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INTERNATIONAL JOURNAL ON FOOD SYSTEM DYNAMICS

Int. J. Food System Dynamics 13 (2), 2022, 174-191

DOI: https://dx.doi.org/10.18461/ijfsd.v13i2.B5

Iranian Consumers' Willingness to Pay for Fresh Fish

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Received May 2021, accepted January 2022, available online April 2022

ABSTRACT

This paper explores attitudes and willingness to pay (WTP) for Norwegian salmon, Iranian rainbow trout, and Iranian narrow-barred Spanish mackerel among Iranian consumers. An interval regression model found that consumption frequency and product attributes affected WTP. Salmon was ranked highest on taste, nutrition, and convenience but lowest on price. The average estimated WTP for salmon was US $14.82, which is higher than for the other species but below the market price. The main challenges for salmon exporters will be to reduce the current high price and to differentiate salmon further in the market.

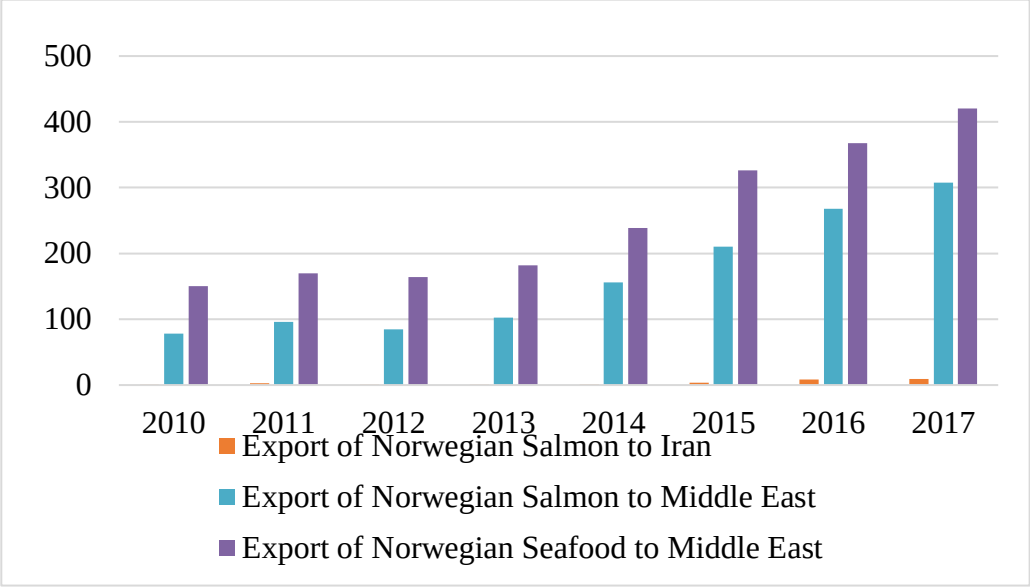
Keywords: *Consumer attitudes; fresh fish; Iran; salmon; willingness to pay*

1 Introduction

According to the Food and Agriculture Organization (FAO, 2015), the annual per capita seafood consumption in Iran is 9.2 kg, which is below the world average of 18.9 kg. A main objectives of Iranian food policy is to increase annual fish consumption to 15 kg per capita by the end of 2020. Another objective is to improve the balance between export and import in the fish market (FAO, 2015). Since the 1980s, Iranian aquaculture and fisheries production have increased steadily to an annual production of over 1 million tons (FAO, 2015). About 60% of this production is wild caught (Innovation Norway, 2016). In 2016, 82,000 tons with a value of US $350 million were exported. The most important wild species in the Persian Gulf are tuna, narrow-barred Spanish mackerel, chub mackerel, and sharks. The most important species in the Caspian Sea are kutum, grey mullets, sturgeon, European carp, and kilka. The main aquaculture species are rainbow trout, different species of Chinese carps, and shrimp (Innovation Norway, 2016). About 44% of the total seafood supply is fresh, 26% frozen, 24% canned tuna, and the remaining seafood is in other processed forms (Islamic Parliament Research Center of the Islamic Republic of Iran, 2005).

Norway is the world's second largest seafood exporter (Norway Exports, 2018). The export value of Norwegian farmed salmon was about US $7.37 billion in 2016 (Statistics Norway, 2017) (exchange rate US $1 = NOK8.33). Norwegian seafood export to the Middle East is quite limited but has increased as shown in Fig 1. Iran has recently started to import seafood from Norway. This import consists almost exclusively of salmon, and only salmon of Norwegian origin is imported to Iran. Norwegian Seafood Council's (NSC) data show that only 0.1% of the salmon export goes to Iran, and about 18% of the salmon were fresh salmon in 2016 (NSC, 2018). However, given increased emphasis on fish consumption in Iran and increased seafood exports to the Middle East, there may be a market potential for Norwegian salmon in Iran.

