







Estimating Individuals' Willingness to Pay to Avoid Corona Disease's Social Consequences

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Abstract

The widespread occurrence of COVID-19 disease has posed a threat to the mental and physical well-being of people living in communities, and its quick expansion has had a significant impact on interpersonal, familial, and social ties. Although it has received less notice, this issue is also evident in Iran. This study's objective was to estimate the economic value of a few chosen societal effects of the coronavirus pandemic using a choice experiment methodology. A mixed logit model was applied in this investigation. 384 citizens of Tehran who responded to a questionnaire and participated in a field survey in 2021 provided the necessary information. Various degrees of income, education, age, the number of children, and awareness of the societal consequences of the disease were found to be influencing factors in this study. The findings of the calculated model demonstrated that the features of unemployment, family problems, and mental illness, in that order, are associated with the greatest willingness to pay.

Keywords: Choice Experiment, Lancaster Theory, Mixed Logit, Willingness to Pay.

JEL Classification: C35, D11, L97, D04.

1. Introduction

An unexpected global public health crisis brought on by the 2020 corona pandemic quickly spread over the Chinese metropolis of Wuhan and put human life in danger. A sizable family of viruses that causes respiratory diseases includes the coronavirus. Due to its rapid dissemination, the outbreak of this new virus began in China in late 2019 and quickly spread throughout the globe (Wang et al., 2020). People with underlying illnesses and the elderly are most commonly affected by coronavirus (World Health Organization, 2020). Since maintaining personal hygiene and maintaining social distance in daily encounters is the only method to combat the disease and break the chain of transmission, governments have naturally established home quarantines and fines for violators. A countrywide quarantine is the name given to this kind of home confinement. Since the COVID-

19 pandemic began, millions of people around the world have experienced social isolation and limitations on social engagement (Taub, 2020).

People's interactions were restricted in Iran, due to the disease's escalation, by the closure of public spaces, and the requirement that residents stay at home and refrain from moving about in them. Since the Iranian culture is centered on interactions, these limits began at the beginning of 2020 and have severely limited people's access to friends and family. Worry, fear of dying, and desperation are the top issues brought up with the Welfare Organization's counseling department in this regard (Welfare Organization of Iran, 2020). Unprecedented in human history, such situations as external, aberrant, uncontrollable stress have caused a variety of behavioral and emotional reactions in people from many cultural backgrounds, some of which are still present today (Gallagher, 2020). These conditions are extremely unfavorable for people and continue to be expressed in a way that makes them harsh compared to the people's willingness to pay to have them removed. In addition to its bodily effects, the COVID-19 virus outbreak has caused a wave of worry and high anxiety among people, which has had an immediate impact on their psychological well-being (Shanafelt et al., 2020). According to certain studies, the individual impacted by the disease's prevalence. For example, Huang and Zhao (2020) have significantly demonstrated that anxiety, dejection, and distress issues in people happened frequently during the disease's epidemic. Additionally, during this time, there may be substantial instances of irritability, loneliness, or hostility in society (Banerjee, 2020). On the other hand, social isolation and constraints on everyday motion foster family issues (Usher et al., 2020).

Quarantine during the COVID-19 disease outbreak had a positive impact on disease control, according to research by Van Gelder et al. (2020), but it can also have significant negative effects on individuals, families, and society. Additionally, reports of domestic violence and elevated danger for children in those family environments have been reported in numerous countries, including Australia (Duncan, 2020). There is a chance of issues like interpersonal discomfort, domestic violence, child neglect, and hostility between family members during this time due to changes in lifestyle and challenging circumstances brought on by following health guidelines (Campbell, 2020).

