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Information based food policy: is nutritional label the right instrument for everyone?

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Abstract. Individuals' time preference is an important driver for several health-related behaviors, but there is still lack of knowledge about its relationship with specific food-related behaviors. In this paper we investigate if time preference may have a role in affecting consumers' use of food label. The data were collected through a face-to-face survey on a sample of 540 Italian consumers. Time preference was estimated through an index including BMI, smoking behavior and physical activity. The analysis was made estimating a set of three equations. The results confirm our hypothesis that individuals with low time preference, who give more importance to future health outcomes, are more willing to use such information.

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1. Introduction

Diet-related chronic diseases constitute a major public concern not only from a medical point of view, but also in economic terms as they are linked to sizable sanitary costs (Rosin, 2008). To challenge these problems and improve public health, economists in the last decades investigated the main determinants of consumers' food choices, and found that food label can play a crucial role in addressing people towards healthier consumptions. The information on label, especially those related to nutritional properties, may lead consumers to more healthful diet choices (Drichoutis *et al*., 2008; Drichoutis *et al.*, 2009; Barreiro-Hurlè *et al.*, 2010). Nonetheless, the effectiveness of label is strictly linked to the individual willingness to care about this information source. Indeed, there are numerous factors which may encourage (or discourage) people from using it (Cavaliere *et al.,* 2015). Among these, the way consumers value their future health might have a primary role.

The importance attributed to future events depends on the individuals' time preference, that is, the extent at which people are willing to subvert a present gratification for a future utility (Komlos *et al.*, 2004; Smith *et al*., 2005; Zhang and Rashad, 2008). Consumers with high time preference are more present-concerned and tend to attach more value to the present satisfaction than to the long term utility of being healthy; on the opposite, low time preference characterizes more future-oriented individuals. Therefore, time preference could heavily affect the extent at which consumers engage in health-enhancing activities (Grossman, 1972; Chapman *et al*., 2001; Smith *et al*., 2005; Zhang and Rashad, 2008; Brown and Van Der Pol, 2013; Cavaliere *et al.*, 2014).

Although the economic literature is rich in evidence concerning the role of individual time preference on health-related activities (Lawless *et al.*, 2013), there is still lack of evidence concerning how time preference specifically affects food behaviors. Thus, trying to fill this gap, in this paper we analyze which could be the role of individuals' time preference in affecting food label use. The hypothesis is that individuals with low time preference, being more future-concerned, are more willing to make use of labelled information, relative to consumers with higher time preference.

2. Economic framework

Following Grossman's model on the demand for health (1972), we assume that the individual state of health is part of a consumer utility function. A good state of health increases the utility since it allows enjoyment of numerous activities which otherwise could not be undertaken. Suppose that an

individuals' utility is a function of working time (W), free time (F), health (H), and the consumption of a bundle of goods (G) different from health. The utility function can be written as:

$$U = U(W, F, H, G) \quad (1)$$

In Grossman's model, the endowment of health that people inherit at birth is subject to a depreciation over time, which can be offset through health investments (I_H). These include all the activities and actions aimed at maintaining or improving health status. Therefore, in this model, health is not only demanded, but also produced by individuals. In fact, people are able to affect their own health level to the extent at which they engage in healthy investments. Thus:

$$H = H(I_H, \Omega) \quad (2)$$

where Ω represents a number of exogenous factors independent from the individuals willingness to invest in health. One of the main factors that may affect individuals' willingness to invest in health is time preference (TP) (Grossman, 2006), which represents people preference for present or future utility (Bishai, 2001; Komlos *et al*., 2004; Smith *et al*., 2005; Brown and Van Der Pol, 2013). Thereby, the health investment function can be specified as:

$$I_H = I_H(TP, \Gamma) \quad (3)$$

where TP represents the individuals' time preference, and Γ represents other factors different from TP.

