# Economic valuation scenarios for native corn tortillas using Contingent Valuation and Discrete Choice Experiments

**De la Cruz-Marcial, Judith1; Martínez-Damián, Miguel A. 1*; Melo-Guerrero, Enrique2, Hernández-Ortiz, Juan3**

[1] Colegio de Postgraduados. Campus Montecillo. 56230. Km.36.5. Carretera México-Texcoco, Edo. de México.
[2] Universidad Autónoma del Estado de Hidalgo. Instituto de Ciencias Agropecuarias, Hidalgo, México.
[3] Universidad Autónoma Chapingo. División de Ciencias Económico Administrativas. Km. 38.5 Carretera México-Texcoco, 56230. Chapingo Texcoco, Estado de México. México.
* Correspondence: angel01@colpos.mx

**ABSTRACT**

**Objective**: To analyze respondents' willingness to pay (WTP) for tortillas with specific attributes handmade, produced from native corn, organic, and traditionally nixtamalized using models derived from the contingent valuation method (CVM) and discrete choice experiments (DCE), while varying the levels of socioeconomic variables and product attributes.

**Design/Methodology/Approach**: The study employed stated preference methods, specifically contingent valuation and discrete choice experiments, to estimate the economic value assigned to tortillas with differentiated attributes. Binomial, multinomial, and mixed logit models were estimated, and multiple scenarios were constructed for municipalities within the metropolitan area of Mexico City. The analysis examined changes in the probability of an affirmative response to the WTP question as a function of variations in respondents' income, educational level, number of dependents, and a 10% reduction in tortilla price.

**Results**: The findings showed that stated preference methods enabled the estimation of respondents' economic valuation of tortillas with differentiated attributes. The probability of answering "yes" to the WTP question varied according to income, education, number of dependents, and price reductions. Among the attributes evaluated, blue tortilla color was the most highly valued, followed by native corn, organic corn, and tortillas with added ingredients. The highest compensatory variation for organic, native-corn, blue tortillas with added ingredients reached 51.59 MXN $kg^{-1}$, whereas the lowest was 32.29 MXN $kg^{-1}$. At the municipal level, Coacalco de Berriozábal assigned the greatest value to tortillas with the analyzed attributes, followed by Texcoco, Tlalnepantla, and Cuautitlán Izcalli.

**Limitations/Implications**: Although stated preference methods are highly useful for valuing goods and services for which no alternative methodology is suitable, they continue to face criticism because they rely on hypothetical behavioral data. Nevertheless, their application provides valuable evidence for the valuation of differentiated products and for understanding potential market behavior toward new goods.

**Findings/Conclusions**: The combination of stated preference methods, contingent valuation, and discrete choice experiments constitutes a valid and reliable methodological framework for estimating the economic value of goods and services. The results were statistically comparable to those obtained through other economic valuation approaches, confirming the robustness of these methods for assessing consumer preferences and WTP for tortillas with value-added attributes.

**Keywords**: stated preference, willingness to pay, *Zea mays* L.

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## INTRODUCTION

The economic valuation of a good or service can be conducted in different ways, either by using market price information or by eliciting consumer preferences through a wide range of non-market valuation methods, which are broadly classified into two major groups: revealed preference methods and stated preference methods. The latter have been frequently criticized because of their reliance on hypothetical behavioral data. According to Haab *et al.* (2020), stated preference methods should be regarded as approaches for providing estimates of the value of certain changes in the allocation of environmental and natural resources for which no alternative method can be applied. Among these, the Contingent Valuation Method (CVM) is the most widely used. One of its principal strengths lies in its flexibility; moreover, because of its hypothetical nature and its independence from existing markets, CVM can be applied to almost all non-market goods, as well as to past and future changes. It is also one of the few available methods capable of capturing all types of benefits associated with a non-market good or service, including those unrelated to current or future use, namely, the so-called non-use values (Hoyos and Mariel, 2010; OECD, 2018). Nevertheless, despite thousands of studies, substantial methodological advances, and extensive policy applications, contingent valuation remains a source of controversy. Critics argue that the values obtained are hypothetical, since payments are not actually made in cash, and that the method is also subject to numerous biases (Van den *et al.*, 2011). Even so, supporters of CVM have found that it produces value estimates comparable to those derived from revealed preference methods, such as the travel cost and hedonic pricing methods.

The popularity of CVM has declined as best practices have increasingly converged with Discrete Choice Experiments (DCE). The number of articles reporting DCE applications in food research evolved from a single publication in 2001 and 2002 to nearly 100 studies per year by 2019 and 2020. Likewise, the number of DCE studies addressing organic production or organic foods has grown steadily. Whereas organic production was previously regarded mainly as a healthier and safer alternative to conventional production, it is now also recognized as a provider of environmental benefits, extending beyond health and safety concerns. At present, DCEs have become a frequently employed research method in food studies due to their capacity to uncover the trade-offs involved in choosing among multiple alternatives, particularly when credence attributes are under consideration (Haab *et al.*, 2020).

