is therefore, observed at the cut points, while the true WTP is somewhere in between the intervals determined in the survey. The appropriate statistical method, which accounts for interval nature of the responses according to Wooldridge (2014) would be censored (interval) regression model.

For the moment, we are not specifically focusing on any of the fish types. Following the

interval-censored data regression explained by Wooldridge (2010)[11], consider the standard linear model below:

$$WTP = x\beta + u \quad (1)$$

$$E(u|x) = 0,$$

which follows the classical linear model assumptions. WTP is the dependent variable; x is the vector of the explanatory variables, which we do not explicitly show them at this stage. It is also assumed that the error term u is not correlated with any of the explanatory variables, and is normally distributed. Let $WTP_1 < WTP_2 < WTP_3 < WTP_4 < WTP_5$ denote the survey-specified interval limits for WTP. Under normality assumption, we can estimate β and σ^2, and obtain the conditional probabilities for each interval.

According to the designed MPL, what we observe is:

$$\begin{aligned}
WTP^* &= 0 && \text{if} && WTP_i = 0 \quad (2)\\
WTP^* &= WTP_1 && \text{if} && 0 < WTP \leq WTP_1\\
WTP^* &= WTP_2 && \text{if} && WTP_1 < WTP \leq WTP_2\\
WTP^* &= WTP_3 && \text{if} && WTP_2 < WTP \leq WTP_3\\
WTP^* &= WTP_4 && \text{if} && WTP_3 < WTP \leq WTP_4\\
WTP^* &= WTP_5 && \text{if} && WTP_4 < WTP \leq WTP_5.
\end{aligned}$$

The maximum likelihood estimators, $\hat{\beta}$ and $\widehat{\sigma^2}$, are called interval regression estimators, given the assumption that the underlying population distribution is homoscedastic, and normal. The interesting feature of interval regression models is that the cut points (or the interval endpoints), are the given data. Therefore, the parameters β present the partial effects of interest, and $\hat{\beta}$ can

[11] All the mathematical steps, descriptions and adjustments are adopted form Wooldridge (2010), unless written otherwise

be interpreted as if we had a normal continuous dependent variable and regressed it on the explanatory variables.

The structure of our data at a glance, suggests that we have panels of data. There are N individuals in the sample, each answered a set of socio-demographic questions about themselves, ranked a set of attributes and stated three bids as their maximum WTP for the fishes included in our study. In other words, our data consists of repeated observations on fish attributes and WTPs for the same cross section of individuals. It is therefore, a cluster sample; as a result outcomes within one cluster are most likely to be correlated with each other (Wooldridge, 2014). Panel data methods can be applied to cluster structured data to take into account these correlations (Wooldridge 2014). So, let us put the interval aspect of our dependent variable aside for the time being, and inspect the application of panel data methods on our data set. Following Wooldridge (2014)[12] consider the unobserved effect model below:

$$WTP_{if} = \beta_0 + \beta(Attributes_{if}) + \gamma(Demographics_i) + a_i + u_{if} \quad (3)$$

where i indexes individual and f indexes fish type. $(Attributes_{if})$ is the vector of ranked attributes for fish f by individual i. $(Demographics_i)$ is the vector of observed socio-demographic characters of each individual, and u_{if} is the error term that represents other factors that affect the dependent variable and are not included in our model. These effects vary across fish types and individuals. The unobserved individual effect a_i, contains any unobserved factor affecting the dependent variable that is not included in our model and is specific to the individuals.

In our case, individuals cluster our data set and we have three fishes for each individual. This means that unobserved individual effect is constant for the fishes within the clusters. That is

[12] All the mathematical steps, descriptions and adjustments are adopted form Wooldridge (2014), unless told otherwise

the reason why a_i does not have *f* subscript; i.e., it does not change for fish types in one cluster, only changes across individuals. One unobserved factor could be individuals' personalities. For example, a high-bidder might have bidden high WTPs for all fishes. Bidding high on all the fish types can be due to high income as well, that we accounted for income in our explanatory variables; still, it might exist other individuals' personality traits that affect their bids, which we have not considered. As a consequence, our model has an unobserved effect a_i, that alters the outcomes of our estimation, and we have to take those effects into account.

One key assumption for equation (3) is that u_{if} is uncorrelated with all the explanatory variables across individuals for each fish type:

$$\begin{cases} Cov(Attributes_{if}, u_{if}) = 0 \\ Cov(Demographics_i, u_{if}) = 0 \end{cases} \quad (4)$$

for all *i* and *f*. This means that if we were able to take out the unobserved individual effect a_i, all the explanatory variables would be strictly exogenous. If that is so, and if we assume that the unobserved individual effect is not correlated with any of the explanatory variables either, then:

$$\begin{cases} Cov(Attributes_{if}, a_i) = 0 \\ Cov(Demographics_i, a_i) = 0 \end{cases} \quad (5)$$

With assumptions (4) and (5) we can estimate equation (3), using a random effects model's methodology. To do so, we define a composite error term:

$$v_{if} = a_i + u_{if} \quad (6)$$

then the equation (3) can be written as:

$$WTP_{if} = \beta_0 + \beta(Attributes_{if}) + \gamma(Demographics_i) + v_{if}. \quad (7)$$

In the equation (7), for each fish type the composite error term v_{if} has the unobserved a_i in it, which makes v_{if} to be correlated across fishes. Expressing this mathematically we actually have:

$$Corr(v_{if}, v_{is}) = \frac{\sigma_a^2}{\sigma_a^2+\sigma_u^2} \qquad f \neq s, \tag{8}$$

where $\sigma_a^2 = Var(a_i)$ and $\sigma_u^2 = Var(u_{if})$.

One issue that arises here, is that the unobserved individual effect is not in fact independent of all explanatory variables. For example, Individuals' personality not only would affect the dependent variable, but they might be correlated with the explanatory variables as well. For instance, those who dislike (like) seafood in general, might have ranked the taste attribute low (high) for all the fishes, or those who perceive fish a necessary food for a healthy diet might have ranked nutrition high for all the fishes. This is not of a great surprise; as one of the main reasons for collecting panel data is actually to allow for the unobserved effect a_i to be correlated with the explanatory variables.

In cases where such correlations are expected to exist, other methods such as fixed effect are preferred. In the procedure of fixed effect model, the unobserved effect a_i will be totally eliminated, but so do any other variables that is constant within a cluster (individual). In our model, we are interested in the effects of socio demographic factors such as age, gender, income, and education. These variables are not changing for an individual, so if we use fixed effect, we will lose these variables. Therefore, it is acknowledged that if good controls are included in the equation, application of random effects model can be justified.

Random effects method, subtracts an average fish-variant fraction from all the variables and composite error term. That fraction depends on the σ_u^2, σ_a^2, and the number of the fish types (three in our case). The fraction is defined as:

$$\theta = 1 - \sqrt{\frac{\sigma_a^2}{\sigma_a^2+3\sigma_u^2}} \tag{9}$$

Then the transformed equation (7) will be:

$$WTP_{if} - \theta\overline{WTP_i} = \beta_0(1-\theta) + \beta\left[\left(Attributes_{if}\right) - \overline{(Attributes_i)}\right] + \gamma\left[(Demographics_i) - \overline{(Demographics_i)}\right]) + \left[v_{if} - \theta\overline{v_i}\right] \quad (10).$$

$\overline{WTP_i}$, is the average difference of WTP among fishes within one cluster; $\overline{(Attributes_i)}$, is the average difference of attributes among fishes within one cluster; and $\overline{(Demographics_i)}$ is actually zero because it is not varying within the cluster. As we can see in equation (12), random effects' transformation involves a quasi-demeaned data on each variable and therefore, allows for explanatory variables that are constant across fish types to stay in the equation. This is one advantage of random effect model to compare with fixed effects.

