PAPER

NEOPHOBIA IN FOOD CONSUMPTION: AN EMPIRICAL APPLICATION OF THE FTNS SCALE IN SOUTHERN ITALY

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ABSTRACT

Through the Food Technology Neophobia Scale (FTNS) proposed by Cox and Evans (2008) this work investigates the role of consumer attitudes to food technology in determining the probability of purchasing innovative products by using a set of commonly purchased food.

Six food categories with different processing levels were analyzed. Consumer choices were empirically modeled through a simultaneous system of three equations. The results confirm the strength of the FTNS scale, reflecting the dichotomy between neophobia and neophilia attitudes even in southern Italy, characterized by a very different socio-cultural context from that analyzed by Cox and Evans. The model highlights the role of both consumer attitudes to technology and socio-demographic characteristics in determining the probability of buying innovative products, providing some initial elements to define ideal customer profiles for the products considered.

- Keywords: food technology, consumer attitude, neophobia, psychometric scale -

INTRODUCTION

Diet is the most intimate form of consumption: according to anthropologists, eating means incorporating, taking food inside oneself, within the confines of one's own body (FISCHLER, 1990). For this reason, diet and food are also characterized by a simultaneous connotation of demand for novelty (neophilia) and by a great caution, at times aversion, concerning the new, the unknown (neophobia). Roughly speaking, it could be said that food choice is a seemingly simple, but in fact very complicated, behaviour, influenced by many interacting factors (KOSTER, 2009).

Consistent with this approach, modern food consumption seems to follow two different and contrasting patterns: while there is a growing demand for modernity (functional foods, convenience foods, healthy foods, such as low calories and low-sodium foods), on the other hand consumers are increasingly demanding for naturalness (organic foods, natural foods, local products and typical products) (GOLDSMITH and HOFACKER, 1991; ROZIN *et al.*, 2004; ROZIN, 2005; ROLLIN *et al.*, 2011; O'BRIEN, 2012).

In recent years, consumers' fears of modern food technologies have been well documented and several studies have analyzed consumer acceptance of new technologies, pointing out that consumers show high levels of concern toward novel food (TOURILA *et al.*, 2001; MATIN *et al.*, 2012; BONANNOXS, 2012; BARRENA and SÁNCHEZ, 2013), genetic modification (HU *et al.*, 2004, 2006; LARUE *et al.*, 2004) and more generally toward foods that have undergone a considerable degree of industrial processing (ROZIN *et al.*, 2004; ROZIN, 2005; ROZIN, 2006). Also factors that can influence consumer acceptance have been analyzed, focusing on the risk-benefit perception, socio-demographic and economic factors, the role and source of information and finally public trust (MACFIE and MEISELMAN, 1996; SIEGRIST, 2000; SIEGRIST *et al.*, 2005; VISSCHERS *et al.*, 2007; COSTA-FONT *et al.*, 2008; ROLLIN *et al.*, 2011; FREWER *et al.*, 2011; CHOE and CHO, 2011; COX *et al.*, 2012; UELAND *et al.*, 2012). At the same time, different psychometric scales were set and tested to analyze consumer attitudes towards modern and new technology (GOLDSMITH and HOFACKER, 1991; STEENKAMP and BAUMGARTNER, 1995; SPARKS and SHEPHERD, 1994; EISER *et al.*, 2002; KIRK *et al.*, 2002; COX *et al.*, 2007; COX and EVANS, 2008). These scales can be particularly useful in identifying population segments that have greater or lesser neophobia-neophilia attitudes, thus enabling identification of early adopters of innovative products (COX and EVANS, 2008; EVANS *et al.*, 2010b).

Psychometric techniques involve several sets of statements, usually formulated through the use of qualitative methods, such as focus groups and in-depth interviews. The statements are submitted to the sample of respondents called to express their degree of agreement-disagreement using Likert scales. This process generates a large amount of information and can be synthesized in correlation and covariance matrices. Consumers' preferences, analyzed by means of factor analysis, multidimensional scaling, cluster analysis, path analysis and structural equations, provide the main outcome of the psychometric analysis (WEBER *et al.*, 2002; SIEGRITS *et al.*, 2008).Thus the adoption of psychometric scales may provide accurate analysis of the consumer preferences structure (BEKER, 1976; LUSK and BRIGGEMAN, 2009).