The main difference between choice experiments and CVM is that the former involve trade-offs among alternatives, whereas in the latter respondents express their willingness to pay (WTP) on the basis of a proposed change. Currently, many economists tend to favor DCEs as an elicitation method on the grounds that the marginal values of goods and services are easier to estimate. In addition, DCEs provide richer information by offering respondents multiple alternatives, thereby reducing response problems and certain biases associated with CVM (Van den *et al.*, 2011).

As can be observed, stated preference methods are highly useful and encompass fields of economics that could not be investigated through any other methodological approach. One way to assess their validity is by constructing scenarios based on real data. Accordingly, the

objective of the present research is to analyze respondents' willingness to pay by generating scenarios and using one model obtained through CVM and another through DCE, while varying the levels of socioeconomic variables and product attributes. The hypothesis is that the combination of stated preference methods, contingent valuation, and discrete choice experiments constitutes a valid and reliable methodology for estimating the economic value of goods and services, yielding results that are statistically comparable to those obtained through other economic valuation methodologies.

## MATERIALS AND METHODS

To obtain the data, face-to-face surveys were conducted from January to March 2024 in 15 municipalities of the State of Mexico, the most populated state in the country: Chalco, Chicoloapan, Chimalhuacán, Coacalco de Berriozábal, Ecatepec de Morelos, Ixtapaluca, Cuautitlán Izcalli, Naucalpan de Juárez, Nezahualcóyotl, La Paz, Tecámac, Texcoco, Tlalnepantla, Tultitlán, and Valle de Chalco Solidaridad.

The target population, defined as individuals older than 18 years, was identified from the total population of the State of Mexico (16,992,418 inhabitants, according to the Population and Housing Census) (INEGI, 2020). Following the recommendations of Ahmed (2024), the sample size was determined using an equation for large or infinite populations:

$$n = \frac{Z^2 pq}{d^2}$$

where: $n$ is the sample size, $Z$ is the $z$-value associated with the desired confidence level (1.96 for a 95% confidence level); $p$ is the proportion of the population willing to pay for the improvement (equal to 0.5); $q$ is the proportion of the population unwilling to pay (equal to 0.5); and $d$ is the permitted estimation error or precision (7%).

For the survey design, focus group discussions were conducted with housewives, consumers, and subject-matter experts. Subsequently, preliminary studies were carried out with 100 consumers in order to detect possible misinterpretations of the questions. Using the sample size equation, the administration of 196 questionnaires was estimated; however, because four price levels were evaluated, a total of 216 surveys were conducted, distributed as 54 for each proposed price.

### Contingent Valuation Method (CVM)

The referendum model consists of presenting the respondent with two response alternatives: yes or no. Since the dependent variable is discrete, the regression analysis is performed using either a logit or probit model. In the present research, the logit model will be used.

According to Tudela *et al.* (2018), the modeling process considers the random utility approach, as shown in Equation 1.

$$U_{ih} = v_{ih}\left(p_h, M_i, s_i\right) + \varepsilon_{ih} \tag{1}$$

where: the utility of alternative $h$ for individual $i$ is a function of $s$, which represents individual characteristics; $p_h$, which denotes the price of alternative $h$, and $M$, which corresponds to the individual's income. Utility is composed of a deterministic component ($v_{ih}$) and an unobservable random error component ($\varepsilon_{ih}$), which is independently and identically distributed (iid), with zero mean and constant variance. Individual $i$ chooses the alternative that provides the greatest utility; therefore, the behavioral model is defined as follows: the individual chooses alternative $h$ if and only if: $U_{ih} > U_{ij}, \forall h \neq j$. The probability that the individual chooses alternative $h$ is given by equations 2 and 3:

$$\Pr(h) = \Pr\left\{U_{ih} > U_{ij}\right\} \tag{2}$$

$$\Pr(h) = \Pr\left\{\varepsilon_{ij} - \varepsilon_{ih} < v_{ih}\left(p_h, Z_{ih}, M_i, s_i\right) - v_{ij}\left(p_j, Z_{ij}, M_i, s_i\right)\right\} \tag{3}$$

To estimate welfare impacts, that is, willingness to pay (WTP) for a change from the status quo (alternative $j$) to the selected state (alternative $h$), Equation 4 is used:

$$\Delta v = v_{ih}\left(p_h, M_i - VC, s_i\right) - v_{ij}\left(p_j, M_i, s_i\right) \tag{4}$$

where $VC$ denotes the compensating variation, which may be interpreted as the maximum amount of money an individual would be willing to pay in order to obtain a favorable change. In this case, for individual $i$, alternative $h$ improves the level of well-being relative to alternative $j$.

Willingness to pay (WTP) for each respondent was estimated using Equation 5:

$$WTP_i = \frac{\alpha + \beta_2(INGR) + \beta_3(GEN) + \beta_4(EST) + \beta_5(DEP) + \beta_6(PRECIOKG)}{-\beta_1} \tag{5}$$

$$i = 1,2,...216$$

where: *INGR* represents monthly monetary income; *GEN* denotes the respondent's gender; *EST* refers to the level of education; *DEP* indicates the number of economic dependents of the household head, and *PRECIOKG* corresponds to the price per kilogram of tortillas at the establishment where the respondent purchases them.