Under the assumption of zero correlation between the unobserved effect and explanatory variables random effects model estimation will be consistent (but unbiased), but if correlation exits, the estimated results will not be consistent either. Decomposing the quasi-demeaned error in equation (12) will be:

$$v_{if} - \theta\overline{v_i} = (1-\theta)a_i + u_{if} - \theta\overline{u_i}. \quad (11)$$

As we can see, the random effect estimation weighs the unobserved effect by $(1-\theta)$. Therefore, although correlations between a_i and one or more explanatory variables cause inconsistency in the random effects estimation, the correlation is moderated by the factor $(1-\theta)$. As the variance of a_i is relatively smaller to variance of u_{if}, θ will be close to zero, and the bias will be close to zero. Whenever the variance of a_i is small it means that the unobserved effect was relatively unimportant.

To sum it up, since our data structure is clustered, and because one important aspect of our study is to explore the effects of socio-demographic factors on WTP, random effect is the appropriate estimation method. On the other hand, our dependent variable is interval censored, and as we discussed earlier we need to use interval-censored data regression model to account

for the interval nature of the WTPs. As a consequence, the model that fits our data set the most, is random-effects interval-data regression model. The model therefore is:

$$WTP_{if} =$$

$$\beta_0 + \delta_0 D_{Sal} + \delta_1 D_{TR} + \beta_1 Age_i + \beta_2 Gender_i + \beta_3 Income_i + \beta_4 Education_i +$$

$$\beta_5 Taste_{if} + \beta_6 Convinience_{if} + \beta_7 Nutrition_{if} + v_{if}. \quad (12)$$

In equation (12) WTP_{if} is individual i's bid for fish *f*, D_{Sal} is 1 if the fish is salmon and 0 otherwise, D_{TR} is 1 if the fish is trout and 0 otherwise. Barred-mackerel is the base fish in the above equation, therefore the intercept for barred mackerel β_0, for salmon is $\beta_0 + \delta_0$ and for trout is $\beta_0 + \delta_1$. Age_i is 1 if the respondent was over forty years old, $Gender_i$ is 1 if respondent was female, $Income_i$ is 1 if respondents' monthly income was more that \$1,235, and $Education_i$ is 1 if respondent had at least sixteen years of education. $Taste_{if}$ is 1 if respondent *i* ranked the fish *f* as delicious and 0 otherwise. $Convinience_{if}$ is 1 if respondent *i* ranked the fish *f* as easy to cook and eat and 0 otherwise. $Nutrition_{if}$ is 1 if respondent *i* ranked the fish *f* as nutritious and 0 otherwise. v_{if} is the composite error term constituting individual- and fish-specific residuals. In equation (12), δ_0 represents the surplus (deficit) an individual would pay for salmon to compare with barred-mackerel, and δ_1 interpreted as the surplus (deficit) an individual would pay for trout to compare with what he/she would be willing to pay for barred-mackerel. β_1 to β_7 indicate the partial effect of each variable; i.e., for each dummy variable it is the difference between the WTPs for each group.

Worthy of notice, attribute were originally ordinal variables from 1 to 5. There are three ways to incorporate such kind of variables; first way is to include them as a normal continuous variable. Second, defining dummies for each value of the variable; and third, if the ordinal variable takes too many values, we can break it down into a fewer categories, and then conduct

dummy variables. The first approach is not recommended because of the associated difficulties on interpretation of the coefficients. We cannot mathematically translate one unit increase in the rankings. In rating the scales, individuals might value same scales differently; i.e., a two for one respondent might be a one for the other (Lusk and Briggeman 2009), therefore, interpretation of the partial effect would not be straightforward. The second approach is clearly not appropriate either, due to several attribute variables with 5 values each; we will be losing degrees of freedom.

Therefore, each attribute variable was broken to a two-category variable as desirable and undesirable attribute of the fish. There is no general rule in the literature for choosing the cut point and it is basically a judgment call. On a scale of 1 to 5, number 3 is the middle point of the attribute rankings that can be viewed as a point where respondent were indifferent towards that attribute. I aggregated rankings above the average; i.e. 4 and 5 as desirables attribute, and average and below the average; i.e., 1, 2, and 3 as undesirable attribute. The aggregation was based on testing different cut points and assessing the clarity of the results in the models.

In equation (12), except the impression that we can get from the fish dummies; i.e., the premium (inferior) WTP for salmon or trout to compare with mackerel, this model does not provide any specific information regarding the fish types. In order to consider the effect of each variable on WTP for a specific fish we need to include interactions among our variables and fish dummies in equation (12). However, given that we have a relatively small sample size, exploring the effects of seven variables on three fish types would yield a complicated model with less significant results.

By decomposing the data however, we can have three data sets, one for each fish. Using interval regression method, with the following equations, each data set can be then used to

evaluate the effects of fish attributes and estimate the WTP for each fish separately. Such models would be:

$$Sal\_WTP_i = \beta_0 + \beta_1 Age_i + \beta_2 Gender_i + \beta_3 Income_i + \beta_4 Education_i + \beta_5 Sal_{Freq.i} + \beta_6 Sal_{Taste_i} + \beta_7 Sal_{Convinience\,i} + \beta_8 Sal_{Nutrition_i} + u_i \quad (13)$$

$$Tr\_WTP_i = \beta_0 + \beta_1 Age_i + \beta_2 Gender_i + \beta_3 Income_i + \beta_4 Education_i + \beta_5 Tr_{Freq.i} + \beta_6 Tr_{Taste_i} + \beta_7 Tr_{Convinience\,i} + \beta_8 Tr_{Nutrition_i} + u_i \quad (14)$$

$$Mc\_WTP_i = \beta_0 + \beta_1 Age_i + \beta_2 Gender_i + \beta_3 Income_i + \beta_4 Education_i + \beta_5 Mc_{Freq.i} + \beta_6 Mc_{Taste_i} + \beta_7 Mc_{Convinience\,i} + \beta_8 Mc_{Nutrition_i} + u_i \quad (15)$$

Abbreviations *Sal* stands for salmon, *Tr* stands for trout, and *Mc* stands for barred-mackerel. Descriptions for the mutual variables with previous model are similar, understanding that the attributes in each model are now based on ranking of individual *i* for the fish type the model is conducted for. Sal_{freq_i} is 1 if the respondents have had eaten salmon during the last month and 0 other wise; Tr_{freq_i} is 1 if the respondents have had eaten trout during the last month, and Mc_{freq_i} is 1 if the respondents have had eaten barred-mackerel during the last month. Interval regression estimators in each of the equations above, represent the partial effect of the variables on the WTP for each fish.