The objective of this paper is to explore Iranian consumers' preferences and WTP for fish. A consumer survey was conducted during three weeks in February and March 2017 in food stores in the Tehran province. The respondents stated their WTP and preferences for Norwegian farmed salmon, Iranian farmed rainbow trout, and Iranian wild narrow-barred Spanish mackerel. WTP and marginal effects on WTP of socioeconomic variables (gender, age, education, and income), intrinsic attributes (taste, convenience, and nutrition), and frequency of consumption were estimated by an interval regression model. To best of our knowledge, this is the first study to investigate WTP for fish in Iran.



Source: Authors' calculations based on data from Norwegian Seafood Council (NSC, 2018). Exports of fresh, chilled, and frozen fish in millions of US$. The only Norwegian seafood exported to Iran during this period was salmon.

Figure 1. Export value of Norwegian seafood to Iran and Middle East

2 Brief literature review

There is a large literature on the effects of socioeconomics variables and intrinsic attributes on the consumption of fish, and we only provide some examples of typical findings from the literature. Gender, age, education, and income have frequently been found to affect consumption, WTP, and purchasing behavior of the consumers' worldwide. Verbeke and Vackier (2005) found that women consume seafood more frequently than men. However, women bid

less for fish than men in an experiment in France (Rickertsen et al., 2017a). Age has been found to be positively correlated with seafood consumption, possibly because older people consume fish for health reasons (Clonan et al., 2012; Gustavsen et al., 2014; Olsen, 2003; Verbeke and Vackier, 2005). However, Rickertsen et al. (2017a) found that WTP for farmed salmon decrease with age, while education and income increased the WTP for seafood. Bronnmann and Hoffmann (2018) found small effects of socioeconomic characteristics on individuals' purchasing decisions for seafood.

Among the intrinsic attributes of seafood, taste and nutrition are important for consumption, while lack of convenience and high prices are main barriers against seafood consumption (Fernández-Polanco et al., 2013; Olsen, 2004; Rickertsen et al., 2017a; Verbeke and Vackier, 2005). Habits have also been found to affect seafood consumption (Honkanen et al., 2005; Verbeke and Vackier, 2005) and purchasing frequencies of fish (Buason et al, 2020; 2021). Perceived safety has been found to be important for consumption of all foods (Bazzani et al., 2018; Lusk and Briggeman, 2009). However, Verbeke (2005) found that concerns regarding food safety are most important for controversial products such as GM or irradiated products. For conventional foods, most consumers are less anxious about food safety.

Studies of Iranian seafood consumption have found that women consume more seafood than men and that age is positively related to the frequency of consumption (RezaeiPandari and Mohammadi, 2015). Furthermore, high education and income have been associated with increased consumption frequency (Dadgar et al., 2015). Unpleasant taste and high prices have also been found to be important barriers against consumption (Alinejad et al., 2015; RezaeiPandari, 2016; RezaeiPandari and Mohammadi, 2015). There has been an increasing preference for fish that is easy to prepare and eat (Adeli and Shabanpour, 2007), and nutrition has been found to be the main reason for consumption of seafood (Adeli et al., 2011).

3 The survey

The survey took place four days per week in one morning and one afternoon session. Every fifth customer passing through the cashier in three major hypermarkets in different areas of Tehran were asked whether they were willing to participate in a survey about consumers' preferences for fish. The survey was translated to Persian and the English version is provided in the Appendix. To reduce uncertainty regarding food quality, safety or price, each respondent was told to assume that he or she was buying fish from a 'reliable' food store. The respondents were also explained that there was no reason not to reveal her or his true WTP. Only seafood consumers who were the main food shopper in their household were included, and the sample consists of 338 respondents.

After a set of initial questions, respondents were asked to score each species on a scale from 1 (lowest) to 5 (highest) for taste (not delicious at all – very delicious), convenience (very difficult to cook and eat – very easy to cook and eat), health and nutrition (not healthy and nutritious – very healthy and nutritious), and price (very expensive –very cheap). Before they responded, a handout with the pictures of the fishes, descriptions of the attributes, and scoring scales was given to the respondent (Handout 1 in the Appendix).

We used fresh whole gutted fish because most seafood in Iran is sold in this form. The domestic species were chosen due to their popularity. Rainbow trout (*Oncorhynchus mykiss* or ghezel ala in Persian) is a freshwater fish, which is farmed in 28 out of 31 provinces and is included as the less expensive substitute (Adeli and Baghaei, 2013). Narrow-barred Spanish mackerel (*Scomberomorus commerson* or shir mahi in Persian) is a saltwater species caught in the Persian Gulf and is included as the expensive substitute. The price of this species is less than half the price of salmon, however, the price of salmon is higher than the price of any other commonly available fish species. The included species will be referred to as salmon, trout, and mackerel for the remainder of this paper.