At least two psychometric applications concerning consumer food preferences are of great relevance today: first the perception of risk and how it affects the markets in the event of a hazard; secondly, the acceptance of novel food technologies.

This paper, following the second line of research, investigates the relationship between the acceptance of modern technology and consumption choices.

The latest proposed scale for the assessment of the neophobia-neophilia dichotomy is the Food Technology Neophobia Scale (COX and EVANS, 2008; EVANS *et al.*, 2010b). The FTNS is presumed to be a better instrument for predicting consumers' willingness to try novel food technologies than an earlier food neophobia scale (FNS) (PLINER and HOBDEN, 1992) because of its specific focus on technology rather than food (MATIN *et al.*, 2012).

It has been mainly applied on specific food technologies or on food specifically related to new and sophisticated technological processes (COX and EVANS, 2008; EVANS *et al.*, 2010a). However it seems worth adopting the Cox scale using, first of all, a set of food products instead of food technologies and, secondly, taking into account a set of commonly used products that can be easily ranked by consumers on higher/lower perceived technology content.

This paper wants to contribute to the debate using a psychometric scale, in particular the Food Technology Neophobia Scale (FTNS), to analyze the relationship between attitude toward food technologies, intention and behavior. According to well-known psychological theories (e.g. theory of reasoned action, planned behavior theory), the most important antecedent of people's behaviour is the intention to act in a certain way, which, in turn, is predicted by their attitude towards the target of that behavior (FISHBEIN and AJZEN, 1975; AJZEN, 1991). Attitudes are defined as people's cognitive and affective orientations towards relevant social targets and can be measured directly (explicitly) or indirectly (implicitly).

The paper explores the neophobia-neophilia dichotomy by carrying out an empirical analy-

sis on a sample of 355 people interviewed shortly after their shopping trip to super- and hypermarkets in Campania, a region in southern Italy. A questionnaire was used to obtain responses to the FTNS statements and to collect information about the perception of six food categories with different processing degrees, the perception of naturalness and its role in determining consumer preferences for each food category.

To assess how neophobia-neophilia attitudes affect purchasing intentions, a Principal Component Analysis (PCA) was carried out on the FTNS statements followed by an econometric model. The econometric model was focused on three food categories, i.e. those with the highest degree of food processing, namely functional foods, low-calorie foods, and convenience (ready-to-eat) foods. The willingness to purchase them was related to factors synthesizing consumers' attitudes toward modern technologies (EISER *et al.*, 2002; BÄCKSTRÖM *et al.*, 2004; BRUNEL and PICHON, 2004; HWANG *et al.*, 2005; CRANFIELD *et al.*, 2012).

The article is organized as follows. After a brief review of psychometric scales (section 2), data analysis and the main research findings of the research are presented in section 3. Finally, in section 4 some conclusions are drawn.

2. MATERIAL AND METHOD

2.1 The survey

A field survey using a three-part questionnaire was carried out during summer 2010 on a sample of 355 people interviewed after shopping at super- and hyper-markets in the Italian region of Campania. The survey in Campania region represents a first attempt to validate the FTNS scale in Italy. The 13 items of Cox and Evans scale were, then, translated to Italian.

The sample is a representative distribution of the regional population in territorial and socio-economic terms (Table 1).

The first section of the questionnaire aimed to define the way consumer perceives six food categories with different degrees of processing that were briefly defined prior to the interview: functional, low-fat, frozen and ready-to-eat products, all involving more processing, on the one hand, and products with a perceived lower level of technology content, such as organic, typical and short-chain products, on the other. These last ones were considered in order to better test whether the consumers clearly distinguish between the two food categories as the technological content is concerned. For each type of food, four main items of information were sought:

– whether consumers trusted it;

– a characteristic that would best represent it among a set relating to safety, environmental impact, naturalness and taste attributes;

– the intensity level of the previous attributes, on a scale from 1 to 7 (from minimum to maximum);

– buying frequencies and the willingness to purchase it.

The second section of the questionnaire aimed to assess consumer attitudes toward technology using the 13 statements taken from the work of COX and EVANS (2008), referring to:

the perception of the consumer about technology, its uses and benefits;

the way consumers feel in new situations and behave when facing unknown circumstances;

food habits and the propensity to taste new products.

