New goods with new attributes: combining revealed and stated preferences to assess the effect of a novel quality label in the food industry

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Abstract. This paper evaluates the effect on market shares and consumer surplus of the introduction of a Good Agricultural Practices (GAP)-labeled product in the frozen fried potatoes (FFP) industry. We first estimate a model of household demand in Mar del Plata, Argentina, using scanner data and demographic information. We find that higher income individuals are more concerned about health and nutrition, and that younger and lower-income consumers are more price-sensitive. Then we postulate that a properly GAP-labeled FFP is available in the market, and we assess its effect by using the estimated utility function and prior information about consumers' declared willingness to pay (WTP) for sustainably produced potatoes. We find that the older the individual, the greater the influence of the hypothetical introduction of the GAP-labeled product; the relationship is less conclusive in the case of income. Finally, we predict the results of a greater consumer surplus extraction by fixing a higher price for the new product, and we calculate the maximum increase in the marginal cost that the firm would be able to afford if farmers charge higher prices for GAP fresh potatoes.

Keywords: Frozen Fried Potatoes, Good Agricultural Practices, Random Coefficients Discrete Choice Model, Willingness to Pay, Welfare Evaluations.

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1. Introduction

Food safety and food quality concerns have increased worldwide among consumers in the last decades, mainly in developed countries but growingly in developing ones. As a consequence, some food-producing firms have begun requiring farmers to accomplish certain quality standards. This is the case of the processed potato industry in Argentina, where some transnational companies have demanded Argentinean potato producers to implement Good Agricultural Practices (GAP) protocols, in order to fulfill global supermarket chains requirements. The products obtained through these practices possess a new attribute, the quality certification, which at present is not identified in their packages, at least when sold in Argentinean domestic markets. However, these firms could extract more consumer surplus by correctly signaling the GAP attribute through a labeling strategy, since previous results indicate that consumers are willing to pay an extra price for potatoes that are produced by following sustainable agricultural practices (Rodríguez *et al.*, 2010).

The effects of the introduction of a new product, like a GAP-labeled processed potato, can be analyzed with the Random Coefficients Discrete Choice Model (RCDCM) of demand (Berry, 1994; Berry *et al*., 1995). This model has gained importance in the study of market power, changes in market structure, and introduction of new goods in differentiated-product markets. Petrin (2002) quantifies the effect of the introduction of the minivan into the U.S. automobile market. Mojduszka *et al*. (2001) investigate preferences for prepared frozen meals and evaluate the impact of a new government regulation policy that changes nutrition labeling from voluntary to mandatory. Kim (2004) evaluates the effect of new brands on market competition and consumer welfare in the U.S. processed cheese market. In these studies, the method allows to evaluate the introduction of a new product defined as a new combination of existing characteristics, i.e. those included in the demand estimation that requires sales data. The main difference between those and this paper is that we evaluate the introduction of a

new product with an inexperienced or unknown attribute (i.e., an attribute that has not been supplied in the market before), namely the GAP label. Therefore, the influence of this attribute on the utility function cannot be recovered with sales data, but requires the use of an auxiliary dataset.

The Argentinean processed potato industry is characterized by high concentration and high degree of horizontal and vertical differentiation. There are virtually no research on the characteristics, evolution, and development of the domestic market. Few exceptions are studies committed to analyze contractual relationships and integration schemes between potato producers and agro-industry stakeholders (Bruzone, 1998; Mateos, 2003). A recent study (González & Lacaze, 2012) analyzes the demand of frozen fried potatoes (FFP) in an important city of Argentina, Mar del Plata, and the effect of changes in market structure on prices, market shares, and consumer welfare.

The objective of this paper is to evaluate the effect on market shares and consumer surplus of the introduction of a GAP-labeled product in the FFP market. To achieve this goal, we first estimate a RCDCM of household demand in Mar del Plata, Argentina, using a scanner data panel provided by a local supermarket chain and demographic information from an official household survey. In a second step, we postulate a hypothetical scenario in which a properly labeled FFP produced following GAP standards is available as an option in the market. Using the estimated price coefficient in the utility function and prior information about consumers' declared willingness to pay (WTP) for sustainably produced potatoes, we recover the effect of the new attribute on utility, and then we assess the effect of the introduced product on sales and welfare. The methodological contribution of this paper is to combine the strengths of both revealed- and stated-preferences approaches.

The rest of the paper is organized as follows. A brief overview of the FFP world market and some notes about the implementation of sustainable agricultural practices, including GAP and

Integrated Production and Pest Management (IPPM) protocols, are presented in Section 2. Section 3 outlines the theoretical framework, the RCDCM of demand. Data, estimation, and identifying assumptions are presented in Section 4. The estimation details of the counterfactual exercise are provided in Section 5. Section 6 reports the results. Finally, Section 7 concludes the paper.

2. The FFP industry and the implementation of sustainable production protocols

Potato is an extensive annual crop of relative high cost, whose productivity can be limited by agro-ecological conditions, water availability, technology, and use of fertilizers and other agrochemicals. These constraints are especially important when considering potatoes destined to processing, as FFP, due to the quality standards usually required. Straight-cut fries, named "papas bastón" in Argentina and some others Latin American countries, are the main product of Argentinean FFP industry, even though there are others, like slices, noisettes, croquettes, etc.

FFP is an extensively consumed food in developed countries, mainly in North America. Although the FFP market has reached maturity in the United States, a swiftly grow in developing countries is related to the higher women's labor force participation rates, the higher frequency of eating-out, and other changes in working patterns. These modifications have caused a rise in the demand for fast food, a market dominated by multinational chains that are the principal FFP supplier. Global production of fries is mainly concentrated in the United States, The Netherlands, Canada, and Belgium, which also are the top exporters. A few companies dominate this market in Mercosur: McCain supplies McDonald's, while Alimentos Modernos supplies Burger King through two own brands, FarmFrites and RapiPap. In Argentina, FFP production amounted to 215,000 tons in 2001 (last available figures), accounting for 80% of the potatoes destined to industrial processing (Mateos, 2003).

Argentinean households' direct demand for FFP is primarily supplied by super and hypermarkets, even though restricted because of the high prices if compared with fresh potatoes.

Some of the firms mentioned above have begun an adaptation process in order to enforce their potato local suppliers to fulfill GAP protocols. According the Food and Agricultural Organization of the United Nations, GAP refers to practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products (FAO, 2003). GAP help reduce the risk of non-compliance with national and international regulations, standards, and guidelines regarding permitted pesticides, maximum levels of contaminants in food and non-food agricultural products, as well as other contamination hazards. One of the challenges involving the application of GAP is the implementation of practices which lead to improvements in terms of yield and production efficiencies as well as environment, health and safety of workers. One approach to overcome this challenge is IPPM, a system developed to address health and environmental concerns by decreasing the net chemical pesticide inputs to agriculture (Bruhn *et al.*, 1992). IPPM introduction propounds a feasible and cost effective alternative to both conventional and organic agriculture (Hamilton, 1995; Robson *et al.*, 1995).

