Consumer's *WTP* for environment-friendly production methods and collective reputation for place of origin: the case of Val di Gresta's carrots.

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Abstract

In this paper we investigate consumers' preferences for various environment-friendly production systems for carrots. We use discrete-choice multi-attribute stated-preference data to explore the effect of collective reputations from growers of an Alpine valley known to for its environment-friendly production: Val di Gresta "the valley of organic orchards". Data analysis of the panel of discrete responses identifies unobserved taste heterogeneity for organic, bio-dynamic and place of origin, while observed heterogeneity for income is treated using the piece-wise linear approach (Morey et al. 2003). The implied sample distributions of individual-specific *WTP* for each of these random attributes are then compared.

Key words: Choice modelling, mixed logit, organic products, marginal utility of income, unobserved taste heterogeneity, collective reputation.

JEL classification: C15,C25,Q13,Q18

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1 Introduction

In this study we try to assess whether the most common environment-friendly production methods (EFPMs) (organic, integrated pest management (IPM) and the lesser known bio-dynamic (BD) (Steiner 1993)) are distinctly recognized and valued by buyers, and whether consumers are willing to pay for the reputation of the area of production beyond what they are willing to pay for EFPMs.[1] Because of lack of existing data from market transactions the data of the empirical study consist of responses to hypothetical questions about purchasing decisions. The product of reference are carrots and the location of production is an Alpine valley with the rare characteristic of being totally dedicated to EFPMs: Val di Gresta.[2] All the produce of this valley is strictly produced by means of EFPMs, and certified as such. Over the years producers of this valley have gained a solid reputation amongst local consumers, and a secondary aim of this study is to estimate consumers' *WTP* for such a reputation.

With the present study we contribute to the literature in at least two ways. We seem to be the first to use stated preference methods to measure *WTP* for collective reputation. On the methodological side we are also amongst the first to derive and compare sample distributions of implicit *WTP* for product traits found to be associated with preference-heterogeneity in a random utility framework employing (continuous) mixed logit panel estimators.[3]

There is a mounting body of evidence that consumers have preferences over origins of production of experience goods. For example, in the meat market these were examined by Roosen et al. (2003), Alfnes (2004), Loureiro & McCluskey (2000), for oranges, grapes and olive oil by Scarpa, Philippidis & Spalatro (2005), and again in olive oil by Scarpa & Del Giudice (2004), Van der Lans et al. (2001).[4]

On the other hand there is theoretical evidence that supports eating quality standards as a means to prevent the dilution of quality amongst groups of farmers enjoying a collective reputation (see the work by Winfree & McCluskey 2005, on Washington apples). In the last stages of a phase during which collective reputation is being built it is of interest to identify and measure the magnitude of the premium that consumers are *WTP* for such reputation. As Winfree & McCluskey (2005) argue, the number of farms sharing such a reputation increases the incentive to depart from the cooperative behavior resulting in collective high quality standards. In our empirical study in Val di Gresta the number of farmers is relatively low so, now that a reputation for quality has been attained, it might be sustained over a long time.

Our focus on specialty products from mountain areas is also of particular policy relevance, as it represents one of the rare success stories in the increasingly economically marginalized uplands. This is valuable information, given the EU intention to phase out the old subsidy system in agriculture combined with the necessity to maintain a viable economy in marginal areas.

The reminder of the paper is organized as follows. This section continues by illustrating the background and motivation to this study and reviewing the importance of EFPMs in Italy, with a particular attention on Val di Gresta. The following section describes the objectives and methods. The third section presents the survey design and the data. Estimation and results are illustrated in section 5, while section 6 concludes.

1.1 Background

In the past ten years environment-friendly production methods for lower-impact agriculture experienced a rapid development in the EU. Politicians engaged in designing policies to jointly deliver farm income security and enhanced environmental standards are interested in the potential for double-dividends, i.e. the scope to improve

[1] For studies of IPM on the production and consumption side see Cuyno et al. (2001), Govindasamy & Italia (1998) respectively.

[2] The interested reader is referred to www.val-di-gresta.it/ to learn more about this group of producers.

[3] Previous research on food choice (frozen meals) has focussed individual specific parameter estimates from random parameter logit (for example see Mojduszka et al. 2001), but not on joint distributions of individual-specific *WTP* estimates.

[4] We refer the reader to these studies for references about the theoretical basis of production of origin labeling, such as protected designation of origin (PDO), protected geographical indications (PGI), and certificate of specific character (CSC), as defined by EU legislation (EC Regulations 208192 and 208292), which provides protection of food names on a geographical or traditional basis.

environmental conditions and jointly produce foods that can command a premium in the market place, so as to make the market for such products self-sustaining.