In this paper, we focus on the effect of time preference on a specific food-related behavior, that is, consumer use of food labels. More specifically, according to Grossman's model, we consider consumers' label use (L) as an indirect investment in health. Indeed, many studies show that through this active process of information searching consumers can become more informed about nutritional issues. This may in turn lead to more awareness about diet choices, consequently having an impact on health status (Drichoutis *et al*., 2006; Drichoutis *et al*., 2008; Drichoutis *et al*., 2009; NØrgaard and BrunsØ, 2009; Barreiro-Hurlè *et al*., 2010). Thus, consumers' label use can be explained as a function of time preference and other factors:

$$L = L(TP, \Gamma) \quad (4)$$

Following the recent literature analyzing the main drivers that can affect the use of label, we assume Γ to be composed by consumers' nutritional knowledge (KN), the average time spent choosing a new food product as a proxy of time constraint (T), and some socio-demographic and economic variables (S). Thus, the equation 4 can be rewritten as:

$$L = L(TP, KN, T, S) \quad (5)$$

The nutritional knowledge component included in the label function (5) may represent a source of endogeneity in the equation (Drichoutis *et al.*, 2005; Grunert *et al.*, 2010; Barreiro-Hurlè *et al.*, 2010). To account for the endogeneity issue we define the KN function as:

$$KN = KN(X, E_i) \quad (6)$$

where X is a vector of observable individuals' characteristics and E_i represents the unobservable characteristics of nutritional knowledge. Precisely, basing on the main evidence in the economic literature, we include in the vector X the socio-demographic and economic conditions (Grunert *et al.*, 2010; Chang and Nayga, 2011), the time spent choosing a new food product, and some sources of food-related information different from labels (i.e., information from TV, internet, and doctors/nutrition experts) (Drichoutis *et al*., 2005). Hence, following the approach used by Nayga (2000) and trying to solve the problem of endogeneity, in the empirical model we treat KN as an endogenous variable (as explained in section 3).

3. Methods

3.1 Data collection

The data for our analysis were collected through a consumer survey with personal interviews on a sample of Italian consumers in charge of their grocery shopping. The survey was carried out in Milan, in northern Italy, using an *ad hoc* questionnaire. Consumers were randomly approached outside the grocery stores, both in the central areas and in the suburbs and covering different time bands (early morning, lunch time, and evening). We excluded *a-priori* only consumers younger than 18 year old and we dropped from the final sample those who did not fully complete the survey. The final dataset consisted of 540 observations. Considering the dimension of Milan's population, the relative error is estimated at 3.95% (Mazzocchi, 2008).

3.2 Model specification and variable descriptions

Following eq. (6) in our economic framework, nutritional knowledge is estimated as:

a) $KN = KN(GEN, AGE, EDUC, INC, HS, I_{TV}, I_{INTERNET}, I_{DOCTORS}, T)$

The predicted value of nutritional knowledge ($\widehat{KN}$) is then included as a regressor in the following two equations having label use as dependent variable:

b) $L = L(TP, GEN, AGE, INC, HS, \widehat{KN}, T)$

c) $L = L(GEN, AGE, INC, HS, \widehat{KN}, T)$

In model a) KN is estimated through an index based on a set of questions about protein, fat, and carbohydrate content of food products. The scores obtained are then summed and converted into an index, so that, final low scores are associated with low nutritional knowledge (Table I). The socio-demographic and economic conditions (gender, age, level of education, household income, and household size) are included in the model as described in the economic framework. The variables (I_{TV}), ($I_{INTERNET}$) and ($I_{DOCTORS}$) are related to the main sources of information (different from label), that consumers use to get information about food products.

In model b) and c) the label use variable is categorical and is constructed to reflect how frequently consumers use food label. As in Variyam (2008) and in Loureiro *et al*. (2012), label use can assume five values: from 1 corresponding to 'never use', to 5 corresponding to 'always use'. This specification of the dependent variable allows for modelling the intensity of use. So responses can vary by frequency and thereby give a better description of the distribution of uses across the population.