Corona disease's widespread incidence has had a negative impact on society. Due to the sickness, interpersonal interactions have declined, which has caused societal discord among people (Venkatesh and Edirappuli, 2020). Undoubtedly, issues with the individual, familial, and social components are far more widespread and have several repercussions. For instance, being away from familiar surroundings, having limited mobility, an inconsistent sleep schedule, and extended school and work closures might permanently harm each member of

society's mind and body (Wang et al., 2020). This study's goals include evaluating respondents' willingness to pay (WTP) throughout the sample population (Tehran) and including respondents' demographic information with social repercussions of corona illness in a mixed logit model using the choice experiment (CE) approach. In the studies carried out so far, the economic aspects of the Corona crisis have been mostly discussed, and its social aspects have been given less attention, and its analysis has been neglected from the economic evaluation of the social consequences' perspective. In this research, by using statistical and economical tools, estimation and analysis of the impact of socio-economic variables from the perspective of willingness to pay to solve the social consequences of the Corona pandemic with the experiment choice method is on the agenda as a new approach in the field of health economics. The remainder of this paper is organized as follows. Section 2 is devoted to the subject's theoretical underpinnings and methodology. We estimate the model and evaluate the data in Section 3 before presenting the conclusion in the last section.

2. Theoretical Basis

The scope of the choice experiment method in various scientific fields such as health economics, natural resource economics and microeconomics has expanded in recent years due to scientific advances in these fields. The choice experiment is based on the Lancaster Microeconomic Theory and Random Utility Theory (RUT). This approach states that consumers inherently are not interested in commodities, but it is the characteristics of goods that are desirable. Lancaster's theory of consumption states that the product utility of consumption is not directly derived from the consumption of that product, but rather from the sum of the utility of the characteristics and specification of that product. In other words, product consumption utility can be decomposed into utility results from its properties. Moreover, random utility theory states that all components of the utility function resulting from an individual's selection are not directly visible to the researcher (Hearne and Salinas, 2002). According to this method, the indirect utility function (U) is divided into two parts for each responder: a deterministic part (V) which usually is as a linear index of the properties of various options j in the selection set and a random part (e) which shows the invisible effects on the individual selection. Equation (1) shows the indirect utility function:

$$U_{ij} = V_{ij}(X_{ij}) + e_{ij} = bX_{ij} + e_{ij} \quad (1)$$

Therefore, this probability that each person prefers g option in the C_i selection set than any other option like h depends on the fact that the utility of option g for the person i to be more than other options in the selection set which is shown in Equation 2 (Hensher et al., 2007):

$$\Pr(U_{ig} > U_{ih}, \forall h \neq g) = \Pr[(V_{ig} - V_{ih}) > (e_{ih} - e_{ig})] \quad (2)$$

To clarify this probability, we need to know the distribution of error terms (e_{ij}) of the indirect utility function. It is assumed that random sentences or disturbance of indirect utility function are distributed uniformly and independently by Extreme-value Distribution (like Weibull distribution).

$$\Pr_i(g | C_i) = P(U_{ig} > U_{ih}, \forall h \neq g) = \frac{\exp(\mu V_{ig})}{\sum_{h \in C_i} \exp(\mu V_{ih})} \quad (3)$$

When it is assumed that random sentences have an indirect utility function of the Weibull distribution, the probability of selecting any preferred option like g from C_i can be expressed as logistic distribution given in Equation (3), which can be estimated through logit models such as Mixed logit or conditional logit model (McFadden, 1973). The mixed logit model is a highly flexible model and it is possible to estimate any discrete choice model derived random utility theory by using this model. Recently, this model has been proposed as a developed model, which has lower behavioral constraints than conventional logit models. The mixed logit model is a generalized model that includes standard conditional logic; it also allows the estimated parameters to vary from one person to another. Moreover, in this model, it is not necessary to consider the assumption of independence of irrelevant alternatives (IIAs). The mixed logit model allows us to model the preference changes (behavior heterogeneity), and it is necessitating considering probabilistic distribution for a number of coefficients. Assuming that person i have his own parameter vector that differs from the mean of society: $\beta_i = \beta + \eta_j$ the utility of each option will be in the

form of Equation (4):

$$U_{ij} = V(X_j(\beta + \eta_{ij})) + \theta_j \quad (4)$$

In which the vector of coefficients b_i with a specific density $f(b)$ varies between different individuals and is independent of e density. If b_i is observed, the probability of selection is simply a standard logit. Due to the uncertainty of b_i , the probability integral of standard logit is obtained for all possible values of b_i . Therefore, the probability of choosing j option by person i is as follows in the mixed logit model:

$$\Pr_{ij} = \int \left[\frac{\exp(V(X_{ij}))}{\sum_{h=1}^C \exp(V(X_{ih}))} \right] f(\beta) d\beta \quad (5)$$