To sum it up, four models have been estimated; one with the panel data; equation (12), which was estimated with random-effects interval-data regression model. Three others with the decomposed data sets; equations (13), (14), and (15), which were estimated by interval regression model. It is remarkable that for the robustness of the outcome, I have tested including interaction terms in equation 12. The outcome form such model confirmed the results achieved from separated models, albeit there was problem with the multicollinearity. Therefore, four

simple models are preferred to one complicated model with multicollinearity issue. Below, analysis of the statistical outcome is provided.

4. Results

4.1 Statistical analysis of the results

To keep the model simple, not all the variables in the survey is included in the model. The proper set of explanatory variables for each model was selected according to three properties; literature's findings, a stepwise procedure, and log likelihood ratio tests. It is noteworthy that for three reasons the variable price, i.e., respondents ranked price of the fish as cheap or expensive, is not included in the model. First, in all the previous studies, price is included in the equations that were measuring consumption frequency of seafood and not WTP. Subsequently, since our dependent variable is WTP that actually represent the prices for the fishes, WTP and price rankings are measuring somehow a similar unit. Therefore, including price in the model would not provide extra information. Finally, the objective of this study is to evaluate the effects of fish attributes and socio-demographic factors on WTP, while price is actually neither a fish attribute nor a socio-demographic factor.

Table 4 provides interval regression coefficients and *p*-values for all the four models discussed in section 3.5. I start with the analysis of the WTP for fresh fish in the general model, which is the estimated results of equation (12); and then will go through more details about the WTP for each fish type by analyzing the estimated results of equations (13), (14), and (15), which are the fish-specific models for salmon, trout, and barred-mackerel, respectively. Finally, the average WTP of different groups in the sample is discussed.

4.1.1 Fresh fish

Ceteris paribus, women have lower WTP than men for fresh fish; $0.61 less, which is similar to Rickertsen *et al.*'s (2017) findings. Most of the previous studies mentioned in section 2.2, found that aging positively affect seafood consumption. However, it seems that the effect of aging on WTP is not the same as its effect on consumption. Similar to the findings of Rickertsen *et al.* (2017) on farmed salmon, people older than 40 years old discount the per kilogram value of fresh fish by $0.83. There are a couple of possible explanations for the age's relationship.

Iranians traditionally have not had high seafood consumption, and the increase in the consumption has been due to marketing and campaigning efforts by the fisheries organization, during the last few decades. Therefore, even though the consumption per capita has been increased; those who are over forty years old are more or less attached to their low-in-seafood habitual diet, which consequently makes them reluctant to pay for fishes as much. Moreover, even though previous studies found that older people consume more seafood; perhaps due to health reasons (Clonan *et al*. 2012), this surplus in consumption does not necessarily translates in to a higher WTP. For instance, many consumers prefer to buy cheaper products of inferior quality, thus a highly demanded product is not always the one for which the consumer will pay the highest price (Waugh 1928).

Those who earn more than $1,235 per month are willing to pay $0.88 extra per kilogram of fresh fish to compare with the low-income group. The positive and statistically significant relationship between income and WTP is as it was predicted (Sylvia and Graham 1992, Engle and Kouka 1995, Rickertsen *et al*. 2017). Rickertsen *et al*. (2017) showed education increases WTP for some of the fish species, but not for salmon. In a like manner, education has a positive

coefficient but the difference is not statistically significant.

Among the fish attributes, taste and nutrition significantly affect consumers' WTP for fresh fish. As predicted, consumers who rank fresh fish as a delicious food, are willing to pay $2.3 more per kilogram of fresh fish. Moreover, people are willing to pay $0.8 more per kilogram, if they perceived fresh fish as nutritious. The effect of convenience however, contradicts to what has been expected (Gempesaw et al. 1995, Olsen 2003, Verbeke and Vackier 2005, Rickertsen *et al.* 2017). According to the model, whether a fish perceived convenient to cook and eat or not, WTP does not differ.

The reason for insignificant effect of convenience could be that, as mentioned earlier, all these three fishes have somehow limited bones to compare with typical bony fishes; hence, relatively easy to be eaten. On the other hand, most of Iranian dishes have a long time-consuming preparation process. As a result, even if Iranian seafood consumers think it is not easy to cook a fish, they seem to have no problem with it. Finally, the contradiction can be due to what has been defined as convenience. Olsen (2003) defined convenience as time spent to purchase, prepare, eat, dispose the leftovers, and cleaning up. Whereas in this study convenience is defined as the degree to which respondents think it is easy to cook and eat the fish. Perhaps, if our definition of the fish convenience, was including more loops of its supply chain as Olsen (2003), we might have gotten some significant results.

Last but not the least, fish dummies in the general model show that to compare with barred-mackerel, consumers are willing to pay $7.83 extra for a kilogram of fresh salmon, while their WTP for trout is $2.54 less than barred-mackerel. Putting the coefficients of the fish dummies aside, taste has the most influence on WTP for fresh fish, both in terms of significance and

magnitude effect.

4.1.2 Salmon

After decomposition of the data set for each fish type, gender and age have become insignificant for salmon. All other factors being equal, people with higher income are willing to pay $2.51 surplus for a kilogram of fresh salmon. The effect of income on WTP is almost 3 times larger for salmon than for fresh fish. Similar to the general model, level of education has not any significant effect. A respondent, who has eaten salmon during the last month, is assumed to be a frequent consumer. Compared with those who do not consume salmon regularly, frequent consumers are willing to pay $3.26 extra per kilogram. Interval regression coefficients for taste, convenience, and nutrition are all statistically significant. The estimation shows that those who appreciate salmon's taste are willing to pay more than 5 additional dollars for each unit. If salmon perceived as a nutritious fish, one kilogram of it has an extra value of $4.41 for the consumers.

Coefficient for convenience is surprisingly negative. Meaning, all other variables hold constant, if a consumer perceives salmon as easy to cook and eat, he/she would be willing to pay less for a kilogram of fresh salmon. This is not only in contradiction with previous findings; it does not make logical sense. Furthermore, including and excluding variables flip its sign. For example, when convenience is the only explanatory variable it has a positive coefficient, but when other attribute variables randomly insert in the model, its coefficient turns to negative. Moreover, as seen in Table 4, this negative sign is only in the salmon-specific model. Kennedy (2005) explain many reasons for such a phenomenon; such as multicollinearity, wrong coding, omitted variable (Simpson's paradox), selection bias, data definition/measurement error, small sample size, etc.

VIF test did not indicate any evidence of multicollinearity. Wrong coding was not an issue either. The problem seems to be a subject of causality. According to Kennedy (2005), if there is a variable (omitted variable) that is negatively affecting the dependent variable, but has positive correlation with one of the explanatory variables in the model, it is possible that the affected explanatory variable get incorrect sign. Convenience is defined as ease of cooking and eating. This definition does not include the effort consumers put for purchasing this fish. This is while salmon is a new product, which is not supplied in all the food stores. Therefore, availability seems to be the omitted variable that is secretly affecting consumers' WTP for salmon. While consumers rank salmon as convenient to cook and eat, it is in fact inconvenient for them to procure salmon because it is not available in many of the stores. In other words, those who perceive salmon as easy to cook and eat, do not always have access to purchase the product. This is referred to as Simpson's paradox.