Following the approach employed by Robb *et al*. (2008), we estimate consumers' time preference through a composite measure. This proxy is estimated creating an index with three variables that are shown in the literature to be strictly related to time preference, specifically: BMI (estimated through self-reported height and weight measures), smoking behavior, and physical activity. These variables were coded so that high scores correspond to consumers' high time preference (present orientation), and low scores to low time preference (future orientation). Then, the variables' values were standardized and used to create the proxy. High time preference is associated with high BMI levels, smoking behavior, and scarce physical activity, whereas the opposite is for low time preference.

Model a) is estimated through an ordinary least squares regression. The predicted value of $\widehat{KN}$ obtained with this regression is then used as an explanatory variable in models b) and c), estimated using an ordered logistic regression having label use as dependent variable. Model c) differs from b) because TP is not included among the regressors. Model c) allows to verify if the relationship between label and TP is significant independently of the other variables included in the equation. As a last step in the analysis we compute the marginal effect estimation of model b).

4. Results and discussion

The results confirm our initial hypothesis concerning the role of consumers' time preference in affecting label use (Table II). As expected, the relationship between consumers' TP and label use is negative and significant (-0.144), that is, more future-oriented individuals are more likely to make use

of the information reported on labels. Giving more value to future health outcomes, these consumers might better perceive the benefits deriving from label use, and consider this kind of information as a possible way to improve their health in the long run.

With regard to the socio-demographic and economic characteristics, people aged between 35 and 54 years old are more likely to use labels. This might be due to the fact that in this age category the probability to have little children is higher, thus leading people to be more careful about what they purchase. Also, people with highest income are more likely to make use of food label. This result is in line with previous research which found that high income consumers rely on labelled information more than low income individuals, and generally attribute more value to such information (McLean-Meyinsse, 2001). Moreover, label use decreases as the household size becomes bigger, probably due to the fact that this households may suffer from higher time constraint.

Nutritional knowledge is positively related to label use, meaning that when consumers are more knowledgeable about nutritional properties, they are more willing to use labelled information. This result is in accordance with previous studies highlighting the important role of nutritional knowledge in leading consumers to invest more time in collecting information on food products (Drichoutis *et al.*, 2006).

Finally, the results highlight that the more is the time spent for choosing a new product, the more consumers are likely to use food label. This indicates that when consumers do not experience high time constraint, they are more willing to get information through labels and to select products that are more in line with their preferences.

The last regression, estimated excluding TP from the explanatory variables, shows overall the same results. The signs and statistical significance of all the original regressors in model b) remain unchanged. The coefficient magnitudes of statistically significant variables are unchanged, suggesting that the effect of TP on label use is uncorrelated with the other individual characteristics included in the analysis.

Moreover, the marginal effect computation (Table III) suggests that the effect of low time preference is more evident for those consumers that use labelled information most frequently. Indeed, results highlight a different pattern of signs between consumers who use label with a low-medium frequency (never, rarely, and sometimes) and those who, instead, habitually use it (often, always).

5. Concluding remarks

This preliminary investigation on the role of time preference in affecting consumers' use of food label confirms our hypothesis that people are more prone to use such information when they are more health-oriented. On the opposite, people having scarce interest in food label are those that show a low health orientation in their behaviors and do not care about their future utility. Thus, although food labelling is effective in increasing market transparency, our results suggest that this tool might be not effective to change the consumption patterns of those consumers with a low orientation to health. Indeed, individuals who mostly use food label are those that already engage in other healthy behaviors, as emphasized through our proxy of time preference.

Therefore, different public intervention should be adopted to improve healthy behaviors. Such policies should attempt to decrease consumers' preference for immediate utilities and lead people to rethink about the value of their future health outcomes. This might be achieved through educational and communication campaigns aimed at making consumers more aware about the strong link existing between their eating behavior and diet-related health problems.

The main limitation of our study is related to the label use variable, since more specific information categories, such as nutrition facts or nutritional claims, could be employed in future research. Furthermore, as the survey is based on stated preferences, social desirability bias might occurred. Future studies should explore more extensively the goodness of our time preference proxy, testing it in different contexts.