While COX and EVANS apply the Food Technology Neophobia Scale (FTNS) to a set of different technologies, in our work the same scale is applied to food categories. This is because:

Since consumers are more knowledgeable about products than technologies, they can express their opinions more fully;

Asking a question on technology is more likely to affect the response negatively because of the negative relation between knowledge and risk perception (FIFE-SCHAN and ROWE, 1996);

Finally, the third section collects socio-eco-

Table 1 - Distribution of main socio-economic indicators: comparison of survey sample and the Campania region data.

	Campania region	Sample
Province		
Avellino	8%	10%
Benevento	5%	7%
Caserta	15%	11%
Napoli	54%	54%
Salerno	18%	18%
Gender		
Male	49%	48%
Female	51%	52%
Education		
Primary school	22%	21%
Middle school	29%	27%
High school	22%	28%
Graduation	15%	24%
Legal status		
Married	38%	37%
Separated	2%	2%
Cohabitant	10%	12%
Single	50%	49%
Professional status		
Self employed	5%	9%
Manager	1%	2%
Employee	20%	20%
Student	18%	15%
Housewife	26%	24%
Retired	12%	9%
Unemployed	11%	9%
Precarious/part time	7%	12%

nomic, psychographic and demographic information on the interviewees and their families, and tries to assess their general approach toward the environment, naturalness and traditions.

2.2 Exploratory analysis and Principal Component Analysis

An exploratory analysis and t-tests were carried out on collected data in order to:

Evaluate how the consumers associate each food category to the attributes relating to safety, environmental impact, naturalness and taste;

Investigate general attitudes toward technology and the perception of its benefits and risks analyzing answers to the Cox & Evans psychometric statements.

Moreover, in order to synthesize consumer attitudes toward technologies and more processed products, Principal Component Analysis (PCA) was performed on the scores to the FTNS questions. In fact, PCA is a statistical technique whose basic assumption is that underlying dimensions, or factors, can be used to explain more complex phenomena. Then, the relationship among FTNS statements could give information on some not-directly-observable factors, relating to attitude toward technology that could lead consumers' behaviour. To test whether the observed variables (the FTNS statements in our case) share common factors the Kaiser-Meyer-Olkin measure of sampling adequacy and the Bartlett's Test of Sphericity can be computed. In our case KMO was 0.746 and Bartlett's Test was 853 (df = 70; $p < 0.0001$), indicating that the dataset was factorable.

The analysis was carried out using SPSS (version 18.0). A varimax rotation was used that allows extraction of components that are highly correlated with a low number of variables and hence results in more interpretable factors.

2.3 The econometric model

To formally assess to what extent the perception of risk affects the consumer's decision to buy food products obtained with modern technologies an analytical approach was developed. The work is based on the hypothesis that the intention of purchasing food products with different technological contents mainly depends on the attitude of consumers toward food technologies measured using the FTNS scale.

This hypothesis is developed by means of a three-equation multivariate Probit model where consumer choice to take part in three markets, namely those with the highest degree of food processing (functional food, light products and ready-to-eat products), is related to the neophobia-neophilia attitudes of consumers (CRANFIELD *et al.*, 2012).

The dependent or response variable is represented by the event that the consumer is interested in the purchase and consumption of a set of three processed food products that are based on the use of modern technology, namely functional foods (y_1), low-calorie foods (y_2) and ready-to-eat food (y_3). In empirical terms, the three-equation multivariate Probit model supposes that:

$$\begin{aligned} y_1^* &= (X\beta_1 + Z\gamma_1 + e_1), \\ y_2^* &= (X\beta_2 + Z\gamma_2 + e_2), \\ y_3^* &= (X\beta_3 + Z\gamma_3 + e_3) \end{aligned} \quad (1)$$

with

$$y_1 = \begin{cases} 1 & if \quad y_1^* > 0 \\ 0 & if \quad y_1^* \le 0 \end{cases}$$

$$y_2 = \begin{cases} 1 & if \quad y_2^* > 0 \\ 0 & if \quad y_2^* \le 0 \end{cases} \quad (2)$$

$$y_3 = \begin{cases} 1 & if \quad y_3^* > 0 \\ 0 & if \quad y_3^* \le 0 \end{cases}$$

X is the matrix of exogenous variables relative to the respondent's socio-economic and demographic characteristics, such as education level, income, age, gender, residency and so forth;

Z is a matrix of exogenous variables that include the consumer's attitudes to technology in relation to food (FTNS scale). These last variables are represented by factors extracted from Principal Component Analysis;

β and γ are parameter vectors.

