Time Preference and Health: The Problem of Obesity

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Abstract

Consumer inability to make healthy food choices and to maintain a balanced diet is one of the main determinants that can explain the growth of overweight and obesity. Many studies have focused on the different factors affecting food behaviour, but only few of these have considered the role of time preference. The term time preference refers to the rate at which a person is willing to trade a current utility with a delayed utility. Generally, a high time preference is associated with a low will to renounce to the present gratification in order to obtain a benefit in the future. On the contrary, consumers with low time preference are more willing to undertake short-term costs to get future improvements. Indeed, people who highly discount the future are expected to suffer overweight and obesity more than others. In this paper we aim at investigating if consumer time preference could be related to overweight or obesity problems, also considering other factors which are predicted to affect BMI. In order to carry out an empirical analysis we conducted a consumer survey using face to face interviews. The sample was composed by 240 consumers living in North Italy. A specific questionnaire was designed and for the empirical estimation was used an Ordinal Regression Model, where the dependent variable is expressed in terms of consumer BMI. The results revealed that the searching frequency for nutrition claims is negatively correlated with BMI. This suggests that this kind of information is not very effective in catching overweight and obese consumer attention. Moreover, the results show that time preference is negatively related to BMI, meaning that to give more importance to taste than to healthy aspects of foods may lead consumers to increase their probability to put on weight.

Key words*: time preference, BMI, consumer, Ordinal Regression Model.*

JEL classification: [Q18, D12, I18]

1 Introduction

The problem of over-nutrition has gained global dimensions in the last few decades. According with OECD data, since 1980 overweight and obesity rates are doubled and even tripled in many OECD countries (OECD, 2012a). OECD predicts that these numbers are expected to grow over again: in 2020 around two out of three people will have a Body Mass Index (BMI) value higher than 25 (OECD, 2012a).

The problem of over-nutrition is not only health-related but also economic. Obesity is strongly associated with considerable sanitary costs (Chou *et al*., 2004; Yaniv *et al*., 2009; Cawley and Meyerhoefer, 2012; Ruhm, 2012). These include direct costs like medical care or pharmaceutical charges, and indirect costs due to the loss of productivity caused by the increase of morbidity and mortality (Rosin, 2008; Banterle and Cavaliere 2009; Molini *et al*., 2010).

Economists in the last decade have tried to understand the causes of obesity focusing on the different drivers affecting the problem of over-consumption, analysing factors such as food technological improvements, industrialisation, mass production of foods, reduction of prices,

modifications in food composition, sedentary lifestyle and the great amount of junk food (Cutler *et al*., 2003).

In the last years, growing attention is noted for consumer individual characteristics in explaining the problem related to over-consumption, but few consideration has been dedicated to time preference issues linked to excess weight problem. The term time preference refers to an individual characteristic that represents the rate at which a person is willing to trade a current satisfaction with a future benefit (Becker and Mulligan, 1997; Bishai, 2001; Komlos *et al*., 2004; Smith *et al.,* 2005). This characteristic could heavily affect consumer food choices and influence the extent at which a person invests in health. Health investments include all activities that can exert a positive effect on the health status, including food habits. People with a high time preference show a tendency to discount health investments value, giving more importance to the current satisfaction. They have a low will to renounce to the present gratification to get health benefits in the future. On the contrary, those having a low time preference are generally more willing to improve their health by consuming healthy foods sacrificing taste, or spending more time doing exercise. These highlights show the importance to further investigate the role of time preference in relation to obesity.

The purpose of this paper is to analyse which could be the role of time preference in explaining overweight and obesity problem. In other words, we try to better understand the relationship between BMI and time preference, also considering other drivers related to excess weight condition. Therefore, we test if low time preference level could be associated with a decreased probability to become overweight or obese.

The empirical analysis has been conducted in Italy, through an *ad hoc-questionnaire* on a sample of consumer resident in Milan.

The present work is organized as follows: in the second section we provide the economic issue and a literature review concerning the relationship between time preference and over-nutrition; in the third section the conceptual framework is described, and in the fourth we explain the methodology. In section 5 we analyse the results and finally in the last section we provide the conclusions.