Another, possible explanation could be the reverse causality problem due to selection bias (Kennedy 2005). Meaning that those who, for any reason, have lower WTP for salmon believe that salmon is convenient food to cook and eat. For instance income could be one the reason for WTP. After checking for this possibility, it turns out that 195 respondents said salmon is convenient, whereas more than 50% of them were among the low-income group. To put it in words, most of the respondents who ranked salmon as a convenience food had low income. This is a selection bias problem, which is usually because of small sample size; it consequently results in unduly relationships between the variables. It is also worth to mention that coefficient for convenience is only significant at 10% level.

4.1.3 Trout

Age is the only demographic variable that affects WTP for trout. Consumers who are older than forty years old are discounting the price per kilogram of trout by $0.23. Gender, education and even income are not affecting WTP for trout. There are three possible reasons that income has become insignificant. First, trout is a cheap fish in the market. Therefore, its price is affordable for all income groups. On the other hand, trout is a popular fish in terms of taste among most of Iranian seafood consumers. So people are used to consuming trout and they buy it at different prices anyway. The third reason is due to price fluctuations in Iran's seafood market from time to time and even at the same time, from store to store. Average Consumer Price Index for all urban consumers in Iran for fish and seafood in 2016 was 319.8; i.e., higher than meat, chicken and any other sources of protein (Central Bank of Iran 2016). According to the comments of some respondents, it occurred to them that they had purchased trout (and barred-mackerel as well) even when it was more expensive than the highest price in the price list. So, those who like the taste of this fish, consume it regardless of their income level and/or its price. Hence, no significant income effect is shown for trout.

Similar to salmon, frequent trout consumers are willing to pay more for fresh trout as well; $0.28 extra for one kilogram of fresh trout. However, this surplus is far below the excess amount that frequent salmon consumers are willing to pay. Among the fish attributes, only taste has statistical significant effect on WTP for trout. Compared with those who dislike the taste of trout, people who like trout's taste are willing to pay $0.4 more. In contradiction with salmon, nutrition and convenience do not affect WTP for trout. Similar to salmon, largest coefficient affecting WTP is for taste.

4.1.4 Barred-mackerel

None of the socio-demographic factors, including income, affect WTP for barred-mackerel. Since barred-mackerel is supposedly the expensive substitute for salmon in this study, some level of significance was expected. Howsoever, there is no such evidence. The reasons could be somehow the same as what mentioned for trout. Price fluctuations, and the consumers' habit of consuming this fish, are the most possible explanation for insignificant income effect. According to Verbeke and Vackier (2005) fish consumption is strongly habituated, and therefore, barred-mackerel, which is an established seafood among Iranian, is consumed by different income groups at the given prices anyway. Frequent consumers of barred-mackerel are willing to pay $0.9 extra for a kilogram of this fish. Taste, with the largest coefficient, significantly influences the WTP. People who believe barred-mackerel is delicious are willing to pay $1.81 extra per kilogram of fresh barred-mackerel. Finally, those who perceived the fish as convenient are willing to pay $0.98 more as appose to the base group. This coefficient is statistically significant.

4.1.5 WTP

To achieve a better understanding of the results above, Table 5 provides conditional WTP for each fish. These are average WTPs of different groups of respondents in the sample. Comparing average WTPs among men and women for salmon shows average female's WTP for salmon is $12.07, while for men it is $13.3. However, there is of course no such difference among men and women's WTP for trout or barred-mackerel, because gender did not show statistical significant result for these two fishes. Frequent users of salmon are willing to pay $17.45 per kilogram for salmon, while those who are not frequent users are only willing to pay

$11 per kilogram. For all the fishes the highest WTP is for frequent users and those who perceive the fish delicious.

Except for the salmon perceived convenience, comparing different group's WTP in the sample confirms the outcome of the analysis discussed in the four sections above. It is interesting to point that contradictory to the negative coefficient of convenience, in average WTP among those who perceived salmon as an easy fish to cook and eat is higher ($14.92) to compare with those who perceive this fish inconvenient ($13.26). This is the result we expected to see at the first place. However due to several reasons discussed in section 4.1.2, we saw a negative correlation.

Table 5 illuminates other aspects of the findings. For the whole sample, average WTP for trout and barred-mackerel is $3.98 and $6.22, which is more or less corresponding to the base price; i.e. cheapest price available in the market. WTP of regular consumers or those who appreciate its taste are even higher than the base price. This is while average WTP for salmon is $12.54, which is nearly half of the cheapest price in the market. Although, it was expected that consumers' WTP for salmon be lower than current market price, the gap is quite large. One reason could be that consumers are aware of trout's and barred-mackerel's market price, while for salmon to some extent they approximated the stated prices.

However, this gap can also be explained by presence of a domestically farmed fish: brown trout (Salmo trutta), which is the same species as 'ørret' in Norwegian. This species is totally different from the common rainbow trout in Iran and is very similar to salmon in terms of appearance and taste. Iran has recently developed farming of brown trout. Domestic producers import eyed trout eggs form Denmark and Norway to Iran and farming it domestically. Even

though the production of this fish type is relatively young, due to governmental support for domestic production, brown trout is produced and sold at fairly a reasonable price; almost half price of salmon. It is still considered an expensive fish, but it is cheaper than Norwegian salmon. What matters the most is that many stores sell brown trout as salmon. Even though it is not sold as if it is imported from Norway, for many consumers who cannot recognize the difference, it is perceived as fresh salmon at a lower price. This decreases the WTP for Norwegian salmon. Given that both brown trout and Norwegian salmon are relatively new in the market, and their attributes are somewhat similar, it is less likely that the expensive Norwegian salmon attracts as much customers as brown trout.

As a consequence, either because consumers can not recognize the difference between Norwegian salmon and brown trout, or just because brown trout is a cheap and very close substitute to Norwegian salmon, consumers' WTP for Norwegian salmon is far below the market price. However, ascertained by the frequent salmon users' WTP, which is $17.45 per unit, it seems that people who consume salmon regularly recognize this difference and value Norwegian salmon more than those who are not regular consumers.

Finally, worth to notice that the increase or decrease in the calculated WTPs in Table 5 are not exactly the same amount that interpreted from the coefficients. It should be remembered that the coefficients are the partial effects, while conditional WTP divides the sample according to one variable and calculates the average WTP for each division. For example, in the sample the average WTP for salmon among high-income level respondents is $15. However, this high-income group contains men and women at different ages, who could have had very different opinions about salmon's attributes.

4.2 Discussions and implications

Predominantly, WTP for salmon is affected by more factors than trout and barred-mackerel. Frequent consumers and/or those who like the taste of trout and barred-mackerel are consuming and willing to pay the base price or even above that price for those fishes. This is true regardless of the perceived convenient, or their income level. This points to the strong effects of habitual diet in seafood consumption (Verbeke and Vackier 2005). Regardless of the demographic characteristics, WTP for trout is only affected by taste; for barred-mackerel is affected by taste and nutrition, but for salmon is affected by taste, nutrient, and convenience. It can be concluded that consumers become more sensitive towards the fish attributes as the price increases.