**Binomial Logit Model**

The willingness-to-pay (WTP) equation for the contingent valuation method (CVM) model was as follows:

$$WTP_i = 5.45716259 - 0.13920993(BI) + 0.0000546293(INGR) + 0.59357879(GEN) + 0.12629926(EST) - 0.09267390(DEP) - 0.06552966(PRECIOKG) \quad (6)$$

*BI* denotes the initial bid price, whereas the remaining variables were defined in Equation 5.

**Scenarios to Be Analyzed**

This analysis aims to determine the impact on predicted probabilities when a particular variable is changed over a range of values, while the remaining variables are held constant at their mean values. For this purpose, the following scenarios were considered:

- Scenario 1: A 10% reduction in the initial bid price (BI). One of the current policies of the federal government is to gradually reduce the price of tortillas by up to 10% over the six-year administration. To this end, the National Corn-Tortilla Agreement was signed with producers, traders, flour manufacturers, nixtamal producers, and tortilla makers (Rojas, 2025).
- Scenario 2: An increase of 1,000 pesos in the respondent's monthly monetary income (INGR). According to González-Juárez *et al.* (2024), lower income is associated with lower willingness to pay, whereas willingness to pay increases as income rises.
- Scenario 3: An increase of one additional level in the respondent's educational attainment (EST). Numerous studies have reported that consumers with a higher level of education exhibit a greater willingness to pay for differentiated goods or services (Lugo *et al.*, 2020; Melo *et al.*, 2022), including organic or blue tortillas (Jaramillo, 2016; Blare *et al.*, 2020).
- Scenario 4: A reduction of one economic dependent (DEP) in the respondent's household. This scenario is considered because, at the national level, the birth rate has been declining; in 2023, the reduction was 2.3% compared with the previous year (INEGI, 2024).
- Scenario 5: A 10% reduction in the price per kilogram of tortillas at the establishment where the respondent purchases them. This scenario was created for the same reason as Scenario 1, namely, the policy aimed at reducing the price of tortillas by 10% (Rojas, 2025).

**Discrete Choice Experiments**

Discrete choice experiments use surveys as a basis for inferring willingness to pay or willingness to accept compensation for a modification in a good or service taking place within a hypothetical market (Melo *et al.*, 2020). They have been applied in diverse fields, including environmental valuation, food studies (Lizin *et al.*, 2022), and health research (Smith *et al.*, 2022).

In a choice experiment, respondents are presented with a series of choice alternatives referring to different states of a good or service and are asked to select their preferred option. In general, these alternatives are organized into choice sets, in which one alternative is fixed and describes the current situation (*status quo*), while the remaining alternatives vary and represent changes relative to the current situation. The different alternatives contain attributes and levels. Attributes are used to explain to respondents both the current state and its possible modifications, whereas different attribute values, referred to as levels, are employed to describe changes from the current state. The importance of choice experiments in economic valuation lies in the estimation of welfare measures associated with the selection of different alternatives that affect individual well-being. For this purpose, multinomial discrete choice models are generally employed, such as the multinomial/conditional logit model and/or the mixed logit model (Tudela and Leos, 2017).

**Multinomial Logit Model**

$$V_{ij} = 0.53961(PAO) + 0.06621(HM) - 0.23527(MMN) + 0.55857(MCN) + 0.24736(AZUL) + 0.12875(CC) - 0.04251(PRECIO) \quad (7)$$

**Mixed Logit Model with Interaction**

$$V_{ij} = 0.52092100(PAO) - 0.91485637(HM) - 3.57294973(MMN) + 0.97411341(MCN) + 1.10813979(AZUL) + 0.07069074(CC) - 0.14942091(PRECIO) + 0.0000605394\,ING1 + 0.41270665\,EST1 + 0.0000307095\,ING2 + 0.42460744\,EST2 \quad (8)$$

where: $V_{ij}$ stands for the probability off alternative *j* chosen by individual *i*; *PAO* for Organic Agricultural Production; *HM* denotes Corn Flour; *MMN* refers to Improved Nixtamalized Corn; *MCN* represents Native Nixtamalized Corn; *AZUL* corresponds to Blue Corn; *CC* indicates Tortilla with Added Ingredients; *PRECIO* is the proposed price; *EST* refers to the level of education, and *ING* denotes monetary income.

**Scenarios to Be Analyzed Using a Mixed Logit Model with Interaction**

**Scenario 1**

Current situation: tortillas are made from corn and/or flour derived from conventional agricultural production.

Scenario: tortillas are made from corn and/or flour derived from organic agricultural production (PAO).

Based on the findings reported by different authors, consumers are willing to pay more for a product with the organic attribute than for one produced conventionally (Ching *et al*., 2020; Rossi *et al*., 2024). Similar results have also been reported for tortillas (Jaramillo, 2016).

**Scenario 2**

Current situation: tortillas are made from a mixture of improved nixtamalized corn and flour.