In the context of a national project launched in 2006 by the Argentinean National Institute of Agricultural Technology (INTA), previous works have analyzed the possibilities and limitations of the implementation of these sustainable practices to potato production in the southeast Province of Buenos Aires, Argentina (Rodríguez *et al.*, 2010; González & Rodríguez, 2011). The main objective of that project is to develop agronomic technologies that enable to produce, certify, and market fresh potatoes by following sustainable agricultural practices. The successful adoption of such technologies and sustainable practices by potato farmers is a key condition for the fulfillment of the project, but another critical task

is consumers' recognition of and WTP for this kind of products with a novel quality certification attribute. The last depends on the product labeling strategy in order to make visible this credence attribute (Nelson, 1970). Previous empirical studies of the effects of voluntary or mandatory product labeling in the food sector have tended to focus on the provision of nutritional information and exhibit diverse results regarding effectiveness of information disclosure (Ippolito & Mathios, 1995; Mojduszka & Caswell, 2000; Teisl *et al.*, 2001; Drichoutis *et al.*, 2009). Overall, results are very mixed ranging from substantial price premiums and sizable consumer segments for the labeled product, to no avoidance behavior (Marks *et al.*, 2003).

In the last decades, food safety scares have certainly led to a significant loss of consumer confidence in the quality and safety of conventional food products. As a consequence, sustainable food products have gained attention from consumers, whose demand for and attitudes toward alternative labeling strategies, as GAP, IPPM or organic, have consistently increased in developed countries. Some results related with vegetables and, more specifically, with potato consumption patterns, are reported in Cheng *et al.* (2001), Matsuda (2005), Yue *et al.* (2007), and Song *et al.* (2010).

3. Random Coefficients Discrete Choice Model

The theoretical framework chosen to analyze the introduction of the GAP-labeled FFP is the RCDCM of demand. Since McFadden's logistic demand model (1973), the discrete choice literature has provided solutions to deal with some obstacles faced in the study of differentiated-product markets, in particular when estimating demand functions. On the one hand, it is the computational complexity of estimating a large number of parameters. On the other hand, there is a difficulty associated with the possibility of modeling the heterogeneity in consumers' tastes with which to get more realistic estimations of substitution patterns and

welfare changes in counterfactual scenarios. The RCDCM overcomes such challenges because it allows to identify individual coefficients of the attributes in the utility function. In the following subsections we outline the main elements of the RCDCM approach.

3.1 Demand

Suppose $t = 1,\ldots, T$ markets (as defined below) are observed, each with $i = 1,\ldots, I$ consumers. The conditional indirect utility of consumer i from product j ($j = 1,\ldots, J$) at market t is

$$u_{ijt} = x_j\beta_i^* - \alpha_i^* p_{jt} + \xi_j + \Delta\xi_{jt} + \varepsilon_{ijt} \quad (1)$$

where x_j is a K-dimensional (row) vector of observable product characteristics, p_{jt} is the price of product j in market t, ξ_j is the mean valuation of the unobserved product characteristics, $\Delta\xi_{jt}$ is a market specific deviation from this mean, and ε_{ijt} is a mean-zero stochastic term distributed i.i.d. with Type I extreme-value distribution. Finally, $(\alpha_i^*\ \beta_i^*)$ are $K + 1$ individual-specific coefficients, defined following the approach of Nevo (2001) as:

$$\begin{pmatrix}\alpha_i^* \\ \beta_i^*\end{pmatrix} = \begin{pmatrix}\alpha \\ \beta\end{pmatrix} + \Pi D_i + \Sigma v_i$$
$$v_i \sim N(0, I_{K+1}) \quad (2)$$

where $(\alpha\ \beta)$ are the mean parameters of the utility function, D_i is a $d \times 1$ vector of observed demographic variables, v_i is a vector of normal random shocks in tastes,[3] Π is a $(K + 1) \times d$ matrix of coefficients that measure how the taste coefficients vary with demographics, and Σ is a scaling matrix.

The consumers may decide not to purchase any of the products (outside option). Without this allowance a homogeneous price increase of all products does not change quantities purchased. The indirect utility from this outside good is

$$u_{i0t} = \xi_0 + \pi_0 D_i + \sigma_0 v_{i0} + \varepsilon_{i0t}$$

[3] The vector v_i represents the unobserved individual characteristics (i.e., not available in the demographic dataset) that affect preferences.

The mean utility of the outside good, ξ_0, is not identified, so it is normalized to zero.

Let $\theta = (\theta_1, \theta_2)$ be a vector containing all parameters of the model. The vector $\theta_1 = (\alpha, \beta)$ contains the linear parameters and the vector $\theta_2 = (\Pi, \Sigma)$, the nonlinear parameters.[4] Combining equations (1) and (2):

$$\begin{aligned} u_{ijt} &= \delta_{jt}\left(x_j, p_{jt}, \xi_j, \Delta\xi_{jt}; \theta_1\right) + \mu_{ijt}\left(x_j, p_{jt}, v_i, D_i; \theta_2\right) + \varepsilon_{ijt} \\ \delta_{jt} &= x_j\beta - \alpha p_{jt} + \xi_j + \Delta\xi_{jt};\ \mu_{ijt} = \left[p_{jt}, x_j\right]' * (\Pi D_i + \Sigma v_i) \end{aligned} \tag{3}$$

where δ_{jt} represents the mean utility, which is common to all consumers, and $\mu_{ijt} + \varepsilon_{ijt}$ is a mean-zero heteroskedastic deviation from that mean that captures the effects of the random coefficients.

It is assumed that consumers purchase one unit of the good that gives the highest utility.[5] This implicitly defines the set of individual-specific variables that lead to the choice of good *j*:

$$A_{jt}(x, p_{.t}, \delta_{.t}; \theta_2) = \left\{(D_i, v_i, \varepsilon_{it}) | u_{ijt} \geq u_{ilt}\ \forall l = 0,1, \ldots, J\right\}$$

Assuming ties occur with zero probability, the market share of the *j*th product as a function of the mean utility levels of all the *J* + 1 goods, given the parameters, is

$$s_{jt}(x, p_{.t}, \delta_{.t}; \theta_2) = \int_{A_{jt}} dP^*(D, v, \varepsilon) = \int_{A_{jt}} dP_D^*(D) dP_v^*(v) dP_\varepsilon^*(\varepsilon) \tag{4}$$

where $P^*(\cdot)$ denotes population distribution functions. The second equality is a consequence of an assumption of independence of D, v, and ε. These market share equations do not have an analytic closed form, and therefore the integral given in equation (4) has to be computed numerically.

Since the main data source includes aggregate sales data, heterogeneity can be modeled either by assuming a parametric distribution of $P^*(\cdot)$ (Berry, 1994; Berry *et al.*, 1995) or as a function of the empirical nonparametric distribution of demographics (Nevo, 2001). We

[4] The reason for distinguishing between linear and nonlinear parameters has to do with how they enter the model and the estimator, as will be shown below.

[5] This is a reasonable assumption since most people consume only one kind of FFP at a time.

implement the second option in this paper, which allows us to assess the joint distribution of the demographic variables in D.