This is due to several reasons. Trout and barred-mackerel are familiar products that have regular customers who like the taste of these fishes, know the market price, and are willing to pay that price. However, this is not the case with salmon. Salmon is a relatively new product, with extremely high prices in the market. Thirty percent in our sample indicated they never tasted salmon. Of the respondents who claimed that they have tasted salmon before, 75% were not frequent consumers. Since salmon is not habituated in seafood consumption behavior, it seems that consumers pay more attention to what they gain in exchange for the high price they pay for salmon. This also implies that the negative effects of the aforementioned variables would impact WTP for salmon to a larger extent.

In addition to high prices and product novelty, there are other obstacles against development of salmon in the market. The main distributor of fresh salmon is ‘Hyperstar’ and frozen salmon is ‘Shahrvand retail chain store’. Salmon is rarely available in the fish markets or local fish stores. Whereas, shopping from hypermarkets is not the most conventional way of grocery

shopping in Iran. Retail sector in food market in Iran is large but highly fragmented. Distribution channel is highly decentralized and include several small stores selling only a sub-range of foodstuffs; i.e., stores that only sell fruits and vegetables, stores that only sell beef and chicken, stores that only sell seafood, etc. Intimacy of the relationship between the buyers and sellers in local stores bring forth trust and loyalty, which plays a hand in shaping consumer's behavior. On a regular basis, most of Iranians purchase their foodstuffs from their local stores or local small markets in their area, which do not sell salmon.

On the other hand, as discussed in section 4.1.5, brown trout in the market is a very close competitor for salmon. Confusion about country of the origin of salmon was evident in some comments by the respondents during the survey. Many indicated that they have eaten salmon, but they were not sure whether it was Norwegian or not. Moreover, some were indicating that they have bought salmon at the cheapest price in the price list (the price with 50% mark down), which in fact is impossible and it is brown trout that is being sold at that price.

From marketing perspective, development of Norwegian salmon in Iran's market requires an understanding of the ongoing marketing strategies. New product development concerns the management of the disciplines involved with the needs of the customers and how the business could best meet these needs (Trott 2008). Lipczynski *et al.* (2005) explain that a successful entrant in a market will need to persuade costumers to switch from their existing habitually consumed products through decreasing the price, advertising and marketing or other promotional campaigns (Comonar and Wilson 1967, as cited Lipczynski *et al.* 2005).

For Norwegian salmon, 'increasing the WTP' and 'decreasing the price' need to be the cornerstone of any strategy to penetrate Iran's market. Salmon exporters, who are interested in

extending their business to Iran and achieve a significant market share, need to incur low profit margin for a while. It is also possible that prices decrease as a result of increase in the number of competing firms exporting to Iran. Moreover, if the amount of salmon imported to Iran increases, prices might fall consequently. Focusing on import of frozen salmon, due to lower transportation costs, would as well be a good strategy to provide salmon at a lower price in the market. However, it might be some barriers against frozen salmon.

Increasing consumers' WTP on the other hand, requires an appropriate choice of marketing strategies. Based on the findings of this study, taste was a key to increase the WTP. As you can see in Table 3, ranking of the taste of salmon shows that among the respondents who have tasted salmon before, 63% ranked the taste (very) delicious. Therefore, one goal is to get more people taste salmon. Advertising through booths with salmon samples in the chain stores can be to some extent helpful. Focusing on restaurants to include salmon in their menu could also be motivating for customers to try salmon. Especially, if restaurants buy frozen salmon, it would be at a cheaper price, and yet using a good recipe they can provide a delicious dish with salmon that can motivate the consumer to buy fresh salmon next time he/she sees this fish on the shelf in the store.

Not only tasting salmon affects consumers' WTP, but frequent users found to have a high WTP for salmon. A sustainable strategy therefore, is to increase the presence and availability of salmon by covering local fish stores and fish markets. In other words, if we want to get customers to consume salmon more often, we need to make it available at the places where they usually purchase their foodstuffs. It is not farfetched that using the common methods in western economies, where the distribution channel tends to be shorter and clearer, will not be successful in regions that involve many levels of distribution (Aaker and Mcloughlin 2010). Sustainable

marketing, analyses customer needs to provide value for the customers and distributes effectively to the selected target groups (Belz and Schmidt 2010).

There is another advantage in presence of Norwegian salmon in local seafood stores. Retailing institutions affect the buyer-seller relationship and therefore marketing decisions (Kaynak and Tamer 1982). The style of shopping from these local stores is very different than shopping form supermarkets and hypermarkets. In local stores, only the salesperson -who is usually owner of the store as well- has access to the shelf and give it to customers. They actually make a sale by giving information and overview of all the products they have. In this manner, the salesperson does half of the work of marketing for a product he/she has in the store. This is in particular effective when customers are not sure, or not familiar with a product. Therefore, clearly if Norwegian salmon enters the market through these local seafood stores; even in the presence of other fishes such as brown trout, the seller as a stakeholder, would provide further information to justify the higher price of Norwegian salmon and try to convince the costumers to buy it. Whereas the responsibility of the sales staff in a hypermarket is limited to refilling the shelves, take the payments, and they only provide further information if a customer ask.

Establishing a distribution system to cover the retail channels has its own complexities. In strategic product development, identification of possible consumers segments and the evaluation of the influence of their individual characteristics are of great importance (Piccolo and D'Elia 2008). For the entry level, distribution can be narrowed down to some specific segments of the market. Income found to significantly affect consumers' WTP for salmon. This implies that distribution of salmon in seafood stores can be localized in wealthier regions for the time being. Targeting the local seafood stores in the regions with wealthy population not only will increase salmon availability for the high-income group consumers, but it contribute to the product

popularity in the market. As salmon become more popular among seafood consumers, the consumption frequency of salmon would increase among the consumers. According to the results of the study, income did not show any significant effect on WTP for the cheap and expensive substitutes for salmon. This implies that as Iranian seafood consumers get used to the consumption of a specific fish type, the income would have smaller effect on their purchasing behavior. Therefore, gradually more regions with lower income levels can be included in the targeted market.

Salmon's popularity would increase faster along with product differentiation. The ability of the supplier to create a physical or psychological distinction between goods that are close substitute, in a way that consumers no longer view them as identical is called product differentiation (Lipczynski *et al.* 2005). Marketing strategies suggest differentiating new products according to a natural or strategic attribute of the product (Lipczynski *et al.* 2005). Differentiating the country of origin for Norwegian salmon is a natural product differentiation. Even though that this study did not consider the effects of the origin of salmon; but by making the Norwegian origin of salmon bold, at least the consumer awareness of the difference between brown trout and Norwegian salmon would increase. Therefore, they would be informed about the source of price difference between these two fishes.

Nutrition found to affect the WTP for salmon significantly. This implies that regardless of whether Norwegian salmon is in fact more nutritious than other fishes or not, more emphasize on benefits of eating salmon can increase the interest in this fish. This is a strategic product differentiation. Sometimes suppliers try to convince consumers that higher prices reflect higher quality (Scitovsky 1950, as cited in Lipczynski *et al.* 2005). If advertising of salmon focus on the health benefits of consuming this fish, high price of salmon could be in a way associated to its

high quality; if such efforts successful demand might even increase as price increases (Lipczynski *et al.* 2005).