Next, a second handout with a multiple price list (MPL) was given to the respondent (Handout 2 in the Appendix). The MPL, as a set of repeated valuation questions offering dollar values to the respondents, was first used in pricing of consumption goods by Kahneman et al. (1990). The main advantage of the MPL is that it is transparent and easy to understand (Andersen et al., 2006).

Our MPL offered five prices for each species, and the respondent indicated the maximum WTP for each species. The base prices were placed as the alternative in the middle and reflected the lowest market price for the species on the first day of the survey. To avoid anchoring effects, the respondents were not told these market prices. The other prices for each alternative were calculated as a 20% or 50% price discount and a 10% or 30% price markup. All the prices were given in Iranian Rial (IRR). Finally, the respondents were asked about their education, occupation, and income.

4 Data and survey results

Table 1 shows the distributions of answers regarding attitudes towards the attributes of each species. The number of respondents scoring each attribute varies between species and attributes. Some respondents did not provide scores because they had not tasted or prepared the species before and were uncertain about what score to give. The last column shows the mean scores.

The mean scores show that salmon was ranked highest on taste (score 3.8), health and nutrition (score 4.3), and convenience (score 4.2) but lowest on price (score 2.0). Large proportions of the respondents found salmon to be very delicious (31.9%), very healthy and nutritious (51.2%), very convenient (45.9%), but very expensive (41.1%). Trout was ranked highest on price (score 3.4), and only 1.8% found trout to be very expensive. The mean scores for trout and mackerel were quite similar for convenience (score 4.0), and taste (scores 3.6 and 3.7). Trout received the lowest score on health and nutrition (score 3.6).

Table 1.
Consumers' attitudes, percentage distributions and mean scores

Score	1	2	3	4	5	Mean
Taste	Not delicious				Very delicious	
Salmon (*n* = 238)	1.7	10.5	24.4	31.5	31.9	3.8
Trout (*n* = 331)	3.6	9.7	29.9	32.0	24.8	3.6
Mackerel (*n* = 300)	4.7	12.7	23.7	25.7	33.3	3.7
Health & nutrition	Not nutritious				Very nutritious	
Salmon (*n* = 246)	0.4	2.0	13.8	32.5	51.2	4.3
Trout (*n* = 329)	1.8	10.6	30.4	36.2	21.0	3.6
Mackerel *(n* = 300)	0.3	2.3	20.7	35.7	41.0	4.2
Convenience	Not easy				Very easy	
Salmon (*n* = 244)	1.6	4.5	13.5	34.4	45.9	4.2
Trout (*n* = 331)	1.5	7.3	18.1	40.2	32.9	4.0
Mackerel (*n* = 300)	1.0	9.7	18.0	32.3	39.0	4.0
Price	Very expensive				Very cheap	
Salmon (*n* = 248)	41.1	25.8	26.6	4.8	1.6	2.0
Trout (*n* = 331)	1.8	9.1	42.9	36.3	10.0	3.4
Mackerel (*n* = 299)	11.4	35.5	39.8	9.7	3.7	2.6

Note: The number of respondents scoring each attribute for each species are given in the parentheses.

The percentage distributions of WTP values for each species are presented in Table 2. Almost 90% of the respondents were willing to pay at least the market price of trout and about two-thirds were willing to pay at least the market price of mackerel. Only about a quarter of the respondents were willing to pay at least the market price of salmon, and about a quarter would not buy salmon at any of the offered prices. About 18% and 6% would not buy mackerel or trout, respectively, at any of the offered prices.

Table 2.
Willingness to pay for fresh fish, percentage distributions

	Salmon	Trout	Mackerel
Will not buy = 0	24.6	6.2	18.3
50% discount (WTP_1)	29.3	1.8	4.1
20% discount (WTP_2)	21.3	4.7	10.4
Market price (WTP_3)	10.7	15.7	14.8
10% markup (WTP_4)	3.6	21.0	17.5
30% markup (WTP_5)	10.7	50.6	34.9

Note: Based on 338 respondents.

Table 3 presents the mean, standard deviation, and number of observations for each explanatory variable. In the survey, age, education, and income had more than four categories. The variables were divided into two groups based on their mean values. Around 60% of the respondents were female and about half were more than 40 years old. Two-thirds were highly educated, and approximately 40% were among the high-income group earning more than $1,235 per month. The respondents included more females, were older, and had higher income than the average of the population in the Teheran province. According to data from Statistical Center of Iran (SCI, 2014; 2016), the population's average age was 33 years, and the average monthly net income was US $750 (exchange rate US $1 = IRR32,258).