3.2 Supply

Suppose there are F firms, each of which produces some subset, $\mathcal{F}_f$, of the j = 1,…, J different products. The profits for a firm *f* are

$$\Pi_f = \sum_{j \in \mathcal{F}_f} (p_j - mc_j) M s_j(p) - C_f \tag{5}$$

where $s_j(p)$ is the market share of product *j*, which is a function of the prices of all products, M is the size of the market,[6] mc_j is the constant marginal cost of production, and C_f is the fixed cost of production. Assuming the existence of a pure-strategy Bertrand-Nash equilibrium in prices, and that the prices that support it are strictly positive, the price p_j of any product *j* produced by firm *f* must satisfy the first-order condition

$$s_j(p) + \sum_{r \in \mathcal{F}_f} (p_r - mc_r) \frac{\partial s_r(p)}{\partial p_j} = 0 \tag{6}$$

In vector notation, the first-order conditions become

$$s(p) + (\Omega .* \Delta)(p - mc) = 0 \tag{7}$$

where Ω is the ownership matrix, whose element Ω_{jr} equals one if *j* and *r* are produced by the same firm, and zero otherwise. Δ is the derivative matrix, where $\Delta_{jr} = \partial s_r(p)/\partial p_j$, which is obtained when estimating the demand model. This implies a system of equations to compute the marginal costs, which are not observed:

$$mc = p + (\Omega .* \Delta)^{-1} s(p) \tag{8}$$

[6] The market size defined in this model includes the share of the outside good, which allows keeping the market size fixed while still allowing the total quantity of products sold to increase. Therefore, the analysis of hypothetical changes in the market is less sensitive to the exact definition of market size.

3.3 Consumer welfare

The measure we use to evaluate the changes in consumer welfare as a result of the introduction of the new product is the compensating variation. This measure does not have an analytical solution for the RCDCM, because α_i^* in equation (1) is a function of income. The compensating variation of individual i, CV_i, has to be computed iteratively, and is equal to $-\Delta y_i$, where Δy_i solves

$$u_i(y_i, p) = u_i^*(y_i + \Delta y_i, p) \tag{9}$$

where y_i is the income of individual i and p is the vector of prices in the initial situation. The left-hand side of equation (9) is the utility of individual i before the introduction of the new product. The utility function $u_i(\cdot)$ is estimated using sales data and demographic information, as explained below. The difference between $u_i(\cdot)$ and $u_i^*(\cdot)$ on the right-hand side is that the last one includes the coefficient of the new attribute, i.e. the effect of the GAP label on utility, whose calculation is explained in Section 5. Note that in equation (9) the compensating variation is computed assuming that prices remain constant after the introduction of the new product. In the analyzed hypothetical scenario, the sole presence of a GAP-labeled FFP available as a new option influences consumers' utility, regardless the changes in prices that it may cause. This is not the case of counterfactual exercises that postulate changes in market structure, in which changes in consumer welfare are driven entirely by the new prices set by firms in response to the new ownership situation (González & Lacaze, 2012). The constant prices assumption is reasonable here since, according to information provided by key actors of the market, potato processing companies do not pay a higher price to farmers for GAP fresh potatoes than for conventional ones, and then their production costs remain constant. However, as mentioned before, in differentiated-product markets the existence of a pure-strategy Bertrand-Nash equilibrium in prices is often assumed, which implies that prices are determined as the sum of the marginal cost and a markup term (equation 8). Therefore,

suppliers could adjust the markup when faced with the introduction of a new substitute, and then prices would react to the existence of the new product. We leave the analysis of this price adjustment behavior[7] to a later work.

Given the individual compensating variation CV_i, the mean compensating variation in the population is given by

$$CV = N \int CV_i \, dP_D^*(D) dP_v^*(v) \tag{10}$$

where N is the total number of consumers.

Two additional assumptions have to be made when computing these changes in consumer surplus. First, the introduction of the new product does not affect consumer valuation of existing attributes, i.e. the coefficients of the characteristics in the utility function remain constant, and so does the unobserved components, ξ_{jt}. Second, there are no changes in the utility from the outside good.

4. Data, estimation, and identifying assumptions

4.1 Data

The data required to consistently estimate the RCDCM consist of the following variables: market shares and prices in each market (as defined below), product attributes, and socioeconomic characteristics of individuals. Since we do not possess information about individual purchases, we match scanner data with a demographic database, which provides the distribution of demographic variables across population in each market, in order to identify the variable part of the coefficients.

The scanner database was provided by a traditional supermarket chain in Mar del Plata, Supermercados Toledo S. A., and consists of the value of monthly sales and the quantity sold

[7] The constant markup assumption implies that the derivative of market shares with respect to prices remains unchanged.

for each product and each of the 23 branches of the supermarket, from July 2005 to December 2009. The city of Mar del Plata is located on the Atlantic Ocean cost, 400 kilometers (249 miles) south of Buenos Aires City, the capital city of Argentina. It is one of the major fishing ports, an important industrial area, and the biggest seaside beach resort in the country. With a population of roughly 600,000 inhabitants, Mar del Plata is the second largest city of Buenos Aires Province and the seventh largest Argentinean city, and is the main urban center of the major potato production area of the country, which is located in the southeast Province of Buenos Aires. Figure 1 shows the geographical distribution of the supermarket branches, confirming their widespread allocation in the city.

[Figure 1 here]

The sales data cover 18 FFP products supplied by three firms (McCain, Alimentos Modernos, and Granja del Sol) through four brands (McCain, FarmFrites, Granja del Sol, and RapiPap), and are classified in six segments or varieties (bastón, golden longs, noisette, rondelles, smiles, and croquettes) and offered in several container sizes. Nutritional information about calories, saturated fat, fiber, and sodium was collected by visual inspection of the products' nutrition facts labels. Unit value per serving was calculated as a proxy for price, by dividing the value of sales by the quantity of servings sold, which was computed as the package size divided by the serving size[8] and multiplied by the quantity of units sold.

Information on the distribution of demographics was obtained by sampling individuals from the Encuesta Permanente de Hogares (EPH), which is carried out by the Instituto Nacional de Estadísticas y Censos (INDEC) in several cities of the country; in this paper we use the information about households in Mar del Plata. The socioeconomic variables of interest are per capita income and average age of the household members, which is related with both household size and presence of children.

[8] According to the Argentine Food Code, the size of a serving of FFP is 85 grams (2.99 oz).

In order to match both data sets it is necessary to define the criterion for aggregating sales data and sampling simulated individuals, i.e. to define a market. Since the EPH does not provide the geographical location of surveyed households, it is not possible to define a market as a combination of a geographical area and a unit of time, as in most previous work, which in our case would be a branch-month combination. Therefore, a market was defined as an income-month combination, and the data were prepared following three steps. First, per capita average income of each Mar del Plata census tract was calculated using data from a household survey.[9] Second, the potential customers of each supermarket branch were identified according to the population of the census tract in which the branch is located. Finally, the branches were classified by the income level of their potential buyers (high, upper-middle, middle, lower-middle, and low)[10], and sales data of branches with the same income level were aggregated by month and product. Thus, the data were structured in 270 markets (5 income levels by 54 months) and 2,145 observations (considering different products sold in each market). The demographic characterization of each market was accomplished by randomly drawing simulated individuals from the corresponding period and quintile of the EPH.[11]

Lastly, to calculate the market shares it is necessary to assess the market size, i.e. the total potential demand for FFP of the supermarket chain. This was obtained as the 35%[12] of the total potential demand of the city, which in turn was calculated by imputing the FFP

[9] The description of this survey is provided in Section 5.