In conclusion, by maintaining the current marketing strategies with high prices, it is unlikely that Norwegian salmon's market share increases. Reducing prices and enhancing the WTP for salmon needs to be accomplished, simultaneously. There is actually a cause-and-effect relationship between the prices and WTP for salmon, as if there is a loop. A drop in prices can increase the demand and consumption of salmon, wherefore consequently the market share for salmon would increase. The more people taste salmon, the higher the average WTP would be. Increasing the WTP for salmon would motivate seafood consumers to choose salmon and therefore generates more frequent users as well. As a result of increase in consumption frequency demand and import of salmon would increase, and prices can drop even further down. However, the salmon exporter/importers can compensate for the low profit margin they incurred at the early stages, by keeping the prices constant and increase their sales, and benefit from economies of scales.

4.3 Limitations

This survey is suffering from several shortcomings. The main issue is lack of real incentive compatible conditions. Due to lack of time and budget, respondents were not obliged to buy any of the fishes according to their stated WTP, neither did they get paid any fee or gift to participate in the survey. Therefore, there was no reason for them to reveal their true WTP and many respondents might have taken the answers less seriously than what they would do in a real purchasing situation. Therefore, hypothetical bias due to over- or under- stated WTPs have probably made the results less reliable (Anderson and Bettencourt 1993, Breidert *et al.* 2006).

For example, during this survey, even though for all the participants we explained that the results are only going to be used in a master's thesis; half way through the price list, some were naively asking whether this is a study to measure to what extent the prices could increase; this is an obvious evidence of possible strategic behavior among some of the respondents.

Another issue is that the MPL started with salmon price list, following by trout and barred-mackerel respectively; i.e., the most expensive fish in the beginning. This ordering might increase the WTP for the two other fishes, as unconsciously the respondent might do comparison of prices of trout and barred-mackerel with salmon, and automatically would be willing to pay a higher price for trout and barred-mackerel; as long as the higher prices were far cheaper than salmon price. Setting the most expensive fish in the end of the list could also lead to lower WTP for salmon; i.e., after observing a set of lower prices for two other fishes, respondents would be reluctant to pay a high price for salmon. This is what Anderson *et al.* (2007) referred to as framing effects, and claimed that the results of MPL method are robust to such framing effects. However, a treatment for future studies could be randomizing the price lists for different respondents.

Furthermore, I did not provide the under-study fish types for tasting; so stated preferences were based on consumers' previous own experience of that type of fish. This did not cause so much trouble for the rainbow trout and barred-mackerel, but since salmon is a relatively new fish in the market, many respondents had never tasted it before, which caused a number of missing observations in ranking salmon's attributes. It was also problematic in terms of the confusion between Norwegian salmon and domestically farmed brown trout.

Due to the limited scale of this project, the results are based on a relatively small sample size. In a small sample, a statistically significant outcome is less likely to be the true effect of the population, and issues such as heteroscedasticity and non-normal distribution of the data arises (Hair *et al.* 2014). Small sample size causes inconsistent results and selection bias (Hair *et al.* 2014), which in particular is what the results of this study encountered with; we touched upon these issues in section 4.1.2

On the other hand, due to small sample, I had to be cautious about the degree of freedom. Therefore some other variables, such as product availability, or farmed vs. wild caught fish, that affects WTP are not included in the study. This is while, in appose to salmon, trout and barred-mackerel are two fish types available in most of the food stores; moreover, two of the chosen fishes (salmon and trout) are farmed and one (barred-mackerel) is wild-caught fish. It cannot be neglected that these omitted variables affect estimation's consistency and bias the coefficients.

5. Conclusion

In this study the effects of fish attributes and socio-demographic factors on WTP for fresh fish have been evaluated among Iranian seafood consumers. The under-study fish types were Norwegian salmon, as apposed to two conventional domestic fishes in Iran i.e., rainbow trout and narrow-barred Spanish mackerel. Data were collected in three weeks from February till March, 2017, through a consumer survey conducted in three different hypermarkets in Tehran province, in Iran. Stated preferences and MPL methods were used in a hypothetical setting to collect the data for consumers' preferences.

Results indicated that gender, age; with negative effects, and income, taste, convenient, and nutrition; with positive effects, influence seafood consumers' WTP for fresh in Iran. WTP

for salmon in particular, is affected by income, consumption frequency, taste, convenient and nutrition. WTP for Trout and barred-mackerel were affected by fewer variables to compare with salmon. The largest partial effects on WTP for salmon were for taste, nutrition, and consumption frequency, respectively. Taste had the largest partial effect on WTP for trout and barred mackerel as well. Among the seafood consumers in Iran, WTP for salmon is around 2 times higher than WTP for barred mackerel and around 3 times higher than WTP for trout. However, the average WTP for salmon in the sample, even among the groups with highest WTP, is far below the market price. This is while WTP for barred-mackerel and trout is on average corresponding to the market price for these fishes. This implies that price for Norwegian salmon in Iran's seafood market is extremely high and consumers' WTP for salmon, relative to this price, is low.

In order to increase the market share for Norwegian salmon, prices need to go down, at least for a while, and at the same time consumers' WTP for salmon need to go up. Exporters of Norwegian salmon to Iran can reduce price and incur lower profit margin at the entry level, so that more seafood consumers can buy and taste salmon. Increasing Norwegian salmon availability in local seafood stores with high-income population, differentiating salmon with respect to its country of origin and its associated health benefits are suggested strategies for marketing plans. In addition, promotional stations in hypermarkets that give out free samples for tasting or collaboration with restaurants to include salmon in their menu could possibly help increasing WTP for salmon. As the establishment of Norwegian salmon continues in the market, WTP would be less affected by income. Therefore, the targeted segment can be then extended to lower income groups, and increase the market share.

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Tables

Table 1. Summary statistics for the sample data

Variable	Definition	Mean	Std. Dev.	Min.	Max.
Gender	0 if male 1 if female	0.61	0.48	0	1
Age	1 if under 20 yrs. old 2 if between 20 and 30 yrs. old 3 if between 30 and 40 yrs. old 4 if between 40 and 50 yrs. old 5 if more than 50 yrs. old	3.64	1.11	1	5
Income	1 if less than $925 2 if between $925 to $1235 3 if between $1235 to $1540 4 if between $1540 to $1850 5 if more than $1850	2.55	1.42	1	5
Education	1 if 8 yrs. or less 2 if 12 yrs. 3 if 16 yrs. 4 if 18 Yrs. and more	2.86	0.83	1	4
Household size	Number of members in household	3.16	1.09	1	6
Kids	Number of kids under 12 yrs. old	0.31	0.59	0	3
Occupation	1 if student 2 if blue collar worker 3 if white collar worker 4 if self employed 5 if retired 6 if unemployed/Others	4.00	1.09	1	6
Average seafood consumption	1 if never 2 if less than once every 3-month 3 if once or twice every 3-month 4 if one to three times every month 5 if one to two times every week 6 if more than two times every week 7 if I don't know	4.03	1.18	1	6
Ever eaten salmon	0 if no 1 if yes	0.70	0.45	0	1
Eaten salmon last month	0 if no 1 if yes	0.25	0.43	0	1
Ever eaten trout	0 if no 1 if yes	0.97	0.14	0	1
Eaten trout last month	0 if no 1 if yes	0.62	0.48	0	1