Table 3.
Summary statistics for the exploratory variables

Variable	Definition	Mean	Std. Dev.	No of Obs.
Gender	= 1 if female	0.61	0.48	338
Age	= 1 if more than 40 years	0.52	0.50	338
Education	= 1 if a BS or more	0.65	0.47	338
Income	= 1 if > $1,235 per month	0.41	0.49	338
Salmon				
Taste	= 1 if ranked 4 or 5	0.63	0.48	238
Nutrition	= 1 if ranked 4 or 5	0.83	0.37	246
Convenience	= 1 if ranked 4 or 5	0.80	0.39	244
Frequent consumer	= 1 if eaten last month	0.25	0.43	338
Not tasted	= 1 if never tasted	0.29	0.45	338
Trout				
Taste	= 1 if ranked 4 or 5	0.57	0.50	331
Nutrition	= 1 if ranked 4 or 5	0.57	0.49	329
Convenience	= 1 if ranked 4 or 5	0.73	0.44	331
Frequent consumer	= 1 if eaten last month	0.62	0.48	338
Not tasted	= 1 if never tasted	0.02	0.14	338
Mackerel				
Taste	= 1 if ranked 4 or 5	0.59	0.49	300
Nutrition	= 1 if ranked 4 or 5	0.76	0.42	300
Convenience	= 1 if ranked 4 or 5	0.71	0.45	300
Frequent consumer	= 1 if eaten last month	0.25	0.43	338
Not tasted	= 1 if never tasted	0.11	0.32	338

Note: The number of observations differs between the attributes and species for several reasons. First, some respondents, who had not tasted or prepared all the species, did not want to score the fish for taste or convenience. Second, some respondents, who had tasted all the species, did not know the nutritional value and could not score this attribute for some of the species. However, some respondents, who had not tasted some of the species, still scored them for convenience and nutrition based on their beliefs.

For each intrinsic attribute, 3 was used as the cut-off point, i.e., the corresponding dummy variable was set to 1 for those who scored 4 or 5 on the attribute and zero otherwise. In the reminder of the paper, the term 'emphasized' is used to refer to respondents who gave the attribute a score of 4 or 5. Sixty-three percent of the respondents emphasized taste, 83% nutrition, and 80% convenience of salmon. A frequent consumer of a species was defined as a respondent who reported to have eaten the species in the month before the interview. Twenty-five percent were frequent salmon consumers while almost 30% had never tasted salmon. During the survey period, most of the main distributors of salmon in Iran only supplied frozen salmon. However, frozen fish has been found to be less desired among Iranian seafood consumers (Mohammad-Rezaei, 2006). Some of the respondents noted that only frozen salmon was available, and they were not sure for how long the fish had been frozen. For trout, 57% emphasized trout's taste and nutrition and 73% its convenience. Sixty-two percent were frequent trout consumers, while only 2% had never tasted trout. The taste of mackerel was emphasized by almost 60%, and its nutrition and convenience was emphasized by 76% and 71%, respectively. Twenty-five percent were frequent mackerel consumers and 11% had never tasted mackerel.

The mean WTP values for the sample and different subgroups, the associated standard deviations, and the number of observations for each group are provided in Table 4. The WTP values are reported in US $ per kg of fresh whole and gutted fish. The lowest prices available in the market at the starting date of the survey were $26.35 for salmon, $3.98 for trout, and $7,59 for mackerel. The average respondent was willing to pay more than the (lowest) market price for trout and close to the market price for mackerel. However, for salmon the average WTP was more than $10 below the market price. All groups of respondents who have tasted trout indicated a WTP above the market price, for mackerel the groups who were frequent consumers and emphasized the different attributes of mackerel were willing to pay more than the price, and for salmon no group had an average WTP equal to the market price. However, as shown in Table 2 and discussed above, 25% of the respondents were willing to pay the market price. The WTP for salmon among respondents who had never tasted salmon was as high as $10.55.