The error terms are assumed to be independently and identically distributed as trivariate normal:

$$\begin{pmatrix} e_1 \\ e_2 \\ e_3 \end{pmatrix} \sim N(0, \Sigma) \quad \Sigma \equiv \begin{bmatrix} 1 & \rho_{12} & \rho_{13} \\ \rho_{12} & 1 & \rho_{23} \\ \rho_{13} & \rho_{23} & 1 \end{bmatrix}$$

Each equation estimates the probability of the consumer purchasing one of the three proposed product categories that are based on the use of modern technology; in this context the $Pr[y_1 = 0, y_2 = 0, y_3 = 0]$ is equal to:

$$\int_{-\infty}^{-x_1\beta_1} \int_{-\infty}^{-x_2\beta_2} \int_{-\infty}^{-x_3\beta_3} \phi_3(e_1, e_2, e_3, \rho_{12}\rho_{13}\rho_{23}) de_3 de_2 de_1 \quad (3)$$

where $\varphi_3(\cdot)$ is the trivariate standard normal distribution and ρ_{ij} is the correlation coefficient between the error terms of the equation, i and j. In the estimation, if the null hypothesis H_0: $\rho_{ij} = 0$ cannot be rejected, this implies that the equations need not be estimated as a system and can be estimated separately[1].

[1] The condition $\rho_{ij} = 0$ can be tested using a LR test. In order to approximate the trivariate normal CDF, we use the GHK (Geweke-Hajivassiliou-Keane) smooth recursive simulator (MARIANO *et al.*, 2000).

The proposed empirical model jointly assesses three hypotheses:

H_1) Consumption intention (y_1; y_2; y_3) might be linked to the consumer's attitude to technology in relation to the food (FTNS factors). This hypothesis can be tested through the estimation of parameters γ, underlying a causal relation of Z on y_1 and y_2 and y_3.

H_2) Consumption intention (y_1; y_2; y_3) might depend on the complex of socio-economic and demographic characteristics that define the profile of the consumers surveyed. This hypothesis can be tested through the estimation of parameters β.

H_3) Consumption intention (y_1; y_2; y_3) might be intercorrelated by the effect of unobserved characteristics or compounding variables. This event can be taken into account and controlled through the estimation of the coefficients ρ (ρ_{12}, ρ_{13}, ρ_{23}).

3. RESULTS

From preliminary analysis of the data a clear dichotomy emerges when confidence in different food types is investigated (Table 2). Over half the interviewees have no confidence in what are perceived as more processed products (functional, low-fat, and frozen and ready-to-eat food). This percentage drops to 10-17% when organic, typical and short-chain products are concerned. The dichotomy is even more evident when scores for different product characteristics are considered. According to the interviewees, organic, typical and short-chain products are all well defined by naturalness and safety attributes, while very few individuals believe that functional, low-fat and ready-to-eat food can be defined as natural.

By means of t-tests (WELCH, 1947) on the differences of scores given to each attribute and for each pair of food products, more information on the way consumers perceive the investigated products can be obtained. First, functional, low-fat and ready-to-eat products are perceived as very different in respect to organic, typical and short-chain categories for each of the attributes considered. Secondly, the consumer is able to distinguish within the category of more processed products, each of which has its own characteristics. For example, functional food is considered more nutrient, rewarding and tasty than low-fat products. Moreover, while organic and typical products differ in terms of taste, safety and environmental impact, a more clear-cut distinction exists between these two categories, on the one hand, and short-chain products, on the other.

In Table 3, the scores represent the mean level of agreement stated on a scale from 1 to 7. In the sample as a whole, a widespread sense

Table 2 - Consumer product confidence and product characteristics.

Food category	Confidence (% of the interviewees)		Product characteristics (mean score)					
	Yes	No	Natural	Safe	Nutrient	Rewarding	Tasty	Environmental friendly
Functional food	56	44	3.3	3.9	4.4	4.5	4.1	3.3
Light products	51	49	3.3	3.7	3.7	3.6	3.8	3.2
Frozen and ready to eat products	46	54	3.3	3.7	3.7	4.3	4.4	3.4
Organic products	79	19	5.8	5.8	5.9	5.8	5.7	5.9
Typical products	88	12	5.9	5.6	5.7	5.9	5.9	5.5
Short chain products	87	13	5.6	5.2	5.2	5.5	5.4	5.5

Table 3 - Level of agreement with the Cox psychometric questions: mean scores on a 1 to 7 scale (1= strongly disagree; 7= strongly agree).