Ever eaten barred-mackerel	0 if no	1 if yes	0.88	0.31	0	1
Eaten barred-mackerel last month	0 if no	1 if yes	0.24	0.43	0	1
Salmon taste	Scale of 1-5 1 = not delicious at all 5 = very delicious		3.81	1.05	1	5
Salmon convenience	Scale of 1-5 1 = very hard to eat & cook 5 = very easy to eat & cook		4.18	0.94	1	5
Salmon nutrition	Scale of 1-5 1 = not nutritious at all 5 = very nutritious		4.32	0.81	1	5
Salmon price	Scale of 1-5 1 = very expensive 5 = very cheap		2.00	1.01	1	5
Trout taste	Scale of 1-5 1 = not delicious at all 5 = very delicious		3.64	1.06	1	5
Trout convenience	Scale of 1-5 1 = very hard to eat & cook 5 = very easy to eat & cook		3.95	0.96	1	5
Trout nutrition	Scale of 1-5 1 = not nutritious at all 5 = very nutritious		3.63	0.98	1	5
Trout price	Scale of 1-5 1 = very expensive 5 = very cheap		3.43	0.85	1	5
Barred-mackerel taste	Scale of 1-5 1 = not delicious at all 5 = very delicious		3.70	1.18	1	5
Barred-mackerel convenience	Scale of 1-5 1 = very hard to eat & cook 5 = very easy to eat & cook		3.98	1.02	1	5
Barred-mackerel nutrition	Scale of 1-5 1 = not nutritious at all 5 = very nutritious		4.15	0.84	1	5
Barred-mackerel price	Scale of 1-5 1 = very expensive 5 = very cheap		2.58	0.94	1	5

Table 2. Summary statistics of the data used to estimate the general model

Variable	Definition	Mean	Std. Dev.	Min.	Max.
Gender	0 if male 1 if female	0.61	0.48	0	1
Age	0 if under 40 yrs. 1 if over 40 yrs.	0.52	0.49	0	1
Income	0 if < $1235 per month 1 if > $1235 per month	0.41	0.49	0	1
Education	0 if 12 Yrs. or less 1 if 16 yrs. or more	0.65	0.47	0	1
Taste	0 if not delicious 1 if delicious	0.59	0.49	0	1
Nutrition	0 if not nutritious 1 if nutritious	0.71	0.45	0	1
Convenience	0 if hard 1 if easy	0.74	0.43	0	1
Salmon-dummy	0 if others 1 if yes	0.33	0.47	0	1
Trout-dummy	0 if others 1 if yes	0.33	0.47	0	1

Table 3. Summary statistics of the data used to estimate the fish-specific models

Variable	Definition	Mean	Std. Dev.	Min.	Max.
Gender	0 if male 1 if female	0.61	0.48	0	1
Age	0 if under 40 yrs. 1 if over 40 yrs.	0.52	0.49	0	1
Income	0 if < $1235 per month 1 if > $1235 per month	0.41	0.49	0	1
Education	0 if 12 Yrs. or less 1 if 16 yrs. or more	0.65	0.47	0	1
Eaten salmon last month	0 if no 1 if yes	0.25	0.43	0	1
Eaten trout last month	0 if no 1 if yes	0.62	0.48	0	1
Eaten barred-mackerel last month	0 if no 1 if yes	0.24	0.43	0	1
Salmon_taste	0 if not delicious 1 if delicious	0.63	0.48	0	1
Salmon_nutrition	0 if not nutritious 1 if nutritious	0.83	0.36	0	1
Salmon_convenience	0 if hard 1 if easy	0.80	0.39	0	1
Trout_taste	0 if not delicious 1 if delicious	0.56	0.49	0	1
Trout_nutrition	0 if not nutritious 1 if nutritious	0.57	0.49	0	1
Trout_convenience	0 if hard 1 if easy	0.73	0.44	0	1
Barred-mackerel_taste	0 if not delicious 1 if delicious	0.59	0.49	0	1
Barred-mackerel_convenience	0 if not nutritious 1 if nutritious	0.76	0.42	0	1
Barred-mackerel_nutrition	0 if hard 1 if easy	0.71	0.45	0	1

Table 4. Effects of fish-attributes and socio-demographic variables on WTP [a]

	General [b]	**Salmon[c]**	**Trout[c]**	**Barred-mackerel[c]**
Gender	-0.61* (0.09)[d]	-0.85 (0.50)	-0.15 (0.20)	-0.50 (0.10)
Age	-0.83** (0.02)	-1.94 (0.13)	-.23** (0.05)	-0.26 (0.40)
Income	0.88** (0.01)	2.68** (0.05)	0.08 (0.50)	0.49 (0.12)
Education	0.45 (0.26)	2.13 (0.15)	0.14 (0.28)	-0.16 (0.62)
Eaten last month		3.26*** (0.01)	0.33*** (0.01)	0.90*** (0.00)
Taste	2.30*** (0.00)	5.31*** (0.00)	0.40*** (0.00)	1.81*** (0.00)
Convenience	0.36 (0.39)	-2.92* (0.08)	0.23 (0. 08)	0.98 (0.01)***
Nutritioun	0.80** (0.05)	4.41*** (0.01)	0.12 (0.33)	0.40 (0.28)
Salmon-dummy	7.83*** (0.00)			
Trout-dummy	-2.54*** (0.00)			
Constant	4.73*** (0.00)	-4.06*** (0.00)	3.45*** (0.00)	4.85*** (0.00)

Notes: [a] All the models estimated with stata version 14.1 [b] Results of the Random-effect interval-data regression general model, panel data; i.e., 338 participants and 867 observations. Estimated with xtintreg. [c] Results of the interval regression fish specific models, based on the decomposed data; i.e., 338 participants with 237 observations for salmon, 327 observations for trout, and 300 observations for barred-mackerel. Estimated with intreg. [d] *p*-values are printed in parenthesis. Significance codes: * denotes significance at 10% level, **denotes significance at 5% level, and ***denotes significance at 1% level.

Table 5.Conditional WTP for each fish type[a]

WTP if [b]:	Salmon (Base price[c]: $26.35)	Trout (Base price: $3.87)	Narrow-barred (Base price: $7.59)
--- (Sample average)	$12.54	$3.98	$6.22
Female	$12.07	$3.97	$5.78
Male	$13.30	$3.98	$6.92
Over 40 years old	$11.22	$3.88	$6.08
Under 40 years old	$14.02	$4.08	$6.36
High income	$15.00	$4.05	$6.48
Low income	$10.81	$3.92	$6.07
Frequent consumer	$17.45	$4.24	$7.78
Not frequent consumer	$10.92	$3.53	$5.71
Delicious	$16.79	$4.26	$7.84
Not Delicious	$10.57	$3.75	$7.84
Easy	$14.92	$4.16	$7.42
Hard	$13.26	$3.78	$5.38
Nutritious	$15.50	$4.20	$7.13
Not nutritious	$9.80	$3.86	$5.85

Notes: [a] Constant only models using intreg lower bound WTP upper bound WTP in Stata 14.1. [b] Using if command in Stata 14.1. [c] Base price: the cheapest prices found for that fish type in the market at the date in which survey was started.