Amongst EFPMs organic farming is the method that has been most successful in Italy, while bio-dynamic agriculture and IPM are still quite uncommon. The recent growth in organic farming in Italy is due to several causes. From the supply side the dominant cause is probably the substantial flow of subsidies used to create incentives for organic food production. From the domestic demand side there is an increasing consumer recognition and *WTP* for organic products, in the aftermath of various food scares which have afflicted Europe (Santucci & Pignataro 2002).

In 2001 Italy—which accounted for 1,240,000 hectares of organic agricultural area spread over more than 60,000 farms—was the third country in the world and the first in Europe in terms of value of organic produce. More recently the growth trend seems to be reversed, as in 2002 organic farms and organic area decreased by 7.6% and 5.6%, respectively. Such reversal is partly due to the loss of subsidies and funds brought about by the new agri-environmental measures of the EU Common Agricultural Policy.

In terms of land use destination most of the Italian rural land used for organic production is devoted to specific crops, as permanent pastures or fodder crops (54%). Furthermore, most of the organic area is concentrated in few districts (regions), located in the major islands (Sardinia and Sicily) and the South of Italy, which account for almost 58% of the total organic agricultural area.

These areas suffered the highest losses, while in the Middle-North only a mild increase was observed. Finally, the majority of organic farms (61%) are in the South and the Islands. Among organic farms there are different degrees of vertical integration. Those farms that are involved in processing tend to be concentrated in Northern Italy (slightly less than 50%) where most of the demand is also located and where such farms experienced a consistent increase (Marino 2004).

1.2 Consumer perception of quality in organic food and purchase behavior

It is estimated that only 5% of the Italian consumers regularly purchase organic food, but at least one consumer out of three occasionally purchases organic food (Torjusen et al. 2004). In 2003 the expenditure for organic food in Italy was estimated to be 1.3 billion US$, or about 1.5% of households' expenditure on food (ISMEA 2004).

But what is the perception of quality in organic food in Italy? In the last decade organic products have received greater attention by Italian consumers. There is a growing demand for food produced with environment-friendly techniques, which can be linked to increased consumer awareness about human health and environmental issues, the development of rural communities and the problem of food safety.

Since the end of the '90s, several studies have investigated households preferences for environmental friendly production, focusing on qualitative and quantitative attributes driving organic products sales in Italy (Canavari et al. 2002). Despite much empirical work the structure of household preferences is still poorly understood. At the beginning Italian consumers of organic products were mostly motivated by ecological awareness. They were simply looking for food derived from lower-impact agriculture. More recently, in addition to these environmental concerns, consumers also focus on food safety and security. According to a nation-wide survey (ISMEA 2002), the main reason for purchase seems to be linked to the absence of chemicals harmful to health; secondly organic products are perceived to be better monitored by regulating authorities; thirdly there is the 'in-any-case-they-won't-do-any-harm' attitude. Environment-related motivations were quoted only fourth, this ranking being shared with other European consumers (Zanoli et al. 2001). At present it would appear that health motivations are the leading ones for both regular and occasional organic consumers. The latter nevertheless are more concerned with personal satisfaction derived from organic food consumption, while regular consumers seem to show more altruistic values, associated to children's welfare and the environment (Zanoli & Naspetti 2002).

Official statistics on consumers' expenditure show that this is distributed over almost all categories of products. Amongst them, dairy products account for 25%, fruits and vegetables and bred and biscuits both 14%, beverage

10% and eggs 6%. Not surprisingly, organic meat is still almost absent, because this sub-sector still needs to be properly organized. Although all sectors showed a very strong growth in the past years (+80% in 2001-2000), as mentioned above, 2003 signed a trend reversal, with a substantial standstill (ISMEA 2004).

According to a recent study (ISMEA 2002), organic consumers in Italy can be divided into five groups: 'historical', 'supermarket', 'occasional', 'taster' and 'I wish, but I can't' consumers. The first group accounts for 30% of the Italian organic consumers, but generates 60% of total expenditure. The 'supermarket' consumers are as numerous as the previous group but account for a lower share of expenditures (30%) and mostly live in Northern Italy. They represent a very interesting segment in terms of marketing strategy since their supermarkets purchases are usually impulse-driven. 'I wish I could' is an emerging segment, with a very limited economic weight (6%) but much promising. They are mostly young people living in the Center and South of Italy. Finally, the 'taster' segment is a very small one (1%) with medium-high income, very low information about organic, who buy organic food only very occasionally.

On the demand side price remains a crucial factor as the retail price difference between conventional and organic is still quite high (Zanoli & Naspetti 2002). Heterogenous reliability of supply is still an obstacle to consumption growth through the large distribution channels. Finally, the need for ancillary information—about place of origin, methods of production and modes of monitoring—are other important issues for the development demand (Zanoli & Marino 2002).