The parameters of the mixed logit model are estimated using the Maximum Likelihood (ML) method (Train, 2003). In the standard logit models, it is assumed that the structure of error terms is identical throughout the studied community, which causes an error in case of heterogeneity in the studied population. The price feature in interaction with other attributes measures the willingness of respondents to pay according to Equation (6) for obtaining or losing various levels. This value is also called implicit price (Greene and Hensher, 2003):

$$WTP = -\frac{\beta_{attribute}}{\beta_{price}} \quad (6)$$

To achieve the objectives of the study, a questionnaire was presented that conformed to the design principles of the choice experiment. The first step in designing the choice experiment is to assign the characteristics and expressions of each attribute. The desired characteristics were selected based on library studies, articles written by social scientists and economists, and pathology reports prepared by them.

The characteristics considered in the present study include mental illness, unemployment, changes in social activities, family problems, concern about social discrimination (all in three levels of low, medium and high) and price based on field research (numerous financial documents of patients and the tariffs of the medical system) in 2021 were defined in three levels (10,000,000 Iranian Rial, 40,000,000 Iranian Rial and 80,000,000 Iranian Rial). Considering the methodology of the choice experiment method and the challenges related to extracting people's willingness to pay in applied studies, considering the respondents' lack of information about the composition and amount of costs associated with the corona disease, the figures reflected in the questionnaires are considered as minimum costs paid by the people involved with the disease in the hospitals. These figures have been suggested to those completing the questionnaires with the aim of reducing the dispersion and variance of the responses and increasing the robustness of the results. Table 1 shows an example of a selection card in the current study.

Table 1. Sample Selection Card

Choice 3	Choice 2	Choice 1	Attributes
Whether or not these conditions are different to me and I do not want to pay any fees for it.	high	low	Mental illness
	high	low	Unemployment
	low	high	Changes in social activities
	low	high	Family problems
	low	medium	Concern about social discrimination
0	10,000,000	80,000,000	Willingness to pay (Iranian Rial)
	*		Which of the above scenarios do you prefer?

Source: Research finding.

According to the defined characteristics and their associated levels, the number of possible modes for the 3⁶ selection test is 729 options. Since it is not possible to test this number of options, 22 options were selected using partial

factorial design and OPTEX method, SAS software. The 22 options considered were included in 11 duplicate choice sets. Then, a null option was added to each selection (I do not care if these conditions exist or not, and I do not want to pay for them) to avoid the negative effects of forced selection. For achieving the desired sample, which is in accordance with the objectives of the study, a simple random sampling method was used and the Cochran relation was used to determine samples. To determine sample numbers using Cochran relation and by error margin of 5%, it was shown that the sample size of this study was 384. Therefore, required information for achieving to goals of the study was randomly selected from 384 in Tehran and all questionnaires were completed through face-to-face interviews in 2021. As well, STATA 16 and NLOGIT 5 software were used for estimating regression models. A review of the research literature indicates that few empirical studies have addressed the topic discussed in this research. In addition, each of these few studies mainly had a theoretical-descriptive approach, and almost no quantitative studies are observed in this regard. Below is a sample of domestic and foreign studies related to this field. For instance, Dadvarkhani and Mousavi (2022) with an analytical-descriptive approach found that the costs imposed by the Coronavirus, as well as the reduction of production and supply at the domestic and foreign levels, can face the economy with higher inflation and lower economic growth; In fact, Corona has affected the supply chain, demand, and liquidity on companies and affected labor supply, consumption of goods and services, especially by reducing the income of consumers and producers of agricultural products, tourism, and handicrafts. In the end, this study claims that the coronavirus shrinks the economic activities of the villages both in the short term and in the long term. In another study, Taherinia and Hasanvand (2021) in an article titled "Economic consequences of the Covid-19 disease on Iran's economy, with an emphasis on employment" investigated employment during the Corona era with an analytical-descriptive approach and found a significant decrease in employment during winter 2018 and Spring 2019 compared to the same seasons of the previous year. Also, Mofijur et al. (2021) tried to provide a comprehensive analysis of the impact of the COVID-19 outbreak on the ecological domain, the energy sector, society, and the economy and investigate the global preventive measures taken to reduce the transmission of COVID-19. In this study, a wide range of recommendations have been presented, from how to collect the waste of families affected by COVID-19 to suggestions for businesses in different economic sectors. Saladino et al. (2020) highlighted the impact on the psychological well-being of the most exposed groups, including children, college students, and health workers, who are more likely to develop post-traumatic stress disorder, anxiety, depression, and other symptoms of distress. This paper aimed to show empirical