[10] These income categories were defined according to the average quintile income of the households surveyed by the EPH in the second quarter of 2009, period in which the potato consumption survey was carried out.

[11] Since the EPH is a quarterly survey, three random samples had to be drawn for each quarter and quintile. The sample size (ns) is of 180 individuals by market.

[12] This is Supermercados Toledo's share of total supermarket sales in Mar del Plata, according to the opinion of key actors in the supermarket industry.

consumption frequency of "real consumers"[13] to the entire city population. This was done for each of the branches regarding their potential customers, and then the market size for each income-month combination was calculated. The market share of each product in each market was determined by dividing the quantity of servings sold by the market size.

Table 1 presents the characteristics of the FFP products covered by our scanner database. We assign them an identification number (ID) which we will refer to in the results section. Bastón is the most popular variety followed by noisette, despite its relatively high price. On the other hand, croquettes and rondelles are the segments with the least market shares. It can be seen that Toledo customers can take advantage of economies of scale in these products, since price per serving decrease as container size increases, at equal value of the other characteristics.

Table 2 reports FFP average prices by segment and income level. For all varieties, prices increase with income; golden longs, rondelles and bastón are the least expensive products in all income levels, and croquettes are the most expensive. The last column shows the percentage difference between average prices in high- and low-income-level markets. Consumers of high income-level face higher prices than consumers of low income-level for any product variety, which suggests the presence of a price discrimination strategy implemented by sellers. Golden longs and smiles are the segments in which the highest surcharges are imposed, while bastón and noisette present the lowest surcharges.

[Table 1 here]

[Table 2 here]

Lastly, Table 3 shows average prices by brand and income level. Such as in the previous table, prices increase with income regardless the brand. Granja del Sol offers the most expensive products on average, while RapiPap FFP is the least expensive option.

[Table 3 here]

[13] This refers to the FFP consumption frequency of those polled in the potato consumption survey who declared they consume FFP.

4.2 Estimation

The key point of the estimation is to exploit a population moment condition that is a product of instrumental variables and a structural error term to form a nonlinear GMM estimator. The main technical difficulties to deal with are related to the computation of the integral in equation (4), and to matching theoretical to observed market shares. Formally, let $Z = [z_1, \dots, z_M]$ be a set of instruments such that $E[Z' \cdot \omega(\theta^*)] = 0$, where ω, a function of the model parameters, is an error term defined below and θ^* denote the true value of the parameters. The GMM estimator is

$$\hat{\theta} = \arg\min_{\theta} \omega(\theta)' Z A^{-1} Z' \omega(\theta) \tag{11}$$

where A is a consistent estimate of $E[Z'\omega\omega'Z]$. Because of the inclusion of product-specific dummy variables as product characteristics (as explained below), the error term is defined as the market specific deviation from the mean valuation of the unobserved product characteristics, $\Delta\xi_{jt}$.[14] This error term is computed by solving for the mean utility levels, $\delta_{.t}$, that solve the implicit system of equations

$$s_{.t}(x, p_{.t}, \delta_{.t}; \theta_2) = S_{.t} \tag{12}$$

where $s_{.t}(\cdot)$ is the market share function defined by equation (4) and $S_{.t}$ are the observed market shares. This inversion is done numerically. Once this inversion has been done, the error term is defined as $\omega_{jt} = \delta_{jt}(x, p_{.t}, S_{.t}; \theta_2) - \left(x_j\beta - \alpha p_{jt}\right)$. The reason for distinguishing between θ_1 and θ_2 becomes clear now: θ_1 enters this error term, and therefore the objective function, in a linear fashion, while θ_2 enters nonlinearly.[15]

[14] A straightforward approach to the estimation of this model is to define the error term as the difference between the observed and predicted market shares. In this work, we define a structural error term following the estimation method proposed by Berry (1994), which allows one to deal with correlation between the error term and prices. The advantage of working with a structural error is that the link to economic theory is tighter, allowing us to think of economic theories that would justify various instrumental variables (Nevo, 2000).

[15] The details on the estimation algorithm implemented to compute the estimates are reported in González & Lacaze (2012).

4.3 Instruments and product-specific dummy variables

As pointed out, once product dummy variables are included in the regression, the error term is the unobserved (to the researcher) income-month specific deviation from the overall mean valuation of the product. Since we assume that players in the industry observe and account for this deviation (i.e., firms take it into account when setting prices, and it affects consumers' utility and WTP), it will be correlated with prices, and therefore least-squares estimate of price sensitivity, α, will be biased and inconsistent.

Our identifying strategy follows that of Nevo (2001), which in turn uses an approach similar to that used by Hausman (1994). Exploiting the panel structure of the data, the identifying assumption is that, controlling for product-specific means and demographics, income-level-specific valuations are independent across income levels (but are allowed to be correlated within an income level). Given this assumption, the prices of the product in other income levels and months (and in other cities) are valid IV's. Since prices are a function of marginal costs, and assuming marginal costs have a common component to all income levels and months, prices of product j in two markets will be correlated (relevance condition). On the other hand, due to the independence assumption they will be uncorrelated with the market-specific valuation of other income levels and months (exclusion condition). According to all this, we use prices in other income levels and months as instruments. Additionally, the data source provides sales data of branches located in other cities (Azul, Balcarce, Miramar, Necochea, Olavarría, and Tandil), so we use the monthly average price of the product in those branches as IVs too.

Regarding the inclusion of product-specific dummy variables as product characteristics, one reason to introduce them is that they improve the fit of the model since we cannot be sure that the observed characteristics capture the entire set of factors that determine utility. But a major motivation is to prevent the mean valuation of the unobserved product characteristics, ξ_j,

from being part of the error term. These dummies capture all attributes that do not vary by market, and therefore the correlation between prices and the unobserved quality is fully accounted for and does not require an instrument. Because observable characteristics (except price) do not vary by market either, the taste parameters have to be retrieved by using a minimum distance procedure (as in Chamberlain, 1982). Let d denote the $J \times 1$ vector of product dummy coefficients, X be the $J \times K$ ($K < J$) matrix of product characteristics, and ξ be the $J \times 1$ vector of unobserved product qualities. Then from equation (1)

$$d = X\beta + \xi$$

If we assume that $E(\xi|X) = 0$,[16] the estimates of β and ξ are

$$\hat{\beta} = (X'V_d^{-1}X)^{-1}X'V_d^{-1}\hat{d}\ , \quad \hat{\xi} = \hat{d} - X\hat{\beta}$$

where $\hat{d}$ is the vector of coefficients estimated from the procedure described in Section 4.2, and V_d is the variance-covariance matrix of these estimates.