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Table I - Definitions of variables, means, standard deviations and frequencies

Variable name	Description	Obs	Freq	Mean	SD
Dependent variable					
Label use	Scale, respondents use labels from never = 1, to always = 5	540		3.27	1.38
Independent variables					
TIME PREFERENCE					
Physical activity	Dummy, respondents practice sport less than once a week = 1; at least once a week = 0	540	237		
Smoking behavior	Dummy, respondents smoke = 1; otherwise 0	540	158		
Body Mass Index	Body Mass Index (weight kg/ height squared m^2)	540		23.64	3.69
GENDER	Dummy, female = 1, male = 0	540	293		
AGE $_{18\text{-}24}$ [a]	Dummy, respondents' age group 18-24 = 1; otherwise = 0	540	64		
AGE $_{25\text{-}34}$	Dummy, respondents' age group 25-34 = 1; otherwise = 0	540	104		
AGE $_{35\text{-}44}$	Dummy, respondents' age group 35-44 = 1; otherwise = 0	540	85		
AGE $_{45\text{-}54}$	Dummy, respondents' age group 45-54 = 1; otherwise = 0	540	87		
AGE $_{55\text{-}64}$	Dummy, respondents' age group 55-64 = 1; otherwise = 0	540	92		
AGE $_{>65}$	Dummy, respondents' age group >65 = 1; otherwise = 0	540	108		
EDUCATION $_{\text{Primary school}}$ [a]	Dummy, respondents' level of education primary school = 1; otherwise = 0	540	32		
EDUCATION $_{\text{Secondary school}}$	Dummy, respondents' level of education secondary school = 1; otherwise = 1	540	99		
EDUCATION $_{\text{Higher education}}$	Dummy, respondents' level of education higher education = 1; otherwise = 2	540	233		
EDUCATION $_{\text{Degree}}$	Dummy, respondents' level of education degree = 1; otherwise = 3	540	160		
EDUCATION $_{\text{Post degree}}$	Dummy, respondents' level of education post degree = 1; otherwise = 4	540	16		
HOUSEHOLD INCOME $_{<800€}$ [a]	Dummy, household income < 800€ = 1; otherwise = 0	540	33		
HOUSEHOLD INCOME $_{800\text{-}1500€}$	Dummy, household income 800-1500€ = 1; otherwise = 0	540	139		
HOUSEHOLD INCOME $_{1500\text{-}3000€}$	Dummy, household income 1500-3000€ = 1; otherwise = 0	540	222		
HOUSEHOLD INCOME $_{3000\text{-}5000€}$	Dummy, household income 3000-5000€ = 1; otherwise = 0	540	97		
HOUSEHOLD INCOME $_{>5000€}$	Dummy, household income > 5000€ = 1; otherwise = 0	540	49		
HOUSEHOLD SIZE $_{1\text{ members}}$ [a]	Dummy, household size 1 component = 1; otherwise = 0	540	124		
HOUSEHOLD SIZE $_{2\text{ members}}$	Dummy, household size 2 components = 1; otherwise = 0	540	168		
HOUSEHOLD SIZE $_{3\text{ members}}$	Dummy, household size 3 components = 1; otherwise = 0	540	107		
HOUSEHOLD SIZE $_{4\text{ members}}$	Dummy, household size 4 components = 1; otherwise = 0	540	108		
HOUSEHOLD SIZE $_{\text{more than 4 members}}$	Dummy, household size greater than 4 components = 1; otherwise = 0	540	33		
INFORMATION SOURCE $_{\text{Tv}}$	Scale, TV as source of information on food properties from never= 1 to always = 5	540		2.25	1.24
INFORMATION SOURCE $_{\text{Internet}}$	Scale, internet as source of information on food properties from never= 1 to always = 5	540		2.09	1.39
INFORMATION SOURCE $_{\text{Doctors}}$	Scale, doctors and/or nutrition experts as source of information on food properties from never= 1 to always = 5	540		3.28	1.54
NUTRITIONAL KNOWLEDGE					
Knowledge $_{\text{carbohydrates}}$	Dummy, level of knowledge on carbohydrates (knowledgeable = 1, not knowledgeable= 0)	540	425		
Knowledge $_{\text{fat}}$	Dummy, level of knowledge on fat (knowledgeable = 1, not knowledgeable= 0)	540	326		
Knowledge $_{\text{protein}}$	Dummy, level of knowledge on protein (knowledgeable = 1, not knowledgeable= 0)	540	424		
TIME SPENT CHOOSING A NEW FOOD PRODUCT	Dummy, more than one minute = 1; less than 1 minute = 0	540	409		