Scenario: tortillas are made from native nixtamalized corn (MCN).

This scenario is evaluated in light of the current federal government policy aimed at promoting the conservation, production, processing, and commercialization of native Mexican corn (Presidencia de la República, 2025).

**Scenario 3**

Current situation: tortillas are made from white corn.

Scenario: tortillas are made from blue corn (AZUL).

This scenario is evaluated on the basis of the same policy framework as Scenario 2.

**Scenario 4**

Current situation: tortillas are offered without any added ingredients.

Scenario: the dough or flour used to make tortillas is supplemented with seeds and/or vegetables such as nopal, epazote, chia, or others (CC).

In recent years, consumer preferences for healthier and more environmentally friendly products have increased, and consumers place greater value on the nutritional contribution of the foods they consume (Aprile *et al.*, 2016; Priya, 2023).

**Scenario 5**

Current situation: tortillas are made from a mixture of improved white nixtamalized corn and flour derived from conventional agricultural production.

Scenario: tortillas are made from native blue corn produced under organic agricultural practices and are supplemented with seeds and/or vegetables (ALL).

The multinomial logit model will be used to obtain the probabilities of each alternative.

## RESULTS AND DISCUSSION

The models were estimated from a sample comprising 216 respondents, of whom 68% were women, with a mean age of 47 years. Most participants had completed high school education (27%), followed by a bachelor's degree (23%) and middle school education (22%). On average, households consisted of four members and two economic dependents. The respondents' average monthly income was 10,200 Mexican pesos. Regarding tortillas, the average price was 20 Mexican pesos per kilogram; 51% of respondents purchased tortillas every day; 65% knew what an organic product is; 40% were familiar with hybrid corn; 75% recognized creole or native corn; 80% knew what nixtamalization is; and 75% believed that the tortillas they consumed were made from a mixture of corn flour and hybrid corn dough.

The following graph (Figure 1) presents the attributes evaluated and their order of importance for respondents, considering 1 as the most important and 4 as the least

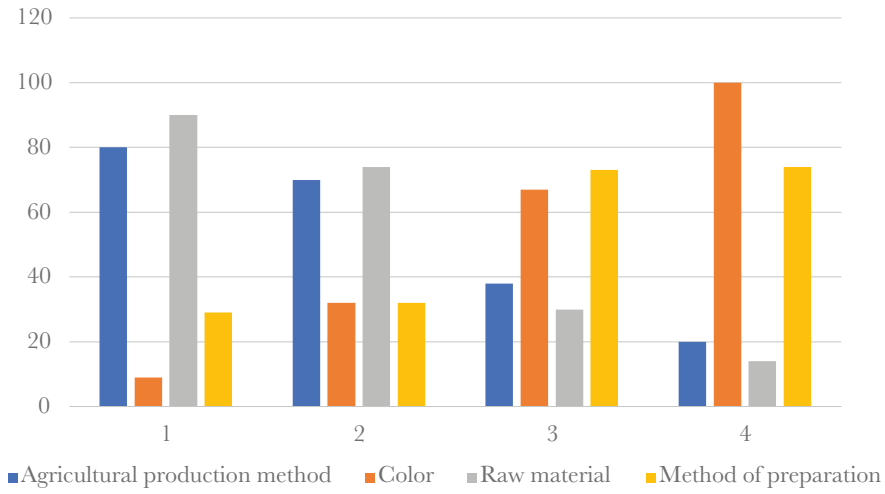


**Figure 1**. Importance of attributes in an artisanal tortilla. Source: Prepared by the authors based on survey data.

important. It can be observed that, for most respondents, the attributes "agricultural production method" and "raw material" were the most important, whereas color and method of preparation were regarded as less important.

The following graph (Figure 2) presents the average income and educational level across the municipalities evaluated. It can be observed that the municipality of Coacalco de Berriozábal exhibited the highest levels of both education and income, whereas the municipality of La Paz showed the lowest levels for these same variables. Overall, a clear pattern can be identified: as educational attainment increases, income level also rises, and *vice versa*. These findings are consistent with those reported by Stryzhak Olena (2020), who