Table 4.
Summary statistics of WTP values for different subgroups

Group	Mean	Std. Dev.	No. of Obs.
Salmon, sample average	15.81	11.10	338
Female	15.25	11.60	208
More than 40 years old	14.55	11.04	178
Bachelor's degree or more	17.27	10.87	221
High income	18.14	11.23	141
Emphasize taste of salmon	20.22	9.43	151
Emphasize nutrition of salmon	18.99	9.75	206
Emphasize convenience of salmon	18.48	9.99	196
Frequent consumer of salmon	20.90	8.95	85
Never tasted salmon	10.55	11.88	100
Trout, sample average	4.37	1.34	338
Female	4.37	1.32	208
More than 40 years old	4.26	1.45	178
Bachelor's degree or more	4.44	1.24	221
High income	4.45	1.33	141
Emphasize taste of trout	4.70	0.78	188
Emphasize nutrition of trout	4.61	0.93	188
Emphasize convenience of trout	4.57	1.06	242
Frequent consumer of trout	4.66	0.77	211
Never tasted trout	0.00	0.00	7
Mackerel, sample average	6.85	3.58	338
Female	6.41	3.83	208
More than 40 years old	6.73	3.63	178
Bachelor's degree or more	6.80	3.61	178
High income	7.08	3.62	141
Emphasize taste of mackerel	8.55	1.82	177
Emphasize nutrition of mackerel	7.83	2.70	230
Emphasize convenience of mackerel	8.12	2.55	214
Frequent consumer of mackerel	8.49	1.86	84
Never tasted mackerel	1.89	3.53	39

Notes: The mean values are reported in US $ per kg of fresh whole and gutted fish.

5 Model

The WTP is censored and recorded for the intervals shown in Table 2. To estimate the WTP values, an interval regression model was employed. The interval regression model is a generalization of the Tobit model with known intervals (Amemiya, 1973). Let $0<WTP_1<WTP_2<WTP_3<WTP_4<WTP_5$ denote the specified interval limits of the latent WTP for each species. The respondents who are not willing to buy the species at any of the offered prices are in the zero block, the respondents who will buy the fish given a 50% discount are in the next block, and so on. The model specification in Rickertsen et al. (2017b) is followed, and the likelihood function for the WTP for each species is:

$$L = \prod_{WTP=0} \Phi\left[\frac{x\prime_i\beta}{\sigma}\right] \prod_{0<WTP\leq WTP_1} \left(\Phi\left[\frac{WTP_1 - x\prime_i\beta}{\sigma}\right] - \Phi\left[\frac{0 - x\prime_i\beta}{\sigma}\right]\right) \prod_{WTP_1<WTP\leq WTP_2} \left(\Phi\left[\frac{WTP_2 - x\prime_i\beta}{\sigma}\right] - \Phi\left[\frac{WTP_1 - x\prime_i\beta}{\sigma}\right]\right) \prod_{WTP_2<WTP\leq WTP_3} \left(\Phi\left[\frac{WTP_3 - x\prime_i\beta}{\sigma}\right] - \Phi\left[\frac{WTP_2 - x\prime_i\beta}{\sigma}\right]\right) \prod_{WTP_3<WTP\leq WTP_4} \left(\Phi\left[\frac{WTP_4 - x\prime_i\beta}{\sigma}\right] - \Phi\left[\frac{WTP_3 - x\prime_i\beta}{\sigma}\right]\right) \prod_{WTP_4<WTP\leq WTP_5} \left(1 - \Phi\left[\frac{WTP_4 - x\prime_i\beta}{\sigma}\right]\right) \quad (1)$$

where Φ is the cumulative distribution function for the standard normal, σ is the standard error of WTP, β is a vector of parameters, and x is a vector of the independent variables in Table 3. However, the not tasted variables were omitted due to multicollinearity.

For each respondent, there exist repeated observations of WTP values and attribute scores, and this panel structure is accounted for by applying a random-effects interval regression model, which treats individual-specific characters as random parameters. Define the latent willingness to pay, WTP^* as:

$$WTP^*_{if} = D_1 x'_{if}\,\beta_1 + D_2 x'_{if}\,\beta_2 + D_3 x'_{if}\,\beta_3 + v_i + e_{if} \quad (2)$$

where f = 1, 2, 3 denotes the three fish species and i = 1, …, n denotes the respondents. D_f equals to 1 for the relevant fish species and 0 otherwise. In Equation (1), $x'_i\beta$ is replaced by $D_1 x'_{if}\,\beta_1 + D_2 x'_{if}\,\beta_2 + D_3 x'_{if}\,\beta_3$. The error term v_i represents respondent specific random variation that is assumed to be iid $N(0, \sigma_v^2)$. This variation is assumed to be constant across species for one individual, for example, a high-bidder is likely to bid high for all species. The error term e_{if} is an observation specific error term that represents all other factors affecting the dependent variable, and it is assumed to be independent of v_i and $N(0, \sigma_e^2)$. The composite error term is $u_{if} = v_i + e_{if}$. The proportion of the total variance contributed by the panel-level variance component, ρ, is given by:

$$\rho = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_e^2} \quad (3)$$

where $\sigma_v^2 = \mathrm{Var}(v_i)$ and $\sigma_e^2 = \mathrm{Var}(e_{if})$. When ρ is high, the panel structure is important, and the pooled estimator will give incorrect standard errors. When ρ is close to zero, the panel-level variance is not important, and the model can be estimated by using pooled OLS with fish specific fixed effects. The random-effects interval regression model estimated by the -xtintreg- procedure in Stata (StataCorp, 2017).