data from recent studies on the effect of the pandemic and possible interventions based on technological tools.

As can be seen, the studies that have been carried out in the field so far have mostly focused on analytical-descriptive approach of the Corona pandemic and its quantification has not been addressed. However, in the current research, the estimation and analysis of this issue are on the agenda and it can be considered as a kind of innovation of the current study.

3. Model Estimation and Results Analysis

The average age of the respondents, as shown in Tables 2 and 3, is 36.6 years. The results of the coronavirus pandemic in the community were known to 44.03% of the respondents. The average number of children was 0.74, and 51.96% of them were female. Table 4 reports the estimation outcomes for mixed logit and mixed logit models with interactions.

All features—aside from the price with normal distribution—are taken into account in mixed logit models. The estimations are statistically significant, and each of the features—such as mental illness, unemployment, changes in social activities, family issues, worries about social discrimination, and prices—is a known indicator, according to the acquired data.

This supports the claim that all of these characteristics significantly influence participants' preferences and decisions when selecting options. Higher attribute levels logically improve the possibility of choosing hypothetical possibilities and attribute coefficient symbols somehow satisfy theoretical assumptions. The higher-priced options lessen people's utility and have a lesser likelihood of being chosen than other options, according to the negative sign of the willingness to pay feature. The variance in people's choices may be explained by the estimated random coefficients' statistical significance.

Table 2. Qualities of Quantitative Variable Descriptive Statistics

Standard deviation	Average	Maximum	Minimum	variables
12.67	36.6	74	14	Age
1.18	0.74	5	0	The number of children
1.14	9.5	7	2	Education
1.08	3.21	5	1	Income level
0.74	3.15	4	1	Awareness of the social impacts of Corona

Source: Research finding

Table 3. Qualities of Quantitative Variable Descriptive Statistics

Frequency	Code	
48.04	Men	Gender
51.96	Women	
44.03	I have average information	Awareness of the social impacts of Corona
36.29	I have high information	

Source: Research finding.

Table 4. Results of Estimating Mixed Logit Model and Mixed Logit with Interactions

Mixed logit with interactions		Standard mixed logit		variable
Random coefficient	Definitive coefficient	Random coefficient	Definitive coefficient	
	3.18*** (0.08)		3.18*** (0.08)	(SP) Constant
0.48*** (0.05)	0.24*** (0.04)	0.48*** (0.05)	0.24*** (0.04)	Mental illness
0.03*** (0.07)	0.27*** (0.04)	0.3*** (0.07)	0.27*** (0.04)	Unemployment
0.008(0.05)	0.11*** (0.02)	0.008(0.05)	0.11*** (0.02)	Changes in social activities
0.01(0.06)	0.26*** (0.03)	0.008 (0.06)	0.26*** (0.03)	Family issues
-0.01 (0.07)	0.13*** (0.03)	-0.01 (0.07)	0.13*** (0.03)	Concerns about social discrimination
	-0.02*** (0.03)		-0.2*** (0.03)	Willingness to pay(price)
	-0.001** (0.0007)			Age×Price
	-0.002 (0.007)			The number of ×Price children
	0.02*** (0.006)			Income×Price
	0.005(0.008)			Awareness×Price
	68.41		67.67	LR(7)

Source: Research finding.