Question Score	
It can be risky to switch to new food technologies too quickly	4.63
New food technologies may have long-term negative environmental effects	4.75
Society should not depend heavily on technologies to solve its food problems	4.71
There are plenty of tasty foods around, so we do not need to use new food technologies to produce more	4.62
New foods are not healthier than traditional foods	4.72
The benefits of new food technologies are often grossly overstated	4.95
New food technologies are something I am uncertain about	4.89
New food technologies decrease the natural quality of food	4.71
There is no sense trying out high-tech food products because the ones I eat are already good enough	4.89
New food technologies give people more control over their food choices	4.15
New products using new food technologies can help people have a balanced diet	4.25
New food technologies are unlikely to have long-term negative health effects	3.69
The media usually provide a balanced, unbiased view of new food technologies	3.00

Table 4 - Factor loading matrix.

	Components			
	1	2	3	4
It can be risky to switch to new food technologies too quickly	0.777	0.122	0.003	-0.141
New food technologies may have long-term negative environmental effects	0.707	-0.045	-0.144	0.026
Society should not depend heavily on technologies to solve its food problems	0.669	0.145	0.123	-0.027
There are plenty of tasty foods around, so we do not need to use new food technologies to produce more	0.479	0.353	-0.341	0.114
New foods are not healthier than traditional foods	-0.136	0.736	0.049	-0.107
The benefits of new food technologies are often grossly overstated	0.141	0.673	-0.120	-0.042
New food technologies are something I am uncertain about	0.447	0.563	0.039	0.124
New food technologies decrease the natural quality of food	0.439	0.514	-0.258	-0.003
There is no sense trying out high-tech food products because the ones I eat are already good enough	0.315	0.510	-0.067	0.395
New food technologies give people more control over their food choices	0.026	-0.091	0.792	0.080
New products using new food technologies can help people have a balanced diet	-0.054	-0.152	0.689	0.250
New food technologies are unlikely to have long-term negative health effects	-0.071	0.193	0.621	-0.432
The media usually provide a balanced, unbiased view of new food technologies	-0.136	0.002	0.167	0.804

of uncertainty on the technology effects emerges, together with the belief that its benefits are overstated. Moreover, the feeling seems to prevail that innovation in the food sector is somewhat futile since traditional products are good enough and healthier.

The PCA carried out on the FTNS statements resulted in a four-factor solution that explains 56% of the whole variance and identifies four thematic areas, quite similar to those already pointed out by COX and EVANS (2008).

In Table 4, the factor loading matrix is presented, which is the basis to interpret the meaning of each component.

The first component explains 25.7% of the total variance and allows identification of the connection between perceived risk and technologies (perceived risk): as the first component increases, shifting from negative to positive values, consumers increasingly perceive technology as a hazardous factor. The component can then be read as a scale of risk. The perception of technology as risky is further characterized by the uncertainty that is associated to food technologies, a statement that is more strongly correlated with component 2.

The meaning of the first component is also linked to the belief that society should not depend heavily on technologies to solve its food problems. Even this statement could in some way be related to risk perception: food security is a strategic matter for society and should not depend upon technologies, which are seen as fragile and unreliable. The statement that "There are plenty of tasty foods around, so we do not need to use new food technologies to produce more" defines an adverse attitude towards technology, adding an ideological connotation to this first component, even if it shows a more transversal correlation with three of the four components.

The second factor extracted (12.2% of explained variance) summarizes the opinion of respondents concerning the usefulness of adopting new technologies and, more generally captures the level of uncertainty (Uselessness of Technology component). When positive, the second component identifies consumers who do not recognize any real benefit stemming from the introduction of new technologies in food sector. This approach is reinforced by the perception of uncertainty ("New food technologies are something I am uncertain about") (HANSEN *et al.*, 2003; FREWER and SALTER, 2003). On the contrary, negative values of the component occur when consumers believe that new technologies can produce more benefit in terms of healthy nutrition, taste and food quality. The third component (9.5% of the total variance) is positively correlated with the perception of benefits of new food technologies in terms of control over food choices; capacity to have a balanced diet and health effects (Benefits and health effects).

Aspects referring to the role of media in conveying information on food technology are shown by the fourth component (Trust in media role). Positive values of the fourth component (8.5% of the total variance) identify those consumers who think that the media usually provide balanced, unbiased information. This kind of trust is particularly important as new food technologies are thought to have long-term negative health effects (negative correlation of the related statement with the fourth component).