2 Collective reputation of Val di Gresta's growers

Val di Gresta is a valley located in the mountains of the Trentino region, in the North East of Italy. It is located between 400 to 1,300 meters on sea level. Because of its proximity to the Garda Lake—the largest Italian lake—the valley enjoys a warm micro-climate, particularly suitable for growing vegetables. The hill slopes are terraced and tend to have South-West aspect, therefore receiving a long daily exposure to solar radiation.

Vegetables—mainly cabbages and potatoes—have been grown in the valley since the beginning of the last century. Carrots cultivation was introduced during the '40s, while at the beginning of the '70s several other kinds of vegetables were introduced. Actually, more than 20 types of vegetables are currently grown in the valley. The particular vocation of the area to vegetables cultivation is due to the good differentiation of soils along the valley. Agricultural products of Val di Gresta have a reputation that goes beyond the local markets in the Trentino Region, as 80% of the products are marketed out of this Region. The area of the valley destined to vegetables exceeds 100 hectares, which is quite surprising when considering that it is achieved in terraced plots and each terrace never exceeds 1,000 squared meters.

The Val di Gresta Fruit and Vegetable Producers' Association is a farmers' cooperative founded in 1969, on the basis of an pre-existent association founded in the '40s. This farmers' cooperative is the largest in the area and it supplies an average of 2-2.2 thousands of metric tons of fruits and vegetables per year. It has a special logo, which is a ladybird. Further produce include cucumber, onion, bean, salad, apple, and kiwi. Of the total environment-friendly products 70% are obtained with organic methods, while the remaining fraction with IPM and bio-dynamic methods.

Carrots represent one of the most important products of the Val di Gresta and are produced either by organic farming or by IPM. This vegetable is available from July till March and the production in 2003 was of 25 metric tons for organic carrots, and of 5.5 for IPM. With such a small production it is difficult to measure consumers' recognition of collective reputation for the Val di Gresta origin starting from market transactions. Furthermore, while the bio-dynamic methods could be used for carrots as they are for other products in the valley, at the moment it is used very little. To obviate to the lack of revealed preference data we developed a stated preference study.

3 Objectives

Apart from the main question of consumers' rewards to producers' collective reputation, our objective is to explore whether less common forms of environment-friendly production methods (bio-dynamic and IP methods) are distinctly recognized by consumers and may command price differential amongst consumers.

Furthermore, given that one of the most frequently lamented traits of environment-friendly carrots is the presence of skin imperfections, we also investigate the *WTP* for this attribute. Because the attributes related to production methods are obviously not limited to carrots from Val di Gresta origin we are specifically interested in interaction effects between each EFPM *and* Val di Gresta origin. Such effects, if present, will constitute our measure of the acquired reputation for these methods by the farmers of the valley. In particular, while there is a well established certification process for organic and IPM produce for Val di Gresta products, the certification process for bio-dynamic produce is only very recent (2003) and does not have a clearly established reputation. The short history for this attribute makes it difficult to use revealed preference data to determine such an effect, hence our reliance on data from a stated preference survey.

Attribute	*Alternative* A	*Alternative* B	*Buy neither*
Production method	Organic	Conventional	
Origin Val di Gresta	Yes	No	
Skin imperfection	more than 10% of the skin	absent	
Packaged	Yes	loose product	
Price in Euro	1.30	2.22	

Table 1: Example of choice task in choice experiment.

3.1 Survey and data

The survey instrument was calibrated via focus groups and a pilot study in early summer 2004, while the final survey data were collected with a face-to-face interviews during the summer and autumn 2004. Respondents were randomly selected from buyers of carrots[5] at supermarkets and grocery shops in the region of Trentino Alto Adige (North-East of Italy).

Eventually a total of 240 completed surveys were collected. The complete experimental design—a main effects plus 2-way interactions D-optimal fractional factorial derived from Design Expert v. 6—consisted of 41 profiles which were divided in three separate blocks with D-optimal properties. Respondents performed either 8 (blocks 1 and 2) or 9 (block 2) choice tasks. Each choice task included a no-purchase option and two experimentally-designed purchase alternatives (product profiles). The product attributes were 5 and included certification of production method (bio-dynamic, integrated pest management and organic), certification of origin (Val di Gresta, elsewhere), skin imperfections (absent, less than 10% of the skin, more than 10% of the skin), packaging (pre-packaged or loose) and finally, retail price per kg in Euros (1.3, 1.5 and 2.2). An example of choice task is reported in table 1.