6 Econometric results

Hundred and forty-seven observations with missing values on some of the attributes were excluded and Equation (2) was estimated using 867 observations. First, a random-effects model was estimated. The panel-level variance was insignificant (p-value = 0.41) and ρ was close to zero. A likelihood-ratio test also rejected significant differences between pooled and panel estimators. Second, a pooled interval regression was estimated. Failure to control for within-cluster correlation can lead to small standard errors and inflated t-statistics, and pooled interval regression using cluster-robust standard errors was applied (Cameron and Miller, 2015). A model with only alternative specific constants (ASCs) was estimated and this model was rejected (p-value = 0.00). A model with all the marginal effects in the salmon equation but only ASCs in the other equations was also rejected (p-value = 0.03).

The results of the pooled OLS regression with cluster-robust standard errors, ASC, and all marginal effects are presented in Table 5. An asterisk indicates significance at the 5 percent level. The parameter estimates represent the marginal price effects in US $ of the corresponding dummy variables on the WTP for one kilogram of whole gutted fresh fish. The parameters associated with the constants can be interpreted as the WTP for the hypothetical reference respondent, i.e., a respondent who is male, young, low income, does not hold a bachelor's degree, has

tasted the species but not eaten it during the previous month, and scores the species low on all the attributes. The ASC is significant in each equation, and they indicate that the reference respondent has WTP values below the unconditional sample averages reported in Table 2. The difference for the reference respondent is very large for salmon with a WTP of $7.76 as compared with the sample average of $15.81. This difference indicates the importance of the other variables for the WTP values. Respondents who were more than 40 years old had $0.26 lower WTP for trout. Except age, demographic variables did not affect the WTP.

The intrinsic attributes are important. Taste significantly affected WTP values for all the species. Respondents who emphasized the taste of salmon were willing to pay $5.51 more for one kg of salmon than other respondents, while those who emphasized the taste of trout and mackerel were willing to pay $0.41 and $1.81 more, respectively. Respondents who emphasized the nutritional benefits of salmon were willing to pay a premium of $4.58. Lastly, convenience increased WTP for mackerel by $0.97.

Frequent consumers were willing to pay a premium. Frequent salmon consumers were willing to pay $3.32 more than other respondents, and frequent consumers of trout and mackerel were willing to pay an additional $0.29 and $0.91 for these species.

Table 5.
Pooled OLS parameter estimates with cluster robust standard errors[a]

	Salmon		Trout		Mackerel	
Variable	Parameter[b]	SE[c]	Parameter[b]	SE[c]	Parameter[b]	SE[c]
Constant	7.76*	2.33	3.51*	0.23	4.82*	0.65
Gender	-1.06	1.32	-0.17	0.12	-0.47	0.32
Age	-2.06	1.40	-0.26*	0.11	-0.24	0.31
Education	1.91	1.62	0.15	0.14	-0.15	0.33
Income	2.66	1.51	0.07	0.13	0.48	0.32
Taste	5.51*	1.46	0.41*	0.13	1.81*	0.40
Nutrition	4.58*	1.76	0.13	0.13	0.39	0.42
Convenience	-2.83	1.61	0.24	0.16	0.97*	0.47
Frequent consumer	3.32*	1.39	0.29*	0.14	0.91*	0.28
Log-pseudo likelihood		-2171				
AIC		4398				
BIC		4531				
N[d]		867				

Notes: [a] Estimated with -intreg- command and -vce- option, using Stata/IC15. [b] An asterisks indicate significance at the 5% level. [c] Cluster robust standard errors. [d] The sample size is 867. Of the 1,014 observations, 147 observations were excluded due to a missing value in the evaluation of one or several attributes.

The sample was bootstrapped with 300 repetitions, WTP values were predicted for each species and respondent, and the average WTP of each species was calculated. The average predicted WTP is $14.82 with a standard deviation of 0.66 for salmon, $4.07 with a standard deviation of 0.07 for trout, and $6.83 with a standard deviation of 0.17 for mackerel. These predicted WTP values are quite close to the unconditional sample averages reported in Table 4, which are $15.81 for salmon, $4.37 for trout, and $6.68 for mackerel.