The t-test (WELCH, 1947) on the means of the extracted factors scores across groups of consumers according to their socio-economic characteristics provides an initial characterization of consumers' attitudes. Scores of all the components are significantly different according to gender: females have a higher perception of the risk and uncertainty associated with new technologies, and perceive the futility of new products more greatly, in terms of taste and quality. However, at the same time, females believe to a greater extent than males that new food technologies can contribute to diet control and health. Having children is associated with

Table 5 - Descriptive statistics of the variables used in the model – (n = 355).

Variable	Variable description	Mean	Std. Dev
Gender	Assumes the value 1 for male interviewees and 2 for females	1.51	0.50
Education	Educational level of the interviewees	2.21	0.82
Children	Takes the value 1 when there are children under 12 years, 0 otherwise.	0.28	0.45
Income	Categorical variable (1-4) assuming the value 1 for low consumer income and 4 for high consumer income	2.55	0.90
Urban	Identifies the respondents living in urban areas. It takes the value 1 if respondents live in the metropolitan area of Naples, 0 otherwise.	0.53	0.50
Farm holidays	Takes the value 1 when the consumer likes to go on farm holidays, 0 otherwise.	0.56	0.51
Traveling	Takes the value 1 when the consumer likes travelling outside the EU, 0 otherwise.	0.35	0.66
Family size	Takes the value 1 when there are more than 3 family members, 0 otherwise	0.45	0.50
Risk	Summarizes the level of perceived risk associated with the use of technology in the food industry	0	1
Uselessness of Technology	Summarizes the assessment of respondents about the usefulness of adopting technologies and, more generally, captures the level of uncertainty	0	1
Benefits and health effects	Summarizes perception of benefits of modern food technologies in terms of control over food choices; capacity to have a balanced diet and health effects	0	1
Trust in media role	Summarizes the consumer perception that the media usually provide balanced and unbiased information	0	1

Table 6 - Regression results from the multivariate probit.

Equation	Functional food		Light Product		Frozen and ready to eat	
	Coefficients	t	Coefficients	t	Coefficients	t
(Constant)	-2.014***	-4.9	-5.913***	-6.8	-0.195	-0.4
Gender	0.503***	2.95	1.501***	4.79	0.217	0.88
Education	0.009	0.09	-0.812***	-3.4	-0.308***	-2.6
Children	-0.217	-1.1	0.193	0.45	-1.198***	-3.1
Income	0.089	0.97	0.727***	3.41	-0.243	-1.6
Urban	0.871***	5.26	-0.277	-0.7	-0.671***	-2.8
Farm holidays	-0.453***	-2.8	0.169	0.53	-0.643***	-3
Travelling	0.223**	2.07	-0.246	-0.6	0.138	1.29
Family size	-0.18	-1	0.315	0.81	0.541**	2.33
Risk	-0.384***	-4.7	-0.841***	-3.9	-0.113	-1.2
Uselessness of technology	-0.132	-1.6	-0.568***	-2.9	-0.148*	-1.7
Benefits and health effects	-0.006	-0.1	-0.049	-0.3	0.071	0.62
Trust in media role	0.031	0.37	0.191	0.82	0.116	1.08

*significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

a higher level of risk perception and trust in the role of media (BARRENA and SÁNCHEZ, 2010). Living in an urban area increases the level of risk perception and the level of belief in the benefits and health effects of new technologies, while it is negatively related to trust in the media.

Table 5 reports definitions and the main statistics of the variables in the econometric model. The system estimation results are listed in Tables 6 and 7. Overall, the model shows a good explanatory capacity. Indeed, prediction indexes, which measures the relation between y values correctly determined and total y values observed, are 77.2, 98.3 and 93.5, respectively for system equations 1, 2 and 3.

According to the results, hypothesis H_1 cannot be rejected. The probability of entering the market of proposed food categories depends on consumer attitudes to technology. Nevertheless, the adopted model shows a wide range of results

Table 7 - Model Diagnostics.

Observation	355
LogLikelihood	-243.2
$\rho_{(1/2)}$	-0.409***
$\rho_{(1/3)}$	-0.487**
$\rho_{(2/3)}$	-0.138
Wald $\chi 2$ (d.f)	252.9(36)
Prob>$\chi 2$	0.000
L.R $\chi 2$ (d.f)	11.7(3)
Prob>$\chi 2$	0.008

Table 8 - Average marginal effects of observed consumer attitudes toward technology on consumption probability (%).