In the second section of the questionnaire, we collected socio-economic data and asked some information about the respondent's attitude towards organic product consumption. Looking at the sample characteristics, the average age of the respondents is 50 years old. 66% of the interviewed are females and the 34% are males. 19.5% of the sample has a university degree, which is definitely a large fraction for Italian standards. The average family size is of 2.8 members and 40% of the respondents have children aged under 12. 88% of respondents were usually in charge of grocery shopping.

[5] Carrots could be either from Val di Gresta or not and either organically grown or not.

4 Method

Previous work on the analysis of preferences on the place of origin of food that employed choice modelling emphasized the importance of *unobserved* heterogeneity. For example, Scarpa, Philippidis & Spalatro (2005) show that—in the case of table grapes and olive oil—even when all the the socio-economic co-variates are employed to account for observed heterogeneity a statistical significant component of unobserved heterogeneity remains.

However, the heterogeneity effects linked to the purchase option relative to the no-purchase option was not investigated in that study because the choice-set did not include a no-buy option. The exclusion of a no-buy option effectively forces respondents to choose amongst experimentally designed alternatives of purchase. The negative implications of 'forced-choice' are investigated in Dhar & Simonson (2003). Their main results suggest that 'survey instruments that include the no-choice response are likely to produce more accurate predictions' and that 'including the no-choice option is likely to have greater impact for new or infrequently purchased products'. Since organic carrots from Val di Gresta are likely to be bought infrequently by the single buyer because they are only available on season and in small quantities, in the present study we included the no-purchase option in the choice-set. As a consequence we face the issue of addressing conventional forms of heterogeneity *as well as* that induced by the presence of a no-purchase option.

Of particular interest is heterogeneity of the parameter for marginal income. Many studies assume this to be fixed, thereby avoiding the complication of having a random parameter at the denominator of a ratio when computing marginal *WTP* measures. A fixed marginal utility of money, however, goes against economic intuition as the same money unit can have different values in households with different income constraints. Similarly, allowing marginal utility of income to be random does not address the systematic effect of income constraints. For this reason we follow the approach proposed by Morey et al. (2003) and use a piece-wise linear formulation for this parameter in the random utility specification.

4.1 The basic RUM model with random taste and error components

Denote the individual by n and the choice-occasion by t. Then, in our estimation the basic specification for the choice probability is that of conditional logit. That is, conditional on the individual-specific random tastes β_{nt} and error-components ε_{nt}, the probability of selection by respondent n of a specific alternative i in choice t of the sequence $\langle t = 1, \ldots, T \rangle$ from the choice-set containing the generic alternative j is logit:

$$\Pr(int|\beta_n, \varepsilon_n) = \frac{e^{x_{int}\beta_n + \varepsilon_n}}{\sum_{j=1}^{j=3} e^{x_{jnt}\beta_n + \varepsilon_n}}, \tag{1}$$

Where x_{int} and β_{nt} are respectively, a conformable vector of variables explaining choice and of parameters to estimate, while ε_{nt} is an error component associated with each of the experimentally designed alternatives involving purchase in each choice set. This is an additional error component to the conventional Gumbel distributed error of the multinomial logit model. It is meant to capture additional variance associated with the cognitive effort of evaluating an hypothetical purchase. The $k = 1, \ldots, K$ elements of the β-vector that are random are collected in the sub-vector denoted as $\tilde{\beta}$ (subscripts omitted to reduce clattering).

Assuming independence across the t choices by the same individual n, the joint probability of a sequence of choices is:

$$\Pr(n|\beta_n, \varepsilon_n) = \prod_{t=1}^{t=T} \frac{e^{x_{int}\beta_n + \varepsilon_n}}{\sum_{j=1}^{j=3} e^{x_{jnt}\beta_n + \varepsilon_n}}, \tag{2}$$

Randomness of taste-intensities is represented by the choice of one appropriate distribution $g(\cdot)$ for each element of $\tilde{\beta}^k$. Each $g^k(\cdot)$ is completely defined by the combination of location (μ^k) and scale (σ^k) parameters.[6]

[6] We intentionally borrow the notation of the normal distribution, although $g^k(\cdot)$ need not be normal.

The marginal probability of choice is derived by integrating expression 1 over the appropriate distribution functions for the K random parameters:

$$\Pr(n, \beta_n | \varepsilon_n) = \int_{-\infty_{k=1}}^{\infty} \ldots \int_{-\infty_{k=K}}^{\infty} \Pr(n|\beta_n, \varepsilon_n) g^1(\tilde{\beta}^1|\cdot) \ldots g^K(\tilde{\beta}^K|\cdot) d\tilde{\beta}^1 \ldots d\tilde{\beta}^K \tag{3}$$

The additional alternative-specific error-component ε_n is assumed to be (normally distributed) white noise and therefore is centered on zero, but with a variance σ^2.[7] So, one can write $\varepsilon_n \sim \mathcal{N}(0, \sigma^2(c))$ or just $\varepsilon_n \sim \phi(\sigma^2(c))$.