Appendix

Questionnaire:

This is a survey about the important factors for Iranian seafood consumers. I would be grateful if you could give me 5 minutes to answer a few questions. The results of this survey are going to be used in my master's thesis only, and your response is guaranteed to be confidential.

Respondent #: _____

1. Do you often do grocery shop? Yes □ No □
2. Sex Male □ Female □
3. What is your age?

	Less than 20
	20 – 30
	30 – 40
	40 – 50
	More than 50
	Will not tell

4. What is the number of people in your household? _____
5. What is the number of children aged under 12 years old in your household:_____
6. On average, how often do you, or a member of your household eat seafood?

	Never
	Less than once every three months
	Once or twice every three months
	One to three times every month
	Once or twice every week
	More than twice a week
	I Don't know

Attributes of Norwegian Salmon[13]

7. Have you ever tasted Norwegian salmon? Yes □ No □
8. Have you eaten Norwegian salmon during the last month? Yes □ No □
9. Think that you are in a good reliable food store to buy fish. How do you rank Norwegian Salmon for the following attributes?

Taste	Not delicious at all	1	2	3	4	5	Very delicious
Convenience	Very difficult to cook & eat	1	2	3	4	5	Very easy to cook & eat
Health and Nutrition	Not healthy & nutritious at all	1	2	3	4	5	Very healthy & nutritious
Price	Very expensive	1	2	3	4	5	Very cheap

Attributes of Rainbow Trout

10. Have you ever tasted rainbow trout? Yes □ No □
11. Have you eaten rainbow trout during the last month? Yes □ No □
12. Think that you are in a good food store to buy fish. How do you rank rainbow trout for the following attributes?

Taste	Not delicious at all	1	2	3	4	5	Very delicious
Convenience	Very difficult to cook & eat	1	2	3	4	5	Very easy to cook & eat
Health and Nutrition	Not healthy & nutritious at all	1	2	3	4	5	Very healthy & nutritious
Price	Very expensive	1	2	3	4	5	Very cheap

Attributes of Spanish mackerel

13. Have you ever tasted Spanish mackerel? Yes □ No □
14. Have you eaten Spanish mackerel during the last month? Yes □ No □
15. Think that you are in a good food store to buy fish. How do you rank Spanish mackerel for the following attributes?

Taste	Not delicious at all	1	2	3	4	5	Very delicious
Convenience	Very difficult to cook & eat	1	2	3	4	5	Very easy to cook & eat
Health and Nutrition	Not healthy & nutritious at all	1	2	3	4	5	Very healthy & nutritious
Price	Very expensive	1	2	3	4	5	Very cheap

[13] Show Handout 1 for all the attribute questions to the participant

Willingness to pay[14]

Consider you are in a good reliable food store to purchase fish, and the price of all other products is the same as last time you were there. The three fish types below are on sale. What is the maximum price you would be willing to pay for a kilogram of each of these fish types? Remember that you have nothing to gain from answering less than the maximum you would be willing to pay.

Price of Norwegian salmon (size 2-3 kg)	**I will buy Norwegian salmon**
1,100,000 IRR ($34.1)[15] (1.3*Market price)	
935,000 IRR ($28.98) (1.1*Market price)	
850,000 IRR ($26.35) (Market price)	
680,000 IRR ($21.08) (0.8*Market price)	
425,000 IRR ($13.17) (0.5*Market price)	
I will not buy salmon irrespective of market price	
Price of rainbow trout (Normal size)	**I will buy rainbow trout**
170,000 IRR ($5.27) (1.3*Market price)	
140,000 IRR ($4.34) (1.1*Market price)	
125,000 IRR ($3.87) (Market price)	
100,000 IRR ($3.1) (0.8*Market price)	
70,000 IRR ($2.17) (0.5*Market price)	
I will not buy rainbow trout irrespective of market price	
Price of barred-mackerel (Normal size)	**I will buy barred-mackerel**
320,000 IRR ($9.92) (1.3*Market price)	
270,000 IRR ($8.37) (1.1*Market price)	
245,000 IRR ($7.59) (Market price)	
200,000 IRR ($6.2) (0.8*Market price)	
130,000 IRR ($4.03) (0.5*Market price)	
I will not buy barred-mackerel irrespective of market price	

[14] Show Handout 2.

[15] Converting exchange rate 1 IRR = 0.000031

16. In which zone of Tehran province are you residing? _____

17. What is your highest level of your education?

	Secondary school or less (<8 years)
	Diploma (12 years)
	Bachelor (16 years)
	Master degree or more (18 years<)

18. What is the occupation of the main earner in your household?

	Student
	Blue collar worker
	White collar worker
	Self employed
	Retired
	Unemployed/Other

19. What is the total monthly income of your household? (The income that is spent for the family)

	Less than 30,000,000 IRR (<$925)
	Between 30,000,000 to 40,000,000 IRR ($925-$1235)
	Between 40,000,000 to 50,000,000 IRR ($1235-$1540)
	Between 50,000,000 to 60,000,000 IRR ($1540-$1850)
	More than 60,000,000 IRR ($1850<)

Handout-1

Norwegian Salmon (Size 2-3 Kg)
Fresh whole fish, gutted

Taste	Not delicious at all	1	2	3	4	5	Very delicious
Convenience	Very difficult to cook & eat	1	2	3	4	5	Very easy to cook & eat
Health and Nutrition	Not healthy & nutritious at all	1	2	3	4	5	Very healthy & nutritious
Price	Very expensive	1	2	3	4	5	Very cheap

Rainbow trout (Normal size)
Fresh whole fish, gutted

Taste	Not delicious at all	1	2	3	4	5	Very delicious
Convenience	Very difficult to cook & eat	1	2	3	4	5	Very easy to cook & eat
Health and Nutrition	Not healthy & nutritious at all	1	2	3	4	5	Very healthy & nutritious
Price	Very expensive	1	2	3	4	5	Very cheap

Spanish mackerel (Normal size)
Fresh whole fish, gutted

Taste	Not delicious at all	1	2	3	4	5	Very delicious
Convenience	Very difficult to cook & eat	1	2	3	4	5	Very easy to cook & eat
Health and Nutrition	Not healthy & nutritious at all	1	2	3	4	5	Very healthy & nutritious
Price	Very expensive	1	2	3	4	5	Very cheap

Handout-2

Willingness to pay

Consider you are in a good reliable food store to purchase fish, and the price of all other products is the same as last time you were there. The three fish types below are on sale. What is the maximum price you would be willing to pay for a kilogram of each of these fish types? Remember that you have nothing to gain from answering less than the maximum you would be willing to pay.

Price of Norwegian salmon (size 2-3 kg)	**I will buy Norwegian salmon**
1,100,000 IRR	
935,000 IRR	
850,000 IRR	
680,000 IRR	
425,000 IRR	
I will not buy salmon irrespective of market price	
Price of rainbow trout (Normal size)	**I will buy rainbow trout**
170,000 IRR	
140,000 IRR	
125,000 IRR	
100,000 IRR	
70,000 IRR	
I will not buy rainbow trout irrespective of market price	
Price of barred-mackerel (Normal size)	**I will buy barred-mackerel**
320,000 IRR	
270,000 IRR	
245,000 IRR	
200,000 IRR	
130,000 IRR	
I will not buy barred-mackerel irrespective of market price	

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