Finally, time dummy variables are included in the estimation in order to identify the pure effect of product characteristics on consumer's utility once the time effect is controlled for. This is especially relevant for price parameter estimates because significant inflation rates were verified over the analyzed period.

5. Counterfactual simulation: the nitty-gritty

As pointed out, previous work that analyzes the effect of new goods defines new products as a different combination of already existing characteristics, that is, those included in the demand estimation. In general, their approach consists of estimating the utility function using data containing sales of the product or attribute of interest, and then evaluating the changes in welfare caused by the withdrawal of the product from the market. Instead, here we analyze

[16] This is the assumption required to justify the use of observed characteristics as IV's. We explain elsewhere (González & Lacaze, 2012) that this strategy could yield inconsistent estimators. Here this assumption is used only to recover the taste parameters and does not impact the estimates of price sensitivity.

the introduction of a product that is new because it possesses an attribute that is not yet available in the market (the GAP label), and therefore its influence on utility cannot be recovered with sales data. However, it is necessary to identify the coefficient of the attribute in the utility function in order to assess changes in consumer welfare (see Section 3.3), so this coefficient was obtained by performing additional calculations, which are explained in what follows.

The utility function in the hypothetical situation is $u_i^*(\cdot)$ from Section 3.3. As previously pointed out, it results from adding a term representing the GAP attribute to the utility function (1), that is:

$$u_{ijt}^* = x_j\beta_i^* - \alpha_i^* p_{jt} + \gamma_i^* GAP_j + \xi_j + \Delta\xi_{jt} + \varepsilon_{ijt}$$

where GAP_j is a dummy variable indicating if product *j* is labeled as produced following GAP protocols. To obtain γ_i^*, note that, given the functional form of the utility function, the price and GAP coefficients can be expressed as the derivatives of utility with respect to these attributes, i.e. $\alpha_i^* = -\partial u_{ijt}/\partial p_{jt}$ and $\gamma_i^* = \partial u_{ijt}/\partial GAP_j$. In this case, the WTP for the GAP attribute, measured as the price premium that consumers would pay for the presence of the GAP label, is obtained as follows

$$WTP_i^* = \frac{\partial p_{jt}}{\partial GAP_j} = \frac{\partial p_{jt}}{\partial u_{ijt}}\frac{\partial u_{ijt}}{\partial GAP_j} = \frac{\frac{\partial u_{ijt}}{\partial GAP_j}}{\frac{\partial u_{ijt}}{\partial p_{jt}}} = -\frac{\gamma_i^*}{\alpha_i^*} \tag{13}$$

which is a well-know result in the literature (Gil *et al*., 2000; Loureiro & Umberger, 2001). Therefore, if we knew the stated WTP of consumers for the GAP attribute, we could calculate the GAP coefficient γ_i^* using equation (13):

$$WTP_i^* = -\frac{\gamma_i^*}{\alpha_i^*} \Rightarrow \gamma_i^* = -\alpha_i^* \times WTP_i^* \tag{14}$$

since we have the individual price coefficients from the RCDCM estimated with sales data.

A measure of the WTP for a GAP-labeled FFP was assessed by employing an auxiliary dataset. It is a survey of fresh potato consumption in which consumers were asked for their WTP for IPPM potatoes using the contingent valuation method. [17] As mentioned above, since IPPM system overcome one of the major challenges of GAP which is minimizing the use of chemical substances in agriculture, both production schemes are closely related because they both can be interpreted as the implementation of sustainable agricultural practices of food production. Therefore, it would be expected that consumers would be willing to pay a very similar amount for GAP than for IPPM fresh potatoes.

Assuming, then, that WTP for IPPM is an accurate measure of WTP for GAP fresh potatoes, we approximated how much would surveyed consumers be willing to pay for GAP-labeled FFP. We distinguished those consumers elicited in the survey who reported consuming FFP from those who reported not consuming. Two scenarios were considered. In the first scenario (Sce1), we assumed that consumers who purchase FFP were willing to pay for a GAP-labeled FFP the same price premium (in percentage terms) as for GAP fresh potato. On the other hand, the WTP of those who do not purchase FFP would be the half of their WTP for GAP fresh potato. In the second scenario (Sce2), it was assumed that consumers who purchase FFP were willing to pay for a GAP-labeled FFP half of their WTP for GAP fresh potato, while those who do not purchase FFP were not willing to pay an extra price premium for a GAP FFP. Therefore, the first is the more optimistic scenario and the second is the pessimistic one. Once we obtained individual WTP for GAP-labeled FFP in both scenarios, we modeled it as a function of the demographic characteristics of the surveyed consumers:

$$WTP_i^* = \overline{WTP} + \phi_1 y + \phi_2 age \qquad (15)$$

[17] This survey was conducted in Mar del Plata in June 2009 by the Grupo de Economía Agraria of the Facultad de Ciencias Económicas y Sociales, Universidad Nacional de Mar del Plata (Argentina) to 500 households in Mar del Plata (Rodríguez *et al*., 2010).

where $\overline{WTP}$ is the average WTP, and ϕ_1 and ϕ_2 were estimated by performing OLS regression.[18] By replacing (15) in equation (14) the individual GAP coefficient γ_i^* is obtained, so we can now compute the counterfactual introduction of the new product.

The proposed methodological strategy to assess the effect of introducing the new attribute allows us to take advantage of the main strengths that each preferences elicitation approach possesses. On the one hand, the demand estimation by using market data (revealed-preferences approach) produces an accurate measure of price sensitivity since they reflect purchasing choices really constraint by household budget restrictions. On the other hand, the contingent valuation method (stated-preferences approach) allows exploring consumers' assessment for attributes that are not available in the market.

We carry out the simulation in the market defined by the income-month combination high income - December 2009. We choose the last month of the sales data for the results to be the most up-to-date as possible, and also because it is close to the date on which the auxiliary survey was held. On the other hand, a high-income market was chosen in order to achieve more sensitive results, since it has been verified that wealthier individuals are more willing to pay for sustainable potatoes (Rodríguez *et al*., 2010).

In our hypothetical scenario, we postulate that one of the available products now possesses a label identifying it as produced under GAP. We pick bastón of brand FarmFrites sold in packages of 700 gr. (ID 2120), because it is the one with the higher market share in our scanner data (Table 2), among those offered in the analyzed market.

[18] This way of modeling the WTP is reasonable since both income and age are expressed as deviations to the mean, both in the auxiliary dataset from which ϕ_1 and ϕ_2 were estimated, and in the demographic database used to perform the RCDCM estimation and the counterfactual simulation.

6. Results

6.1 Utility function coefficients

We estimate a RCDCM of demand, whose results are shown in Table 4.[19] The constant term, content, brand, and bastón and noisette segments enter the model linearly; price, nutritional variables, and smiles have random coefficients. While nutritional parameters are assumed to be affected by income, the coefficient of smiles variety is interacted with age. As for price, its coefficient is supposed to depend on both consumer income and age.