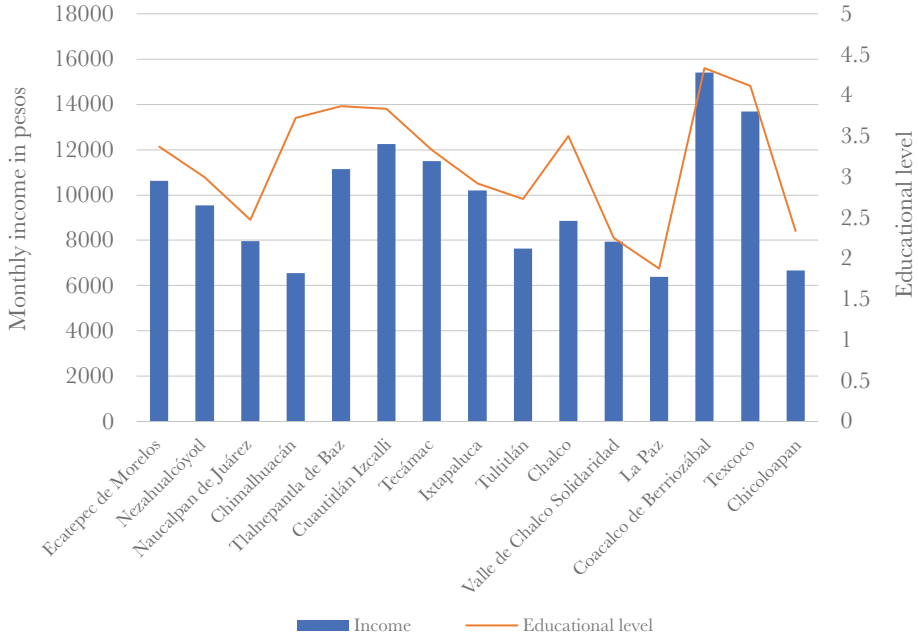


**Figure 2**. Educational level and income in the evaluated municipalities. Source: Prepared by the authors based on survey data.

indicates that education contributes to higher income levels.

**Binomial Logit Model Scenarios**

The following graphs (Figure 3) present the probabilities of willingness to pay in relation to the corresponding explanatory variables. The observed behavior is consistent with economic theory. The variables initial bid price (BI) (Figure 3-A), economic dependents of the household head (DEPEN) (Figure 3-D), and the price per kilogram of tortillas at the establishment where the respondent purchases them (PRECIOKG) (Figure 3-E) exhibit a negative relationship. In other words, as the initial bid price, the number of economic

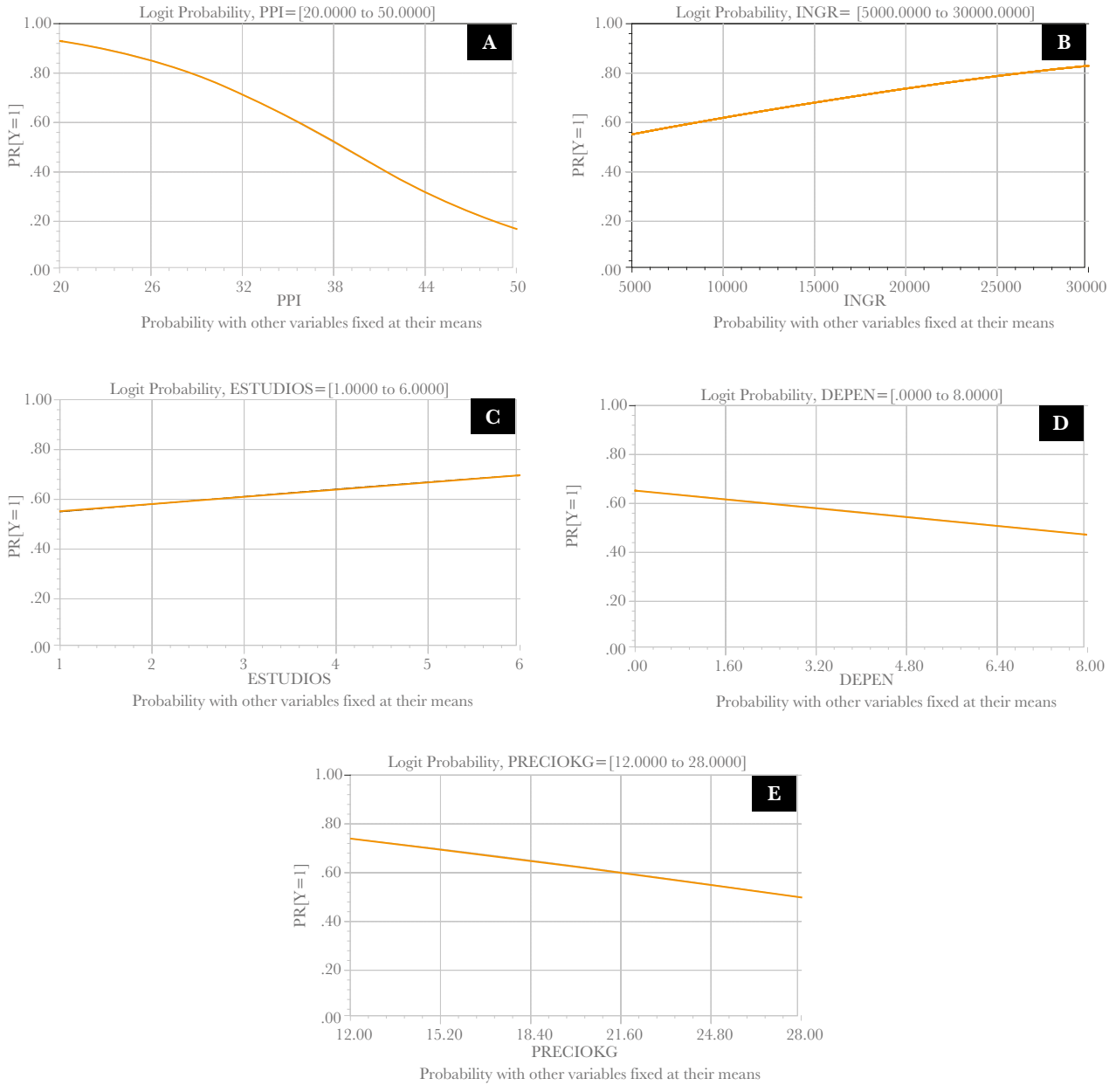


**Figure 3**. Predicted probability of willingness to pay (WTP) according to the initial bid price (A), monthly monetary income (B), educational level (C), economic dependents of the household head (D), and the price per kilogram of tortillas at the establishment where the respondent purchases them (E), using N-logit.