	Functional food	Light Product	Frozen and ready to eat
Risk	-9.8	-2.5	-1.1
Uselessness of technology	-3.4	-1.7	-1.5
Benefits and health effects	-0.2	-0.1	0.7
Trust in media role	0.8	0.6	1.2

in terms of the relationship between consumption propensity and consumer attitude.

Specifically, our estimate provides evidence for the existence of a direct relationship between the perception of risk and consumer participation in the market of "Functional" and "Light" products. Moreover, respondents showing greater skepticism toward food technologies and their usefulness are associated with a low probability of buying "Light" and "Frozen or ready to eat" products. By contrast, the third and fourth components were not found to be statistically significant and they do not seem to affect consumer intention. However, the latter two components account for the least explanatory power in terms of the proportion of total variance.

Therefore, the propensity to purchase more processed food products is mostly affected by the perception of risk and by the judgment about the usefulness of technologies. When perceived risk and the feeling of uselessness of technology are high, consumers tend not to participate in the market. The above result is confirmed by the computed marginal effects as reported in Table 8, demonstrating and quantifying the role of the factors for each selected food category.

Among the three products considered, the consumption of functional food seems to be more influenced by the consumer's attitude to technology, presenting a higher marginal impact.

The model results highlight the role of the socio-demographic characteristics of the respondents in determining the probability to purchase innovative products, validating the second hypothesis H_2. The value of the coefficients can provide initial elements to depict the ideal customer profile for the various goods considered. With respect to functional foods, we can assume that a typical consumer is female; she lives in a city, and has a passion for travelling. The typical consumer of light food is also female; she has a high income and her level of education is below average. The consumer of frozen and ready to eat foods has a large family and both the income and the level of education are below average.

The particular behaviour of women, however, is not in contradiction with what we described in the previous section: from cross-comparisons with the presence of children, women seem to perceive more risk, but at the same time, in the absence of children they are more likely to consume functional foods and light products.

The proposed model also confirms the H_3 hypothesis. The correlation coefficients between the error terms among the equations ($\rho_{1/2}$ and $\rho_{1/3}$) are significantly different from zero. Compounding factors influencing consumption of functional food are negatively correlated with the compounding factors influencing consumption both of light products and frozen and ready-to-eat food. This outcome confirms the empirical efficacy in modelling consumer choices simultaneously; it improves the estimation efficiency, including in the analysis the impact of valuable non-observable information.

Since its development the FTNS scale was tested as predictor of the willingness to try foods produced by novel technologies. COX and EVANS (2008) provide information on the FTNS predictive validity by means of Pearson correlation with the willing to try foods produced using novel technologies. Other studies focused on different food technologies (MATIN *et al.*, 2012; EVANS *et al.*, 2010a; CHEN *et al.* 2013). In all these studies the predictor was the total score of the FTNS, while in the current application the predictors were the 4 components extracted from the factor analysis. In this way, the multidimensional nature of the FTNS, is taken into account and it has been possible to analyze the different roles played by the four components in addressing the purchase behaviour toward each specific food category.

5. CONCLUSION

The present study adopted a psychometric scale proposed by COX and EVANS (FTNS) to relate the consumption of specific food categories with the attitude of consumers towards technology.

Our results confirmed the strength of the FTNS scale. First of all, the survey confirms that the psychometric scale used by COX and EVANS can reflect the dichotomy between neophobia and neophilia attitudes. PCA analysis extracted 4 factors: the first two factors (risk and uselessness of technology) are strictly linked to the more or less innovative behaviour of the interviewees.

Consumer choices were empirically modelled through a simultaneous system of three equations. The model highlighted the role of both consumer attitudes to technology and socio-demographic characteristics in determining the probability of purchasing products with a higher degree of processing. It also provided some initial elements to define ideal customer profiles for the products in question. The most important finding concerns the propensity to purchase more processed food products which is mostly affected by the perception of risk and the opinion of the usefulness of technologies.

This evidence may influence future developments of the research in question. The joint use of the COX and EVANS scale and a large set of socio-demographic, behavioural and psychographic data could allow identification of the early adapters segment most willing to join markets for innovative products. This would provide useful insights for marketing strategies, effectively targeting communication techniques and new product launches.

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