The estimates of the mean parameters of the utility function indicate that, on average, consumers' utility increases as the FFP content of fiber and calories increase, and as the content of fat decreases. McCain products were revealed as the least valued FFP. The most popular varieties, bastón and noisette, are valued very differently by the average consumer if compared with the base group (golden longs, rondelles, and croquettes): the valuation of bastón is negative, and the valuation of noisette is positive. The sign of the mean price coefficient is negative as expected. Finally, content, sodium, and smiles coefficient are statistically insignificant (though of the expected sign). As pointed out above, most of these mean parameters (except the mean price parameter) are estimated by a minimum-distance procedure. The ability of the observed characteristics to fit the coefficients of the product dummy variables is measured by using a chi-squared test provided by Chamberlain, which is presented at the bottom of Table 4. This test evaluates a restricted model that sets ξ to zero, and therefore the rejection of this model emphasizes the importance of product fixed effects to control for unobserved characteristics that affect utility.

Estimates of heterogeneity around these means are presented in the next few columns. The results suggest that the marginal valuation of the nutritional attributes is accentuated by increasing income; in other words, individuals are more sensitive to the negative effect of fat

[19] The software packages used to obtain the results in Section 6 are Stata 11.2 and MATLAB 7.0.

and sodium as are wealthier consumers, and are also more sensitive to the positive effect of fiber. These results are in line with the literature, according to which high income individuals are more concerned about health and nutrition than low income individuals. Coefficients on the interaction of price with demographics are statistically significant, and indicate that younger and lower-income consumers tend to be more price-sensitive. A more elastic demand of younger households might be associated with a low participation of FFP in their diet. Given that household average age decreases with the presence of children, and according to the literature, it could be driven by parents' concerns about their children's health, if FFP are perceived as an unhealthy food (Figure 2). This argument is reinforced by the statistical insignificance of the mean parameter of smiles and its interaction with age, since smiles is a kid-oriented variety.

[Figure 2 here]

[Table 4 here]

Finally, the effect of random shocks to tastes on price and fat coefficients is not significant, suggesting that the heterogeneity in the coefficients is mostly explained by the included demographics. On the contrary, calories, fiber, sodium, and smiles present statistically significant coefficients, implying that part of the parameter variability (all of it in the cases of calories and smiles) is captured by unobserved individual characteristics. This is especially interesting for sodium and smiles, since the average effect of these variables on utility is not statistically different from zero, but even so our results indicate there is heterogeneity in preferences for these attributes, driven by unobserved (smiles) or by both observed and unobserved (sodium) demographic characteristics.

6.2 Counterfactual introduction of a new product: a GAP-labeled FFP

In this section, the simulation results of the introduction of a GAP-labeled product in the FFP industry are presented. To perform this counterfactual exercise, we use the demand estimation, the computed GAP coefficient, and the measure of welfare detailed in Section 3.3. In Table 5 we present the effects on market shares and sales for each of the scenarios defined in Section 5. With the addition of a GAP label, bastón FarmFrites in packages of 700 gr. (ID 2120) would improve its market share and sales in both Sce1 and Sce2, although in a lesser extent in the pessimistic scenario. The market share of the remaining FFP would decrease, even for the other FarmFrites products, and mainly among other bastón FFP. However, the total sales of FarmFrites would rise.

To evaluate the importance of the introduction of the new product, we assess its influence on consumer welfare. First, we computed the compensating variation CV_i for each sampled individual in the analyzed market. Then we averaged the compensating variation across the sample and multiplied by the number of consumers to get total change in consumer surplus (equation (10)). Total number of consumers was assumed to be 600,000 (the population of Mar del Plata). Table 6 shows the monthly change in consumer welfare implied by each hypothetical scenario; both average individual surplus and welfare change for the entire population of the city are reported. In Sce1, the introduction of the GAP-labeled FFP would cause an increase in the welfare of the consumers of Mar del Plata of $17,810 a month. In Sce2, the monthly improvement in consumer surplus would only rise to $472. It can be appreciated that the welfare increase caused by the new product is lower in Sce2 than in Sce1, because of the more pessimistic assumption about consumers' valuation of the GAP attribute in FFP.

[Table 5 here]

[Table 6 here]

Note that the outside good possesses a very high market share in this industry, since every inside good has a little market share because of the scarce importance of these products in consumers' regular diet. This relates to our result that most simulated individuals keep choosing the outside good after the addition of the new product. Therefore, few consumers must be income-compensated, either because they change their choice and start consuming the GAP-labeled FFP, or because they change from the outside good to the new product. This explains the low impact of the change in available FFP on consumers' welfare. If we were analyzing a product with a higher participation in consumers' diet we certainly would find more pronounced changes in welfare.

In order to analyze the heterogeneous impact of the counterfactual simulation on consumers' welfare, Figure 3 shows the relationship between the individual compensating variation and demographic characteristics. In general, the older the individual, the greater the individual welfare change due to the hypothetical introduction of the GAP-labeled product. The relationship between CV_i and income seems to be direct too, but is less conclusive.

[Figure 3 here]

Although we perform the previous counterfactual exercise assuming that all prices remain constant after the introduction of the GAP-labeled product, it would be reasonable for FarmFrites to extract more consumer surplus by fixing a higher price for the new product. We compute how much the price of the GAP-labeled product could raise maintaining constant the initial level of welfare, assuming that the prices of the other products remain constant. In Sce1, the GAP-labeled product price would reach a value of $1.25598 per serving, while in Sce2 this maximum price is $0.99968 per serving. Considering the initial non-label price of $0.96049, these results imply that the highest price increase that could be charged to the labeled product would be $0.29549 for Sce1 and $0.03919 for Sce2, if it is not to reduce initial consumer welfare.

On the other hand, the implementation of GAP protocols raises production costs, and therefore farmers could start claiming processing companies to pay higher prices for GAP fresh potatoes than for conventional ones. To evaluate the effects of this event, we first recover the marginal costs per serving in the initial situation of the products offered in the analyzed market, using equation (8). Then we calculate the maximum increase in marginal cost of product 2120 that FarmFrites would be able to afford if farmers charge higher prices, assuming that the marginal cost of the other products remain constant. Note that a higher cost of the new product is affordable since FarmFrites could charge a higher price for it, and therefore the results will be different in both scenarios. The highest affordable marginal cost of the GAP-labeled FFP accounts for $0.95781 and $0.87740 for Sce1 and Sce2, respectively. Considering a non-GAP cost of $0.80781, the maximum increase in costs derived from the use of potatoes produced under GAP as FFP input would be $0.15 per serving in Sce1. If it were higher, it would not be profitable for the firm in this scenario to offer the new product. Analogously, the increase of costs should not exceed $0.077 per serving in Sce2. This result emphasizes the importance of both the agronomic issues and consumers' preferences for the success of any strategy that seeks to introduce a sustainable food product in the market.