dependents, or the cost per kilogram of tortillas increases, the probability of willingness to pay decreases. By contrast, as monthly monetary income (INGR) (Figure 3-B) and educational level (ESTUDIOS) (Figure 3-C) increase, the probability of willingness to pay also rises, indicating a positive relationship.

The following table (Table 1) presents the results of the analyzed scenarios. In Scenario 1, a reduction in the initial bid price (BI) was proposed in response to the new federal government policies aimed at achieving a 10% reduction in tortilla prices (Rojas, 2025). If BI decreases by 10%, the probability of responding YES to the willingness-to-

**Table 1**. Simulation results in the binomial logit model.

| **Scenario 1**. Effect on aggregate proportions. The threshold T* of the logit model to calculate the fit=1[Prob>T*] is .50000. Changing variable=BI, Operation=*, value=0.900. | | | |
|---|---|---|---|
| **Result** | **Base** | **Scenario** | **Change** |
| 0 | 88=40.74% | 58=26.85% | −30 |
| 1 | 128=59.26% | 158=73.15% | 30 |
| Total | 216=100.00% | 216=100.00% | 0 |
| **Scenario 2**. Effect on aggregate proportions. The threshold T* of the logit model to calculate the fit=1[Prob>T*] is .50000. Changing variable=INGR, Operation=+, value=1000.000. | | | |
| **Result** | **Base** | **Scenario** | **Change** |
| 0 | 88=40.74% | 84=38.89% | −4 |
| 1 | 128=59.26% | 132=61.11% | 4 |
| Total | 216=100.00% | 216=100.00% | 0 |
| **Scenario 3**. Effect on aggregate proportions. The threshold T* of the logit model to calculate the fit=1[Prob>T*] is .50000. Changing variable=STUDIES, Operation=+, value=1.000. | | | |
| **Result** | **Base** | **Scenario** | **Change** |
| 0 | 88=40.74% | 84=38.43% | −5 |
| 1 | 128=59.26% | 132=61.57% | 5 |
| Total | 216=100.00% | 216=100.00% | 0 |
| **Scenario 4**. Effect on aggregate proportions. The threshold T* of the logit model to calculate the fit=1[Prob > T*] is .50000. Changing variable=DEPENDENTS, Operation=−, value=1.000. | | | |
| **Result** | **Base** | **Scenario** | **Change** |
| 0 | 88=40.74% | 84=38.89% | −4 |
| 1 | 128=59.26% | 132=61.11% | 4 |
| Total | 216=100.00% | 216=100.00% | 0 |
| **Scenario 5**. Effect on aggregate proportions. The threshold T* of the logit model to calculate the fit=1[Prob>T*] is .50000. Changing variable=PRICEKG, Operation=*, value=0.900. | | | |
| **Result** | **Base** | **Scenario** | **Change** |
| 0 | 88=40.74% | 84=38.89% | -4 |
| 1 | 128=59.26% | 132=61.11% | 4 |
| Total | 216=100.00% | 216=100.00% | 0 |

Source: Results from the N-logit software.

pay question increases by 13.89%, which is consistent with economic theory. Conversely, if monthly income increases by MXN $1,000, the probability of responding YES rises by 1.39%, a result similar to that reported by Jaramillo (2016). If the level of education increases by one category, the probability of responding YES increases by 2.31%, in agreement with the findings of Hernández *et al.* (2019) and Lugo *et al.* (2020), who reported that a higher educational level is associated with a greater probability of obtaining an affirmative response. Similarly, if the number of economic dependents of the household head decreases by one, the probability of responding YES increases by 1.85%; this result is consistent with Valdivia *et al.* (2011) and Hernández *et al.* (2023). Finally, if the price of tortillas at the establishment where the respondent purchases them decreases by 10%, the probability of responding YES increases by 1.85%.

Using the scenarios analyzed with the binomial logit model, it can be concluded that consumers increase their willingness to pay when the price of tortillas decreases by 10%, when the number of economic dependents is reduced, or when their income or educational level increases.

### Mixed Logit Model Scenarios

The following table (Table 2) presents the change in consumer welfare resulting from modifying or combining tortilla attributes. This change corresponds to the Compensating Variation (CV), which is a Hicksian monetary measure of welfare and serves as an approximation of willingness to pay (WTP). It is important to note that the attributes HM and MMN were not included because their negative signs indicate a loss of welfare for consumers.