7 Discussion and implications

Salmon scored highest on taste, health and nutrition, and convenience but lowest on price. These attitudes towards Norwegian salmon correspond well with the attitudes among French consumer reported in Rickertsen et al. (2017a) where salmon received the highest scores on taste and convenience (as compared with cod, pangasius, and monkfish) and received second highest score on health but was perceived as a relatively expensive fish. Attributes such as wild caught versus farmed or domestic versus imported were not investigated in this study. However, salmon scored high even though it is a farmed, new, and imported species in the Iranian seafood market, and the results correspond well with Sogn-Grundvåg et al. (2014), who found a preference for imported fish which perceived to be of a higher quality. However, the Iranian preferences contrast results from some other countries, which found preferences for domestically produced and wild fish (Asche and Guillen, 2012; Claret et al., 2012; Rickertsen et al., 2017a; Roheim et al., 2012).

In the econometric model, age was the only socio-demographic variable affecting WTP. Previous studies have also reported insignificant effects of socio-demographic variables on individuals' choice probabilities and decision makings regarding seafood and food in general (Bronnmann and Hoffmann, 2018; Grebitus et al., 2015). The

intrinsic attributes were important as in several other studies (Fernández-Polanco et al., 2013; Rickertsen et al., 2017a; Verbeke and Vackier, 2015). We also found that frequent consumers were willing to pay a premium, which is consistent with habitual effect in seafood consumption (Belz and Schmidt-Riediger, 2010; Verbeke and Vackier, 2005, Buason et al., 2021).

The most important barrier towards increased sales of salmon is its high price. To substantially increase sales, the price must be reduced. As shown in Table 2, almost three quarter of the respondents would be willing to buy salmon given a price reduction of 50% or a price corresponding to the typical price found in European countries. To reduce the price of salmon, sales of larger volumes are required. The highly decentralized distribution system represents a challenge for increasing the volume. Approximately 75% of the more than 300,000 food outlets are small and independent grocery stores (Innovation Norway, 2016). Trout and mackerel are available in local as well as large chain stores, while salmon is only available in some hypermarkets. It is very challenging to focus on all outlet channels, and the focus should be on distributing effectively to the selected target groups (Belz and Schmidt-Riediger, 2010). The target group consists of well-educated and high-income households in wealthy regions of Tehran.

A complementary strategy is to increase the WTP for salmon, by product differentiation and other marketing activities. Product differentiation implies that suppliers must create a physical or psychological distinction between goods that are close substitute such that consumers no longer view them as identical products (Lipczynski et al., 2005:465). This strategy is frequently used in the seafood industry, and previous practices on differentiating Norwegian salmon in other markets have been found to be successful (Kinnucan and Wessells, 1997). Emphasizing salmon's good taste in advertising and providing nutritional facts on labels may also increase the WTP for salmon (Alfnes et al., 2018).

A close substitute to Norwegian salmon, which recently has appeared in the Iranian market, is domestically farmed brown trout (Salmo trutta). Iran has started to import brown trout eggs from Denmark and Norway for domestic aquaculture. Brown trout is quite similar to salmon in terms of appearance and taste. Due to governmental support for domestic production, brown trout is produced and sold at almost half of the price of salmon. Furthermore, brown trout is commonly referred to as salmon. Given the novelty of both species, the differences between Norwegian salmon and brown trout may not be apparent to consumers. In this situation, labeling and advertising for the country-of-origin can differentiate the fish and affect the WTP (Alfnes et al., 2018; Asche and Guillen, 2012; Claret et al., 2012; Sogn-Grundvåg et al., 2014; Zander and Feucht, 2018). Other promotional activities could be to give out samples for tasting in hypermarkets or to collaborate with restaurants to include salmon in their menus (Kinnucan and Venkateswaran, 1990). Such collaboration would increase the chances for consumers to try salmon and develop a preference for this fish (Redkar and Bose, 2004). Finally, marketing activities may also contribute towards establishing a habit of eating salmon among some consumers as discussed in Buason et al. (2021).

There are two main limitations in this study. First, the sample size is relatively small and from a relatively wealthy area in Teheran, which will affect the generalizability of the results. However, this sample is representative for the market where increased sales of salmon is most likely. Second, the survey did not include real economic incentives, and the results may suffer from a hypothetical bias. For a meta-analysis of the hypothetical bias problem see List and Gallet (2001).

8 Conclusions

Salmon was ranked highest in terms of taste, nutrition, and convenience and worst in terms of price. The average unconditional WTP among the respondents was $15.81 for salmon, $6.86 for mackerel, and $4.37 for trout. The average predicted WTP by the estimated model was $14.82 for salmon, $6.83 for mackerel, and $4.07 for trout. The WTP for mackerel and trout corresponds well with the market prices for these species. Except the negative association between age and WTP for trout, demographic characteristics did not have significant effects on WTP. Respondents who emphasized salmon's taste were willing to pay $5.51 extra, while those who emphasized trout's and mackerel's taste were willing to pay $1.81 extra. Respondents who emphasized salmon's nutrition were willing to pay $4.58 extra for salmon, and those who emphasized mackerel's convenience were willing to pay approximately $1 extra for mackerel. Frequent consumers of salmon, trout and mackerel were willing to pay $3.32, $0.29, and $0.91 more than other respondents, respectively. At current prices, about a quarter of the respondents indicated that they would buy salmon. In total, these results suggest a substantial market potential for Norwegian salmon.