7. Conclusions

This paper makes a contribution to the empirical literature of RCDCM of demand, which has been scarcely applied in Argentina, mainly regarding food industries. Besides, it contributes to the analysis of a food market which is rapidly growing in developing countries and, as a consequence, is starting to play a more relevant role in consumers' diet. The main motivation of this paper stems from the fact that the Argentinean processed potato industry is growingly demanding potato producers to implement GAP protocols. By using declared consumers' WTP for IPPM fresh potatoes, the article makes hypothetical assessments of a new attribute

that FFP would possess, i.e., the quality certification that GAP label would assure. Finally, we argue for and predict the results of a greater consumer surplus extraction, which should definitively require an appropriate signaling of the GAP attribute. The results of our work emphasize that technological adoption, agri-industry contracts, and communication issues along the supply chain are of extremely importance behind a successful introduction of a credence-attribute product in the food market.

To produce such welfare evaluations, we start by studying the heterogeneity in consumer preferences for FFP attributes, the analytical details of which are fully presented in a previous work. The RCDCM provides to add consumer heterogeneity into the utility function. The degree of substitutability among the available products is therefore assessed in a more realistic way than other discrete choice models do. Results from RCDCM estimations indicate that the attributes of the FFP actually affect consumers' utility and that this effect is conditioned by their demographic characteristics. They also suggest that high income individuals are more concerned about health and nutrition than low income individuals, and that younger and lower-income consumers tend to be more price-sensitive.

The applied RCDCM of demand allows us to evaluate the introduction of a new product with an attribute not supplied in the market before, namely the GAP label. Since the influence of this attribute on the utility function cannot be recovered with sales data, we need to use stated-willingness to pay from an auxiliary dataset to compute it. The proposed methodological strategy allows us to take advantage of the main strengths that revealed- and stated-preferences approaches possess. On the one hand, by using market data the demand model retrieves an accurate measure of price sensitivity. On the other hand, the contingent valuation method allows exploring consumers' assessment for attributes that are not available in the market. Two scenarios were formulated in order to assess the welfare changes. With the new product, consumers' welfare enhances, mainly in the more optimistic scenario.

Because of the minor importance of these products in consumers' regular diet, the outside good reaches a high valuation and therefore most consumers continue choosing it after the new product addition. The compensatory variation for those who should be offset increases with age but the correlation with income seems to be not conclusive. The maximum increase of price that could be charged for the new product if the initial welfare were not to be reduced was computed for each scenario. Finally, the maximum cost that could be afforded if this price rose to its maximum value was also calculated. This would be interpreted as the upper bound for production costs that allow the firm to offer the new product under profitable conditions.

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Tables and Figures

Figure 1. Allocation of Supermercados Toledo branches in Mar del Plata, Argentina

Source: Google Maps ©2011 at www.supertoledo.com.

Table 1. Product characteristics, market shares, and prices

ID	*Brand*	*Segment*	*Cont size (g)*	*Calories (kcal)*	*Fat (g)*	*Fiber (g)*	*Sodium (mg)*	*Avg price*	*Avg mkt sh*
1110	McCain	Bastón	720	106	0.3	4	66	0.71	0.0026
1111	McCain	Bastón	720	106	0.3	4	66	0.40	0.0008
1120	McCain	Bastón	1000	106	0.3	4	66	0.48	0.0021
1130	McCain	Bastón	1500	106	0.3	4	66	0.42	0.0007
1210	McCain	Golden Longs	1000	127	0.4	0.6	54	0.44	0.0014
1310	McCain	Noisette	500	228	0.4	1.7	336	1.45	0.0012
1320	McCain	Noisette	1000	228	0.4	1.7	336	0.99	0.0013
1410	McCain	Rondelles	1000	127	0.4	0.6	54	0.53	0.0005
1510	McCain	Smiles	600	177	0.6	1.9	383	1.04	0.0008
2110	Farm Frites	Bastón	400	91	0.1	1.7	15	1.06	0.0009
2120	Farm Frites	Bastón	700	91	0.1	1.7	15	0.65	0.0021
2130	Farm Frites	Bastón	1000	91	0.1	1.7	15	0.61	0.0019
2310	Farm Frites	Noisette	450	121	2	3	374	1.20	0.0008
2320	Farm Frites	Noisette	1000	121	2	3	374	1.04	0.0013
3110	Granja del Sol	Bastón	500	99	0.5	2.8	34	0.51	0.0021
3120	Granja del Sol	Bastón	800	99	0.5	2.8	34	0.50	0.0014
3610	Granja del Sol	Croquettes	300	174	0.9	2.4	444	1.93	0.0005
4110	RapiPap	Bastón	700	99	1.1	2.8	20	0.66	0.0030

Note: 1 g = 0.0353 oz. Nutritional information refers to a serving of the product. Prices are expressed in Argentine Pesos ($1 = U$S 3.19, on average, during the period of analysis). Products 1110 and 1111 differ in package design. The average market size of the outside good is 0.98714.
Source: Own elaboration based on scanner data and products' nutrition facts labels.

Table 2. FFP average prices by segment and income level

Segment \ Income	*High*	*Upper-middle*	*Middle*	*Lower-middle*	*Low*	*High/low surcharge*
Bastón	0.613	0.611	0.604	0.612	0.607	0.99%
Noisette	1.125	1.119	1.092	1.124	1.103	1.99%
Golden Longs	0.446	0.441	0.439	0.423	0.421	5.94%
Rondelles	0.539	0.534	0.529	0.519	0.518	4.05%
Smiles	1.069	1.059	1.033	1.028	1.021	4.70%
Croquettes	1.956	1.964	1.907	1.921	1.885	3.77%

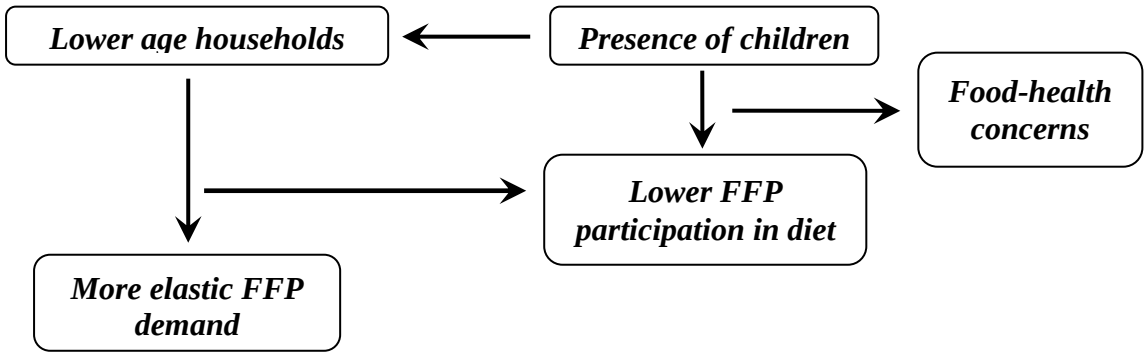
Note: Prices are expressed in Argentine Pesos.
Source: Own elaboration based on scanner data.

Table 3. FFP average prices by brand and income level

Segment \ Income	*High*	*Upper-middle*	*Middle*	*Lower-middle*	*Low*	*High/low surcharge*
McCain	0.752	0.740	0.728	0.728	0.722	4.16%
FarmFrites	0.875	0.885	0.870	0.895	0.875	0.00%
Granja del Sol	1.235	1.240	1.210	1.210	1.195	3.35%
RapiPap	0.66	0.660	0.650	0.670	0.660	0.00%

Note: Prices are expressed in Argentine Pesos.
Source: Own elaboration based on scanner data.