Note: *,** and *** denote significance levels of 10,5 and 1%.

The other characteristics have a standard deviation corresponding to the parameter distribution since only the price feature among the attributes under consideration has a normal distribution. These numbers show how widely spread

out the calculated parameters are. The insignificant coefficient parameters in the section on standard deviation reveal that respondents' preferences for that component are evenly distributed. That is the computed average contains all information about participants' preferences for these components. However, if the predicted standard deviations for the components are considerable, it indicates that the sample's parameterization is heterogeneous and that individual preferences may differ from the sample's average estimate (Vojacek and Pecakova, 2010). The estimated standard deviation for all features included in the estimated model is significant in the results shown in Table 4. As a result of the aforementioned concerns, it may be concluded that there is heterogeneity in people's preferences for all factors taken into consideration and that different factors affect people's decisions differently. Different aspects of the sample population might be investigated through data analysis as a potential source of heterogeneity in people's preferences (Boxall and Adamowicz, 2002). Demographic characteristics were used, which may be the root of this problem, to get an overview of the causes of heterogeneity in different studies. Consequently, these factors were taken into account when estimating the mixed logit model (Ortega et al., 2011).

As is well known, socioeconomic factors play a significant role in understanding people's choices. The mixed logit model was estimated by taking into account socioeconomic variables and how they affected it.

A wide range of multiplicative relationships between personality traits and traits particular to the alternatives were tested to estimate the mixed logit model with interactions, and ultimately the variables of age, the number of children, income level, and awareness of the consequences of corona disease multiplication with price were identified as having a significant effect and explanatory power. According to Table 4's findings, the age variable has a detrimental impact on the likelihood of selection.

Therefore, elderly individuals are less inclined to pay more to lessen the effects of corona disease. The positive and significant coefficient of the income variable demonstrates that as income levels rise, so does people's willingness to pay to lessen the effects of Corona disease.

The results of the present study also indicated that those who are more aware of the impacts of Corona disease are more willing to pay a greater price to lessen these problems.

The findings also indicate that having more children has a negative significant impact on the choice and additional funding of individuals to reduce the effects of this disease. This might be a result of the disease's escalating costs for big households. The initially estimated coefficients only show the effect of the explanatory variables on the probability of accepting the dependent variables, but

they do not have a quantitative interpretation. In this case, the marginal effect and marginal elasticity are used, the results of which are reported in Table 5.

Table 5. The Results of Estimating the Marginal Effect and the Marginal Elasticity of the Mixed Logit Model with Interaction Effects

Marginal elasticity		Marginal effect		variable
Z statistics	coefficient	Z statistics	coefficient	
6.5	0.1*** (0.01)	6.01	0.24*** (0.04)	Mental illness
6.7	0.11*** (0.01)	6.4	0.27*** (0.04)	Unemployment
4.6	0.04*** (0.09)	4.5	0.11*** (0.02)	Changes in social activities
9.7	0.1*** (0.01)	8.6	0.26*** (0.03)	Family issues
4.4	0.05*** (0.01)	4.3	0.13*** (0.03)	Concerns about social discrimination
-21.45	-0.25*** (0.01)	-29.26	-0.2*** (0.07)	Willingness to pay(price)

Source: Research finding.

Note: *** denote significance levels of 1%.

As expected based on the results of Table 5, the sign of the marginal effect and the marginal elasticity of the willingness to pay variable is negative. According to the marginal elasticity of the willingness to pay variable, with other conditions being constant, a 1% increase in price reduces the probability of choosing a better hypothetical option (improvement of current conditions) by 0.25%. Also, according to the marginal effect of the price variable in the model, an increase of one monetary unit leads to a 0.2 percent decrease in the probability of choosing the better hypothetical option. Based on the results of Table 5, the characteristics of unemployment, illness, and family problems are also among the important variables that have attracted the attention of people exposed to corona disease.