[a] Removed for estimation purpose.

Table II – Model estimation

	NUTRITIONAL KNOWLEDGE			LABEL USE (Whith TP)			LABEL USE (Whithout TP)		
	Coef.	*SE*		Coef.	*SE*		Coef.	*SE*	
TIME PREFERENCE				-0.144	*0.083*	*			
GENDER	0.180	*0.085*	**	0.129	*0.170*		0.159	*0.169*	
AGE $_{25\text{-}34}$	-0.113	*0.161*		0.350	*0.298*		0.351	*0.298*	
AGE $_{35\text{-}44}$	-0.191	*0.163*		0.665	*0.315*	*	0.675	*0.316*	*
AGE $_{45\text{-}54}$	-0.074	*0.162*		0.969	*0.310*	***	0.938	*0.309*	***
AGE $_{55\text{-}64}$	0.045	*0.169*		0.139	*0.310*		0.071	*0.308*	
AGE $_{>65}$	0.050	*0.180*		0.361	*0.314*		0.297	*0.313*	
EDUCATION $_{\text{Secondary school}}$	0.482	*0.214*	**						
EDUCATION $_{\text{Higher education}}$	0.692	*0.218*	***						
EDUCATION $_{\text{Degree}}$	1.037	*0.237*	***						
EDUCATION $_{\text{Post degree}}$	1.254	*0.329*	***						
HOUSEHOLD INCOME $_{800\text{-}1500€}$	-0.178	*0.200*		0.087	*0.353*		0.097	*0.352*	
HOUSEHOLD INCOME $_{1500\text{-}3000€}$	-0.176	*0.201*		0.509	*0.352*		0.551	*0.350*	
HOUSEHOLD INCOME $_{3000\text{-}5000€}$	-0.045	*0.228*		0.400	*0.408*		0.483	*0.404*	
HOUSEHOLD INCOME $_{>5000€}$	-0.210	*0.247*		0.936	*0.445*	*	1.010	*0.441*	*
HOUSEHOLD SIZE $_{2\text{ members}}$	0.145	*0.122*		-0.090	*0.229*		-0.100	*0.229*	
HOUSEHOLD SIZE $_{3\text{ members}}$	-0.030	*0.137*		0.239	*0.264*		0.211	*0.263*	
HOUSEHOLD SIZE $_{4\text{ members}}$	0.195	*0.142*		-0.044	*0.277*		-0.019	*0.276*	
HOUSEHOLD SIZE $_{\text{more than 4 members}}$	0.259	*0.199*		-0.871	*0.379*	*	-0.830	*0.378*	*
INFORMATION SOURCE $_{\text{Tv}}$	-0.010	*0.037*							
INFORMATION SOURCE $_{\text{Internet}}$	-0.063	*0.033*	**						
INFORMATION SOURCE $_{\text{Doctors}}$	0.131	*0.030*	***						
NUTRITIONAL KNOWLEDGE				0.954	*0.295*	***	0.925	*0.294*	***
TIME SPENT CHOOSING A NEW FOOD PRODUCT	0.195	*0.100*	**	0.497	*0.199*	*	0.477	*0.199*	*
α_1	-1.154	*0.305*	***	-0.443	*0.451*		-0.422	*0.450*	
α_2				0.214	*0.451*		0.230	*0.450*	
α_3				1.222	*0.454*		1.231	*0.454*	
α_4				2.560	*0.462*		2.566	*0.462*	
R-squared	0.122			0.038			0.038		
N	540			540			540		

Significance: *** p < 0.01; ** p < 0.05; * p < 0.10

Note: the variable education has not been included in models 2 and 3 because of multicollinearity problems.