**Table 2**. Changes in well-being due to different attributes of the tortilla (weights/$kg^{-1}$).

| Municipality | PAO | MCN | AZUL | CC | ALL |
|---|---|---|---|---|---|
| Ecatepec de Morelos | 28.8608036 | 31.8937955 | 32.7907676 | 25.8476359 | 43.269389 |
| Nezahualcóyotl | 26.1267014 | 29.1596933 | 30.0566653 | 23.1135337 | 40.5352868 |
| Naucalpan de Juárez | 22.198277 | 25.2312689 | 26.1282409 | 19.1851093 | 36.6068624 |
| Chimalhuacán | 28.3479558 | 31.3809477 | 32.2779197 | 25.3347881 | 42.7565411 |
| Tlalnepantla de Baz | 31.9529569 | 34.9859488 | 35.8829209 | 28.9397892 | 46.3615423 |
| Cuautitlán Izcalli | 32.448096 | 35.4810879 | 36.37806 | 29.4349283 | 46.8566814 |
| Tecámac | 29.1882195 | 32.2212114 | 33.1181834 | 26.1750518 | 43.5968049 |
| Ixtapaluca | 26.0645333 | 29.0975252 | 29.9944972 | 23.0513656 | 40.4731187 |
| Tultitlán | 23.4325615 | 26.4655534 | 27.3625255 | 20.4193938 | 37.8411469 |
| Chalco | 28.5038625 | 31.5368544 | 32.4338265 | 25.4906948 | 42.9124479 |
| Valle de Chalco Solidaridad | 20.9419541 | 23.9749461 | 24.8719181 | 17.9287864 | 35.3505395 |
| La Paz | 17.8863631 | 20.919355 | 21.8163271 | 14.8731954 | 32.2949485 |
| Coacalco de Berriozábal | 37.1837913 | 40.2167832 | 41.1137552 | 34.1706236 | 51.5923767 |
| Texcoco | 34.8992438 | 37.9322357 | 38.8292078 | 31.8860761 | 49.3078292 |
| Chicoloapan | 20.6328544 | 23.6658463 | 24.5628183 | 17.6196867 | 35.0414398 |

PAO: Organic Agricultural Production; MCN: Native Nixtamalized Corn; AZUL: Blue Corn; CC: Tortilla with Added Ingredients. ALL: All atributes combined.

The results show that the blue color attribute of tortillas (AZUL) is the most highly valued by consumers, a finding similar to that reported by Blare *et al.* (2020). However, in the direct question regarding the most valued attribute (Figure 1), color ranked fourth, that is, among the least valued attributes. Although some studies have reported that tortilla color is not a highly important characteristic (Escobedo and Jaramillo, 2019), in the present study this discrepancy may be due to respondents not having fully understood the direct question, although there is not sufficient evidence to confirm this assertion.

The attribute CC was the least valued, and these results are consistent with those reported by Espejel *et al.* (2016) and Escobedo and Jaramillo (2019), who indicate that consumers attach little importance to tortillas being supplemented with other products such as nopal, fiber, or vitamins. It was also observed that the municipality of Coacalco de Berriozábal assigned the highest value to the evaluated attributes, whereas the municipality of La Paz assigned the lowest value. These results may be explained by the fact that respondents from Coacalco de Berriozábal had higher income levels and higher educational attainment than those from La Paz (Figure 2). Moreover, several authors have reported a positive relationship between educational level, income level, and willingness to pay for a differentiated good or service (Jaramillo, 2016; Blare *et al.*, 2020; González *et al.*, 2024).

The highest compensating variation for organic, native-corn, blue tortillas with added ingredients was 51.59 MXN $kg^{-1}$, whereas the lowest was 32.29 MXN $kg^{-1}$.

Figure 4 graphically presents the mean changes in consumer welfare (MXN $kg^{-1}$) associated with tortilla attributes. The most highly valued attribute was blue corn (AZUL), followed by native nixtamalized corn (MCN), then organic agricultural production (PAO), and finally tortilla with added ingredients (CC). Nevertheless, tortillas combining all the aforementioned attributes (ALL) were valued more highly than any individual attribute considered separately. The figure also shows that Coacalco de Berriozábal and Texcoco