The marginal probability of choice is therefore obtained by integrating equation 3 over the error-component space:

$$\Pr(n, \beta_n, \varepsilon_n) = \int_{-\infty}^{\infty} \Pr(n, \beta_n | \varepsilon_n) \phi(\sigma^2(c)) d\varepsilon_n \tag{4}$$

while the sample log-likelihood $\mathcal{L}$ is given by the sum across respondents of the log of the probability of sequences:

$$\mathcal{L} = \sum_{n=1}^{N} \ln \Pr(n) = \sum_{n=1}^{N} \ln [\Pr(n, \beta_n, \varepsilon_n)]. \tag{5}$$

Because equations 3 and 4 have no closed-form in estimation they are simulated (Train 2003) by averaging the log-likelihood computed at a sufficiently high number of draws with good equidispersion properties.[8] Notice that both β_n and ε_n are indexed by n these can change only across individuals (panel estimation). If they were indexed by nt they would change across *both* choices and individuals (cross-section estimation). In this study we adopt the panel approach so as to model permanence of preferences and error (additional variance from the no-buy option) across choices by the same respondent.

To characterize more meaningfully the economic implications of taste variation for an attribute we focus on marginal *WTP* for attributes. With linear indirect utility marginal *WTP* can be shown to be equal to $WTP = -\beta/\beta^{\$}$, where the denominator is the marginal utility of income, i.e. the price coefficient in a linear utility specification. For non random parameters this is just derived by using the invariance property of the maximum likelihood estimator:

$$\widehat{E}[WTP_n] = \frac{-\hat{\beta}}{\hat{\beta}^{\$}} \tag{6}$$

For random parameters the individual-specific mean *WTP*—denoted as $\widehat{\widehat{E}}[WTP_n]$—can be estimated from knowledge of the T choices made by each respondent in the panel (Train 2003, Scarpa, Willis & Acutt 2005). To compute such conditional value distributions we adopt the approach shown in Greene et al. (2005) using a simulated estimate as follows:

$$\widehat{\widehat{E}}[WTP_n] = \frac{1/R \sum_{r=1}^{R} WTP_n(\hat{\beta}_{nr}) L(\hat{\beta}_{nr}|data_n)}{1/R \sum_{r=1}^{R} L(\hat{\beta}_{nr}|data_n)}, \tag{7}$$

where r denotes the simulation draws $1, 2, \ldots, R$, and $L(\cdot)$ denotes the likelihood evaluated at the r draw.

[7] Choice-complexity is normally tackled by parameterizing the distributional features of the the Gumbel-distributed error-term, such as the scale parameter (e.g. Swait & Adamowicz (2001) and DeShazo & Fermo (2002)) or directly its variance (e.g. Scarpa et al. (2003)). Both approaches end-up with log-likelihood functions that are not globally concave on the parameter space, while this approach based on error-components implies a globally concave—and hence easier to maximize—simulated log-likelihood.

[8] We employed 350 Halton draws (Train 1999)

According to their proponents, such estimates seem to overcome the problem of behaviorally unrealistic ranges which are often encountered when using the more commonly employed estimator based on population moments:

$$\widehat{\widehat{E}}[WTP_n] = \frac{1}{R}\sum_{r=1}^{R}\frac{-\hat{\beta}_{nr}}{\hat{\beta}^{\$}_{nr}} = \frac{1}{R}\sum_{r=1}^{R}\widehat{WTP}_{nr}. \quad (8)$$

This latter estimator sometimes is found to produce behaviorally implausible estimates, especially when the assumed distributions of the taste parameter allow for 'fat-tails', such as when using the log-normal, which can be used to 'bound' the negative of price to the positive orthant. Or when values proximate to zero are drawn and used in the denominator of the ratio. In this event the ratio 'explodes', implying extremely high consumer surplus estimates.[9]

In the remainder of this section we explain how we tackle each of the important modelling decisions involved in the specification testing of complex mixed logit models with continuous mixtures. The decisions we focus on are the selection of variables with heterogeneity, the choice of mixing distributions, and the error component variables.