Since it is impossible to directly understand logit model coefficients, implicit pricing or willingness to pay for features are utilized in these models to interpret and compare feature coefficients.

The willingness to pay for each feature can be determined for this purpose by dividing the coefficient of each feature by the coefficient of the monetary variable. The results of the choice experiment's study on people's willingness to pay for features are shown in Table 6.

Table 6. Willingness to Pay (10 Million Rials)

Mixed logit model	Attributes
1.2	Mental illness
1.33	Unemployment
0.54	Changes in social activities
1.3	Family problems
0.63	Concern about social discrimination
5	Willingness to pay (Total)

Source: Research finding.

4. Conclusion

Around the world, coronavirus has contributed to several social, economic, and psychological issues. The ambiguity and unpredictable nature of pandemic outbreaks have a great potential for inducing psychological fear of disease transmission, which frequently results in a variety of psychiatric issues. In a patriarchal society, staying home for an extended period puts more pressure on women to take care of the home, which can lead to conflicts between partners or between young people and the elderly.

Millions of kids, teens, and young adults are cut off from educational and social opportunities when schools and institutions close, and this situation may be difficult to reverse in the future. On the other hand, pre-vulnerable populations including those who experience depression and anxiety would be severely impacted (Imani Jajarmi, 2020). Implementing the policy of staying at home means increasing the responsibility for women in Iranian society, where housework and childcare are still the responsibility of women, while at the same time, a large number of women are engaged in economic activities. If this situation is not corrected, it may result in dissatisfaction and an increase in family disputes. The new environment necessitates changing gender roles and enlisting more male participation in domestic duties (Imani Jajarmi, 2020).

According to a poll by the Tehran Municipality done in April 2020, family conflict has risen in 16% of Tehran families as a result of staying at home. In 58% of households, there is more friction between the spouses, and in 46%, there is more friction between the parents and children (Tehran Municipality, 2020). In this regard, the adoption of the policy of social distance has resulted in the suspension of several social mechanisms, such as numerous social rites, which induced sympathy and empathy among members of society. For instance, it is currently not able to organize a mourning ritual, which was crucial in helping the mourners heal, and at the same time, no substitute methods have been created (Imani Jajarmi, 2020). To lessen the frequency of COVID-19 and prevent big crowds from negatively affecting people's sadness and sorrow, the majority of funerals were postponed to a later date (Jahangiri and Sahebi, 2020). In a report titled "Studies

on the Cultural and Social Consequences of the Outbreak of Coronavirus in Iran,” the Office of Cultural Studies of the Academic Center for Education, Culture and Research identified the intensification of feelings of injustice in society due to disparities in access to health services and the appearance of behavioral inconsistencies in the media as effects of the disease’s outbreak (Eskandarian, 2020). The choice experiment method and mixed logit model were employed in the current study to evaluate the economic worth of the selected social effects of the Corona pandemic, and the sample’s willingness to pay was determined. The mixed logit model’s Table 6 indicates that the factors associated with unemployment, mental illness, and family issues have the highest willingness to pay. The willingness to pay for unemployment feature is estimated at 13,300,000 Rials, family issues at 13,000,000 Rials, and mental illness at 12,000,000 Rials based on the mixed logit model. In the aforementioned model, the feature of changing social activities has the lowest willingness to pay (5,400,000 Rials). According to the mixed logit model, the average willingness to pay is pegged at 50,000,000 Rials. However, the results of the present study regarding the willingness of Iranians to pay to avoid the social effects of the corona were not observed in the literature on the subject. Nevertheless, it is consistent with the results of the studies conducted in the field of appraisal pandemic consequences. For instance, Kitamura et al. (2020) by focusing on the Japanese tourism industry observed COVID-19 outbreak has led to consumption, employment, and carbon footprint loss.

The research’s findings suggest that policymakers should take these costs into account as well, as the social effects of Corona illness appear to be at least as significant as its economic ones.

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