Acknowledgements

The authors wish to thank Frode Alfnes for his useful comments on questionnaire design and model estimation, Geir Gustavsen for providing the codes for bootstrapping, and Mohammad Javad Zali for his comments on the Persian questionnaire, and two anonymous assistants for their help with the data collection

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Appendix

Survey questionnaire

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

Respondent #: _____

1. Do you often do grocery shop? Yes ☐ No ☐ **(If no Stop rule 1 applies)**

2. Sex Male ☐ Female ☐

3. What is your age?

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

4. What is the number of people living in your household? _____

5. How many children aged less than 12 years are living 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
	Do not know

(If never Stop rule 2 applies)

Attributes of Norwegian salmon

Handout 1 was shown to the respondent for the attribute questions below.

Have you ever tasted Norwegian salmon? Yes ☐ No ☐

7. Have you eaten Norwegian salmon during the last month? Yes ☐ No ☐
8. Think that you are in a good reliable food store to buy fish. How do you score 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 & nutrition	Not healthy & nutritious	1 2 3 4 5	Very healthy & nutritious
Price	Very expensive	1 2 3 4 5	Very cheap

Attributes of rainbow trout

9. Have you ever tasted rainbow trout? Yes ☐ No ☐
10. Have you eaten rainbow trout during the last month? Yes ☐ No ☐
11. Think that you are in a good food store to buy fish. How do you score 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 & nutrition	Not healthy & nutritious	1 2 3 4 5	Very healthy & nutritious
Price	Very expensive	1 2 3 4 5	Very cheap

Attributes of Spanish mackerel

12. Have you ever tasted Spanish mackerel Yes ☐ No ☐
13. Have you eaten Spanish mackerel during the last month? Yes ☐ No ☐
14. Think that you are in a good food store to buy fish. How do you score 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 & nutrition	Not healthy & nutritious	1 2 3 4 5	Very healthy & nutritious
Price	Very expensive	1 2 3 4 5	Very cheap

Willingness to pay

Handout 2 was shown to the respondent for the willingness to pay questions below.
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 for 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 salmon for**
1,100,000 IRR ($34.10 or 1.3·market price) [1]	
935,000 IRR ($28.98 or 1.1·market price)	
850,000 IRR ($26.35 or market price)	
680,000 IRR ($21.08 or 0.8·market price)	
425,000 IRR ($13.17 or 0.5·market price)	
I will not buy salmon irrespective of market price	
Price of rainbow trout (normal size)	**I will buy rainbow trout for**
170,000 IRR ($5.27 or 1.3·market price)	
140,000 IRR ($4.34 or 1.1·market price)	
125,000 IRR ($3.87 or market price)	
100,000 IRR ($3.10 or 0.8·market price)	
70,000 IRR ($2.17 or 0.5·market price)	
I will not buy rainbow trout irrespective of market price	
Price of narrow-barred Spanish mackerel (normal size)	**I will buy mackerel for**
320,000 IRR ($9.92 or 1.3·market price)	
270,000 IRR ($8.37 or 1.1·market price)	
245,000 IRR ($7.59 or market price)	
200,000 IRR ($6.20 or 0.8·market price)	
130,000 IRR ($4.03 or 0.5·market price)	
I will not buy mackerel irrespective of market price	

15. In which zone of the Tehran province are you living? _____

16. What is the highest level of your education?

	Secondary school or less (≤ 8 years)
	Diploma (8 – 12 years)
	Bachelor (13 - 16 years)
	Master degree or more (17 years ≥)

[1] Exchange rate used for conversion is IRR 1 = US $0.000031. In Handout 2 only the prices in IRR where printed.

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

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

18. What is the total monthly income of your household (the income of any member of the household that is not spent on the household expenditure should not be taken into account)?

	Less than 30,000,000 IRR (< $925)
	Between 30,000,000 and 40,000,000 IRR ($925 - $1235)
	Between 40,000,000 and 50,000,000 IRR ($1235 - $1540)
	Between 50,000,000 and 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 & 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 & 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 & 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 for 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 salmon for**
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 for**
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 narrow-barred Spanish mackerel (normal size)	**I will buy mackerel for**
320,000 IRR	
270,000 IRR	
245,000 IRR	
200,000 IRR	
130,000 IRR	
I will not buy mackerel irrespective of market price	