4.2 Taste heterogeneity

The decision of what product attributes to allow to be random is based on the model performance on the available data. We tested a series of models allowing each taste parameter to be variable according to a chosen distribution, except for marginal utility of income, which we specify either as a constant, or as a piece-wise linear spline, as proposed by Morey et al. (2003). Differently from the latter though, we assume that, apart from high income, other latent variables representing constraints on income (such as the number of kids in the household) are additional determinants of heterogeneity in marginal utility of income γ. For example, a general utility specification incorporating this form of heterogeneity, as well as random parameter for other attributes $\tilde{\beta}_{hn}$ and one error component ε_n is:

$$U_{nti} = \sum_{g=1}^{G} x_g\beta_g + \gamma + 1(\text{high inc})\gamma^h + 1(\text{2kids})\gamma^{2k} + 1(\text{3kids})\gamma^{3k} \quad (9)$$

$$+ \sum_{h=1}^{H} x_h\tilde{\beta}_{hn} + 1(\text{buy})\varepsilon_n + u_{nti}, \quad (10)$$

where $1(\cdot)$ is a binary indicator function.

In practice, the formal testing for a candidate parameter to be deemed 'random' is complicated by the fact that the restriction implies the scale parameter for the distribution to be a degenerate with scale = 0 (i.e. for fixed parameters all mass is on one value). Because zero is at the boundary of the range of values admitted for the scale parameter, rather than within its interval, the asymptotic distribution of the test statistic under the null is unknown. So, whenever the null involves such a restriction a likelihood ratio test will not be adequate and other selection criteria need to be invoked. When this is the case we used the Bayesian information criteria and the Akaike information criteria. If the model with variability is superior to the restricted model according to these criteria, then that attribute may be deemed variable in nature.

The choice of parametric distribution for the attributes displaying taste variation is possibly the most delicate one. The pros and cons of various tractable distributions have been discussed at length in the literature in this field (see for example Train 2003, Greene et al. 2005, Train & Sonnier 2005, Train & Weeks 2005, for some in-depth discussion of this problem and some suggestion for remedies). Here the random taste parameters for attributes are all assumed to be normal, and hence are unconstrained in terms of axis.

[9] Amongst the various alternative approaches put forward to mitigate such effect we mention the work by Train & Sonnier (2005) based on bounded transformations of normal variates, and by Train & Weeks (2005), who discuss the implications of modelling heterogeneity directly in *WTP* space.

4.3 Error component for purchase decisions

The presence of a no-buy option is known to modify the substitution patterns within the alternatives of even relatively simple choice situations, thereby undermining the logit assumption of independence of irrelevant alternatives. The simple inclusion of an alternative-specific constant (ASC) for the no-price option cannot account for such a violation. Previous attempts to address this issue used either the nested logit model (Haaijer et al. 2001). Some more recent Monte Carlo results (Scarpa, Ferrini & Willis 2005) suggest that error-component models—which may be formulated to account for similar correlation patterns across utilities as the nested logit—show higher robustness to mis-specification. We hence build on this result and we test for the presence of error components associated with the two alternatives involving purchase in each choice-set.

The resulting model in equation 9 includes a zero-mean normal error, which is additional to the Gumbel error, associated only with the utility of alternatives that portray a purchase decision (a non status-quo decision).[10] This joint error induces correlation patterns (Brownstone & Train 1999) amongst the utilities of purchase.

4.4 Hypotheses

The hypotheses to be tested concern the following:

1. relevance of environment-friendly production methods (EFPMs) in consumers' choice, and their interactions with place of origin (Val di Gresta);
2. the presence of unobserved heterogeneity or randomness in taste parameters (identification of $\tilde{\beta}_h$);
3. the presence of extra variance in alternatives involving purchase (significance of σ_ε);
4. the presence of piece/wise linear effect of latent variables on marginal utility of income (various γ coefficients).

Starting from a general model, each set of hypotheses has an associated restriction:

1. a given environment-friendly production method or its interaction with being produced in Val di Gresta is deemed as relevant in consumer's choice if its $\hat{\beta}$ is statistically different from zero;
2. a given taste parameter is deemed as affected by unobserved heterogeneity or defined as random if its estimated scale parameter $\hat{\sigma}$ is statistically different from zero. This may or may not happen in conjunction with a corresponding location parameter estimate statistically different from zero;
3. additional variance in the utility of alternatives implying purchasing decisions is revealed by a significant scale parameter estimate $\hat{\sigma}_\varepsilon$ for the distribution of a zero mean error ;
4. finally, piece wise linearity of marginal utility of income is implied by significance in the estimated parameters for the interaction variables between cost and indicator functions for income effects.

[10] Some respondents in choice modelling always choose the so-called no-choice or status-quo option when this is present. In our case this takes the form of a not buying any of the two alternatives describing purchase. The refusal to engage in the preference-revelation mechanism may conceal some protest behavior, and on these basis some researchers select them out of the sample used for estimation. However, of course, estimates of structural parameters of RU models can be very sensitive to this practice as reported by Burton et al. (2001). We believe that one should allow for these options, but account for the fact that there is an asymmetry between alternatives describing purchase and those describing no-purchase. Such asymmetry in our model is accounted by extra variance.