Figure 2. Factors affecting the relationship between household age and price sensitivity



Source: Own elaboration.

Table 4. Results from the RCDCM of demand

Variable	Mean parameters (α, β)		Interactions with demographic variables (Π)				Random shocks to tastes (Σ)	
			Income		Age			
Constant	-5.975		-		-		-	
	(3.953)							
Price	-6.677	**	0.030	**	1.500	*	2.033	
	(2.823)		(0.015)		(0.879)		(6.008)	
Content	-0.584		-		-		-	
	(0.608)							
McCain	-6.938	***	-		-		-	
	(2.483)							
Calories	5.581	***	0.006		-		1.060	***
	(1.779)		(0.009)				(0.382)	
Fat	-1.763	***	-0.183	*	-		-2.159	
	(0.509)		(0.099)				(1.974)	
Fiber	5.229	**	0.220	*	-		0.813	***
	(2.491)		(0.120)				(0.313)	
Sodium	-4.243		-0.003	**	-		-1.126	**
	(2.847)		(0.001)				(0.488)	
Bastón	-15.97	*	-		-		-	
	(9.845)							
Noisettes	0.891	*	-		-		-	
	(0.477)							
Smiles	0.715		-		0.128		2.495	**
	7.334				(0.090)		(1.257)	

R^2	0.647
GMM Objective	4.36
Minimum distance χ^2	13,369.93
% of price coefficients > 0	0.067

Note: Standard errors are given in parentheses. *** indicates significance at a 1% level, ** 5%, * 10%. The regression includes time dummy variables. The units of measurement of content, nutritional characteristics, and demographic variables were adjusted to scale these variables similarly.
Source: Own elaboration based on scanner data and demographic information.

Table 5. Changes in market shares and sales after the introduction of a GAP-labeled FFP

ID	Initial situation		Sce1		Sce2	
	Share	Sales	Share	Sales	Share	Sales
1310	0.00480	0.00766	0.00465	0.00742	0.00480	0.00766
1510	0.00133	0.00173	0.00128	0.00167	0.00131	0.00171
2120	**0.00066**	**0.00063**	**0.00097**	**0.00093**	**0.00072**	**0.00069**
2130	0.00129	0.00108	0.00115	0.00097	0.00127	0.00106
2310	0.00133	0.00192	0.00125	0.00181	0.00130	0.00188
2320	0.00127	0.00151	0.00126	0.00149	0.00126	0.00150
4110	0.00072	0.00068	0.00070	0.00066	0.00072	0.00068
3610	0.00031	0.00085	0.00030	0.00082	0.00031	0.00085
Outside good	0.98830		0.98844		0.98830	

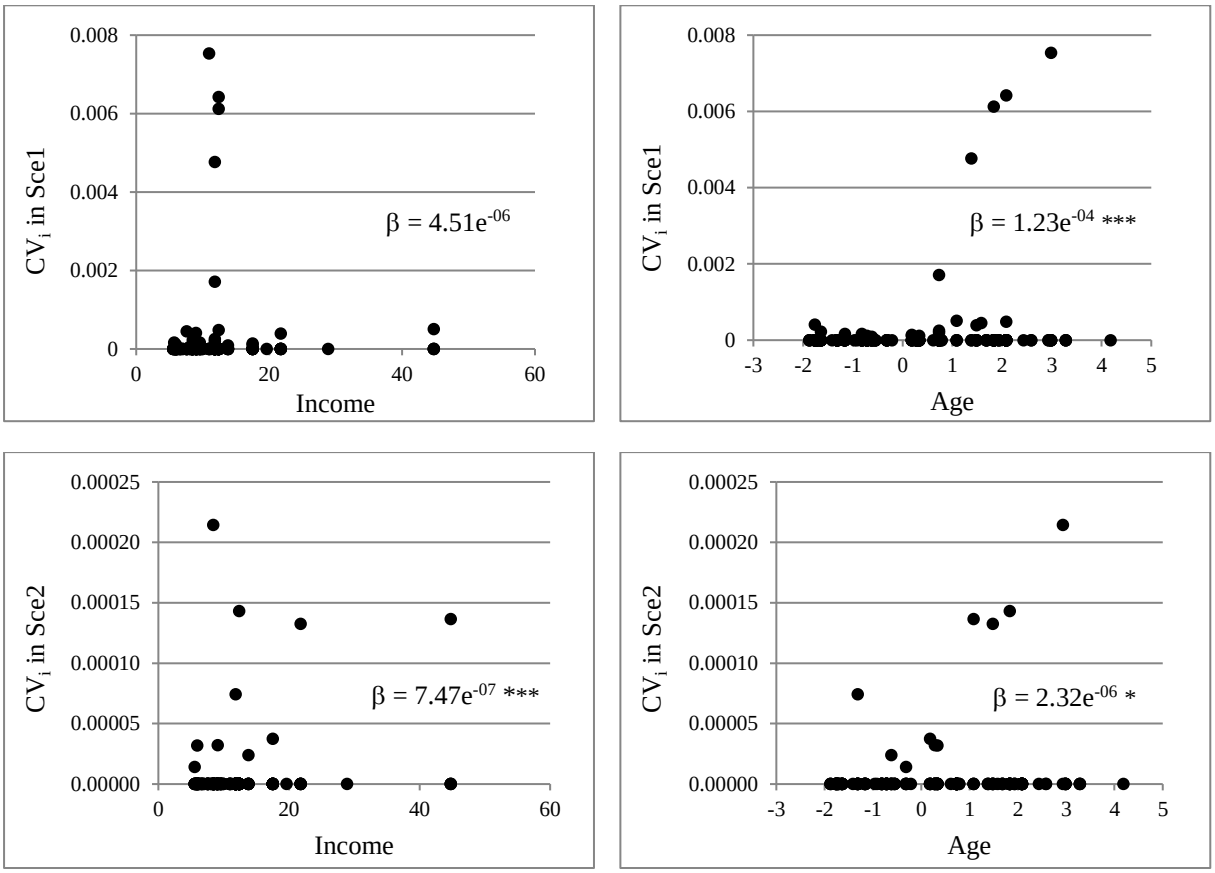
Note: Sales (expressed in Argentine Pesos) are calculated as the product of price and market share.
Source: Own elaboration based on scanner data and demographic information.

Table 6. Monthly change in consumer welfare due to the introduction of a GAP-labeled FFP

Counterfactual scenario	Average CV_i	Total CV
Sce 1: Optimistic	0.02968375	17,810.251
Sce 2:Pessimistic	0.00082131	472.784

Note: Welfare changes are expressed in Argentine Pesos.
Source: Own elaboration.

Figure 3. Welfare change and demographic variables



Note: The simple regression coefficient is reported in each graph. *** indicates significance at a 1% level, ** 5%, * 10%.
Source: Own elaboration based on estimation results.