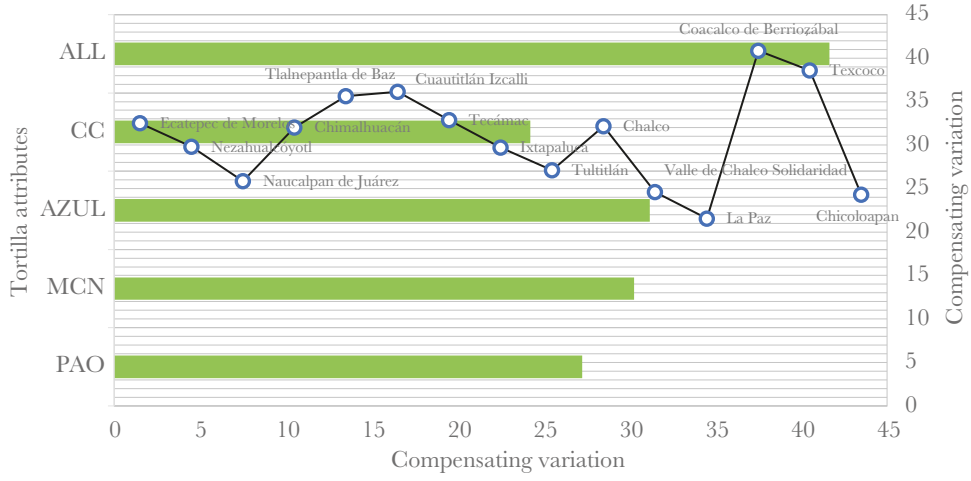


**Figure 4**. Changes in welfare associated with tortilla attributes (MXN $kg^{-1}$). PAO: Organic Agricultural Production; MCN: Native Nixtamalized Corn; AZUL: Blue Corn; CC: Tortilla with Added Ingredients; ALL: tortillas combining all the aforementioned attributes.

were the municipalities that assigned the greatest value to organic, native-corn, blue tortillas with added ingredients.

Based on the scenarios analyzed using the mixed logit model, it can be concluded that respondents placed greater value on the attributes of blue corn and native nixtamalized corn; however, they assigned even higher value to tortillas combining all the evaluated attributes. The municipalities of Coacalco de Berriozábal and Texcoco were those that valued this product most highly.

**Multinomial Logit Model**

Using the multinomial logit model, the probabilities of each alternative were obtained, as shown in the following table (Table 3). Alternative 1 and Alternative 2 consist of combinations of different attributes and levels, whereas Alternative 3 corresponds to the status quo. It can be observed that, when each alternative is analyzed individually, Alternative 3 has the highest probability of being selected. However, when the combined effect is considered, the probability of choosing Alternatives 1 and 2 reaches 0.54, which is 8% higher than that of the status quo alternative.

**Table 3**. Probability of each alternative.

| ALT | EXP | PROBABILIDAD |
|---|---|---|
| 3 | 1.5341868 | 0.4593990 |
| 2 | 0.5865062 | 0.1756242 |
| 1 | 1.2188585 | 0.3649767 |

ALT3: status quo; ALT1 and ALT2: combinations of different attributes and levels.

**Social and Policy Implications of the Results**

It was found that a 10% reduction in the price of tortillas, in line with the current federal government policy, increases the probability of responding YES to the willingness-to-pay question. A decrease in tortilla prices improves consumer welfare by enhancing purchasing power and increasing economic surplus. At the same time, a reduction in tortilla prices would increase demand for the product and for all the inputs required for its production, including corn.

Regarding the federal government policy aimed at promoting the conservation, production, processing, and commercialization of native Mexican corn (Presidencia de la República, 2025), these results confirm that artisanal tortillas constitute a viable means of adding value to native corn, since consumers value this attribute and are willing to pay a premium for it.

**CONCLUSIONS**

The use of the Contingent Valuation Method (CVM) with a binomial logit model, together with discrete choice experiments estimated through multinomial logit and mixed logit models, proved highly useful, as it made it possible to analyze different scenarios

involving changes in socioeconomic variables and tortilla attributes. Likewise, it allowed the evaluation of two federal government policies, leading to the conclusion that a reduction in tortilla prices improves consumer welfare and that artisanal tortillas represent a viable strategy for adding value to native corn, given that consumers value this attribute and are willing to pay a premium for it.

Furthermore, the probability of preference for the status quo was estimated, and the most highly valued attribute was identified as the blue color of the tortilla, followed by the native, organic, and added-ingredient attributes. The highest compensating variation (CV) for organic, native-corn, blue tortillas with added ingredients was 51.59 MXN $kg^{-1}$, whereas the lowest was 32.29 MXN $kg^{-1}$. The municipality of Coacalco de Berriozábal assigned the highest value to tortillas with the analyzed attributes, followed by Texcoco, Tlalnepantla, and Cuautitlán Izcalli. These findings support the validity of stated preference methods, since the results are consistent with those reported in other studies using different methodologies (Espejel *et al.*, 2016).

With regard to public policy, it is suggested that direct subsidies be granted to native corn producers with the following objectives: to make the cost of native-corn tortillas more affordable and to promote germplasm conservation. This is especially relevant because climate change is creating new agricultural challenges, corn is a crop of global importance, and Mexico possesses the genetic diversity that will be required to respond to such challenges. Simultaneously, the implementation of labels such as "Native Corn" or "Traditional Product" is recommended in order to add value to these tortillas, together with educational campaigns on native corn that provide clear information on its nutritional, cultural, and environmental benefits.

It is important to mention that, although the correct methodology was followed in the design and administration of the questionnaire, the study may still be subject to some degree of bias, particularly with respect to respondents' understanding of the questions. Therefore, it is recommended that the study be replicated in other regions of the country. This would also make it possible to identify the preferences of a broader range of consumers, since such preferences are likely to vary according to the region under study.

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