		Model 1	*Model* 2	*Model* 3	*Model* 4	*Model* 5
Fixed parameters						
Cost		–0.16 (3.0)	–0.35 (5.7)	–0.36 (4.9)	–0.54 (6.0)	–0.80 (4.0)
Cost × high income						0.43 (2.0)
Cost × 1-2 kids						–0.29 (1.7)
Cost × 3 or more kids						–1.16 (1.8)
Bio-dynamic		0.80 (5.9)	1.30 (6.8)			
Organic		0.96(12.8)	1.90(11.1)			
Val Gresta		0.81(14.3)	1.87(10.7)			
Integr. pest mgmt.		0.99 (7.9)	1.34 (7.7)	1.39 (7.6)	1.43 (5.4)	1.47 (5.5)
Many skin imperf.		–0.38 (5.3)	–0.40 (5.7)	–0.63 (6.5)	–0.64 (6.5)	–0.64 (6.5)
Few skin imperf.		0.58 (4.0)	0.46 (3.1)	0.48 (3.0)	0.69 (3.3)	0.70 (3.4)
Org. × Val Gresta			–1.88 (6.0)	–1.64 (4.8)	–2.09 (4.6)	–2.12 (4.7)
Biodyn. × Val Gresta			–1.28 (4.6)	–1.08 (3.1)	–1.24 (2.9)	–1.23 (2.9)
Integr. × Val Gresta			–1.09 (4.0)	–0.90 (3.0)	–1.08 (2.7)	–1.13 (2.8)
Random parameters						
Biodynamic	$\hat{\bar{\beta}}$			1.18 (4.7)	1.31 (4.2)	1.31 (4.2)
Biodynamic	$\hat{\sigma}$			1.50 (7.5)	1.27 (6.4)	1.28 (6.4)
Organic	$\hat{\bar{\beta}}$			2.02 (9.9)	2.23 (8.7)	2.25 (8.8)
Organic	$\hat{\sigma}$			1.02 (7.0)	1.10 (6.9)	1.12 (7.0)
Val Gresta	$\hat{\bar{\beta}}$			1.95 (9.1)	2.18 (8.4)	2.21 (8.5)
Val Gresta	$\hat{\sigma}$			1.28(10.9)	1.08 (9.0)	1.06 (8.8)
Error components						
ASC buy	$\hat{\sigma}_{\varepsilon}$				2.60 (8.8)	2.57 (8.8)
Pseudo-R^2		0.06	0.07	0.23	0.27	0.27
$\mathcal{L}$		–1,770	–1,747	–1,635	–1,551	–1,545
Bayes IC		3,593	3,570	3,382	3,223	3,238
Akaike IC		3,554	3,514	3,295	3,130	3,224
Observed choices = 1,949				Respondents = 240		

Table 2: Estimates for the models. In brackets absolute values of t-statistics.

4.5 Model evaluation and hypotheses testing

Selected estimation results are reported in Table 2. We proceed using a bottom-up approach. We start from a basic fixed parameter conditional logit specification (Model 1 in Table 2). In Model 2 we allow for interactions between EFPMs and origin from Val di Gresta. Such an addition significantly improves the fit of the model, with a likelihood ratio test showing a p-value of <0.001.

Model 3 is the result of a specification search over possible random parameters. The taste parameters for two out of three EFPMs are assumed to be random and normally distributed.[11] Such an assumption cannot be evaluated using a likelihood ratio test, but the BIC and AIC suggest this specification to be superior to Models 1 and 2 based on fixed parameters. Model 4 is the same as Model 3, except that it introduces a random error component associated with all utilities for alternatives involving purchase. Again the BIC and AIC suggest this to be an improvement on previous specifications.

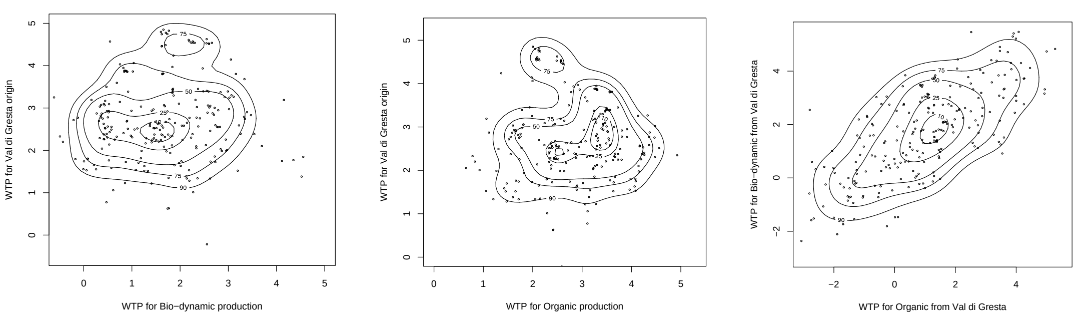
[11] Tests for randomness of IPM rejected the null.