Table III - Marginal Effect for label use equation

	LABEL USE														
	Never			Rarely			Sometime			Often			Always		
	Coef.	*SE*		Coef.	*SE*		Coef.	*SE*		Coef.	*SE*		Coef.	*SE*	
TIME PREFERENCE	0.019	*0.011*	*	0.009	*0.005*	*	0.008	*0.005*	*	-0.012	*0.007*	*	-0.024	*0.014*	*
GENDER	-0.017	*0.023*		-0.008	*0.011*		-0.007	*0.009*		0.011	*0.015*		0.021	*0.028*	
AGE $_{25\text{-}34}$	-0.044	*0.035*		-0.022	*0.018*		-0.022	*0.021*		0.026	*0.019*		0.061	*0.055*	
AGE $_{35\text{-}44}$	-0.076	*0.031*	*	-0.040	*0.018*	*	-0.047	*0.026*	*	0.039	*0.012*	**	0.123	*0.065*	*
AGE $_{45\text{-}54}$	-0.104	*0.027*	***	-0.056	*0.017*	***	-0.072	*0.028*	**	0.044	*0.011*	***	0.188	*0.068*	**
AGE $_{55\text{-}64}$	-0.018	*0.039*		-0.009	*0.019*		-0.008	*0.019*		0.011	*0.024*		0.023	*0.054*	
AGE $_{>65}$	-0.045	*0.036*		-0.022	*0.019*		-0.023	*0.022*		0.027	*0.020*		0.063	*0.058*	
HOUSEHOLD INCOME $_{800\text{-}1500€}$	-0.011	*0.046*		-0.005	*0.022*		-0.005	*0.020*		0.007	*0.029*		0.014	*0.059*	
HOUSEHOLD INCOME $_{1500\text{-}3000€}$	-0.066	*0.045*		-0.031	*0.022*		-0.029	*0.021*		0.041	*0.026*		0.086	*0.061*	
HOUSEHOLD INCOME $_{3000\text{-}5000€}$	-0.049	*0.046*		-0.024	*0.025*		-0.026	*0.030*		0.029	*0.023*		0.070	*0.077*	
HOUSEHOLD INCOME $_{>5000€}$	-0.096	*0.034*	***	-0.054	*0.023*	**	-0.072	*0.041*	*	0.036	*0.012*	**	0.186	*0.102*	*
HOUSEHOLD SIZE $_{2\ members}$	0.012	*0.031*		0.006	*0.014*		0.005	*0.012*		-0.008	*0.020*		-0.015	*0.037*	
HOUSEHOLD SIZE $_{3\ members}$	-0.031	*0.032*		-0.015	*0.016*		-0.014	*0.017*		0.019	*0.019*		0.041	*0.047*	
HOUSEHOLD SIZE $_{4\ members}$	0.006	*0.038*		0.003	*0.017*		0.002	*0.014*		-0.004	*0.024*		-0.007	*0.045*	
HOUSEHOLD SIZE $_{more\ than\ 4\ members}$	0.148	*0.078*	*	0.047	*0.016*	**	0.011	*0.014*		-0.094	*0.045*	*	-0.113	*0.037*	**
NUTRITIONAL KNOWLEDGE	-0.128	*0.040*	***	-0.059	*0.020*	**	-0.051	*0.018*	**	0.082	*0.028*	**	0.157	*0.049*	**
TIME SPENT CHOOSING A NEW FOOD PRODUCT	-0.073	*0.032*	*	-0.030	*0.012*	**	-0.020	*0.007*	**	0.048	*0.021*	*	0.076	*0.028*	**

Significance: *** p < 0.01; ** p < 0.05; * p < 0.10