Finally, Model 5 allows for piece-wise linear marginal utility of income. This is a direct extension of Model 4 and as such it can be tested by using likelihood ratio tests for joint restrictions on the additional γ parameters for affecting marginal utility of income. Restrictions to zero on the effects of high income, having 1 or 2 children, and having more than 3 or more children show a p-value of <0.0103. Hence the null is rejected for any confidence level higher than this very low value.

5 Results

Model 5 emerges as the specification most supported by our data. All hypotheses fail to be rejected at very low probabilities of type I errors. We conclude that there is evidence of taste variation for bio-dynamic, organic and place of origin, while the utilities of purchase alternatives are correlated, and marginal utility of income varies across respondents responding to latent constraints, such as the number of kids, and to income size.

Figure 1: Bivariate kernel plots of conditional *WTP* estimates from model 5.



(a) Certified bio-dynamic production *vs.* Val di Gresta origin.

(b) Certified organic production *vs.* Val di Gresta origin.

(c) Certified organic from Val di Gresta *vs.* certified bio-dynamic from Val di Gresta.

To explore the consequences of such results on the distribution of respondent-specific conditional *WTP* estimates for the sample we report in Figure 1 the bivariate kernel plots of the distributions of marginal $\widehat{WTP}_i$ for the two modes of production and plot them against Val di Gresta origin (Figure 1.a and 1.b). In both plots it is evident how a cluster of respondents groups around high implied *WTP* values for the attribute Val di Gresta. This supports and illustrates the notion of a well-established reputation for the farmers of this area amongst consumers for these two EFPMs.

Figure 1.c reports the scatter plot of individual-specific marginal *WTP* values for the interaction effects between certified Val di Gresta *and* organic, versus that of certified Val di Gresta *and* bio-dynamic. These appear to be very correlated in the sample, as one would expect given the high substitutability between these goods.

The marginal effects of EFPMs from Val di Gresta—broken down by income constraints—are summarized in Table 3. Such values illustrate the advantage of accounting for a systematic heterogeneity in marginal utility of income, rather than assuming this parameter to be randomly distributed according to some unconditional parametric distribution. Estimated values are plausible and show how *WTP* is lowest for respondents with many children and low income. The relative magnitudes of the *WTP* estimates seem to suggest that IPM is probably better received by consumers of Val di Gresta products than bio-dynamic methods. Nevertheless, the degree of uncertainty of the estimates is such that no clear-cut indication seem to emerge.

The interaction effects that became estimable by using an experimental design with 2-ways effects showed significance and suggest that there is a distinct premium for all 3 EFPMs when they are associated with Val di Gresta origin. This is a clear indication of the collective reputation of this group of producers, and a measure of their success in pursuing a high quality standard in production.

Attribute	*Organic×Gresta*	*Bio-Dyn.×Gresta*	*IPM ×Gresta*
Low income and no kids	2.01	1.95	3.20
	(3.1)	(2.6)	(3.8)
High income and no kids	4.36	4.22	6.93
	(2.9)	(2.5)	(3.4)
High income and 1 or 2 kids	2.44	2.36	3.88
	(3.3)	(2.7)	(4.1)
High income and 3 or more kids	0.89	0.86	1.41
	(2.5)	(2.1)	(2.7)
Low income and 1 or 2 kids	1.48	1.43	2.35
	(3.3)	(2.7)	(4.0)
Low income and 3 or more kids	0.72	0.69	1.14
	(2.8)	(2.3)	(3.2)

Table 3: Estimates of marginal $\widehat{WTP}$ for interaction variables between EFPMs and Val di Gresta origin broken down by income category. In brackets approximate absolute values of t-statistics obtained with the delta method.

6 Conclusions

We developed a choice-experiment to investigate consumers' preferences over environment-friendly production methods (EFPMs) in carrots produced in a distinctive Alpine valley (Val di Gresta) where producers have been investing in building a collective reputation for the last three decades.

To address unobserved taste heterogeneity we investigate the consequences of different specifications of mixed logit and to account for differences in marginal utility of income we used a piece-wise linear specification.

The presence of a reputation effect is supported by both, the distribution of individual-specific *WTP* estimates, and by the significance of interaction effects between EFPMs and Val di Gresta origin.

Integrated pest management practices as well as the better established organic method of production seem to be the most promising avenues for producers of this valley, while bio-dynamic approaches appear to be less valued by consumers.

Investment on collective reputation is an avenue through which producers located in marginal areas can secure customer loyalty and increase their revenues, thereby decreasing reliance on external subsidies.

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