2 Economic Issues

An interesting approach to study economic issues related to health comes from Michael Grossman's theory on the *demand for health* (1972). In this work he treats health as an economic good, describing it as a capital stock that everyone inherits at birth, and that depreciates with aging. This depreciation can be offset by some investments, both direct investments like medical care, and indirect investments, which can be grouped in the so called 'health behaviours'. In this paper the terms 'health investments' and 'health behaviours' are used with the same significance. They are defined as 'behaviour patterns, actions and habits that relate to health maintenance, to health restoration and to health improvement' (Gochman, 1997). According with Grossman's theory, the health state is therefore the result of the individual health investments. Since healthy behaviours imply a trade-off between a current utility and a delayed utility (Bishai, 2001), the rate at which a person invests in health could be heavily influenced by time preference.

Consumers with a high time preference are characterized by low self-control and tend to consider present utility more than future benefits. A low time preference is, instead, associated with high self-control levels. These people are more patience and tend to value future utilities more than present gratifications. For these reasons, consumer time

preference could affect the degree of health investments, and consequently healthful activities.

Thus, time preference can be seen as measure of impatience. It affects consumer willingness to undertake a cost in the present in order to get a coming benefit. Time preference comes into play every time a consumer has to face with an intertemporal choice, that is any situation in which it is necessary to decide whether to get an immediate gratification or a future benefit (Chapman *et al.,* 2001; Frederick *et al.,* 2002)

Impatience (or time preference) can be measured using the intertemporal discount rate ($1/1+\sigma$) that allows to estimate the present value attached to future utility (Komlos *et al.,* 2004). In this formula (σ) is time preference. The value of the future health benefit decreases when (σ) rises. When, instead, future utility is valued equals to the utility derived from present consumption, (σ) equals 0 and the consumer intertemporal discount rate is 1. The discount rate equals 0 when consumer impatience is maximum and the future utility is not considered at all. In the last case $\sigma = \infty$.

Several studies have underlined the role of time preference in influencing consumer healthy behaviours (Fuchs, 1991; Chapman *et al*., 2001; Rosin, 2008; Mazzocchi *et al*., 2009), but only few of these have analysed the relationship between time preference and consumer excessive body-weight (Smith et al., 2005; Zhang and Rashad, 2008).

Komlos *et al.* (2004) founded that people who highly discount the future are generally more obese. Consumer impatience leads to behave in order to get an immediate gratification from consumption, omitting to evaluate the negative consequences on health. In this context, the sensory dimension of food prevails on the nutritional aspect. Another evidence about the existence of the relationship between BMI and time preference comes from Smith *et al.* (2005). They use consumers saving and dissaving information as a proxy for time preference, and related these data with BMI. Their results confirm that time preference is positively correlated with body-weight levels. The economic literature also shows a possible association between time preference and addictive behaviours: persons with high tendency to depreciate future outcomes seem to be more prone to develop addictions (Becker and Murphy, 1988; Cutler and Glaeser, 2005), and food one may be included. This could be due to two main reasons: first, the consumption of addictive substances greatly increases consumer present utility (Becker and Mulligan, 1997); second to the fact that caloric consumption could be addictive (Becker and Murphy, 1988). At the same time, the opposite relation has been founded: addictions could increase individual's time preference by inducing to discount future outcomes more heavily (Becker and Mulligan, 1997).

In this context, we may argue that those having a high time preference show a high tendency to discount the negative consequences that an unhealthy life style can exert on the health status. Therefore, these consumers are predicted to suffer overweight and obesity more than others. On the contrary, the efforts to preserve the health stock should be high when time preference rates are low. In this case, consumers should be less likely to become overweight or obese.

3 Conceptual Framework

Our conceptual framework has been designed in order to empirically analyse the relationship between BMI and some factors predicted to affect overweight and obesity rates, with a particular focus on the role of consumer time preference.

Figure 1 depicts our conceptual framework in more details. In the next paragraphs it is explained how socio-demographic conditions (gender and age), time preference, physical

activity, weight check, nutrition knowledge and the searching frequency for nutritional claims can affect consumer body weight.

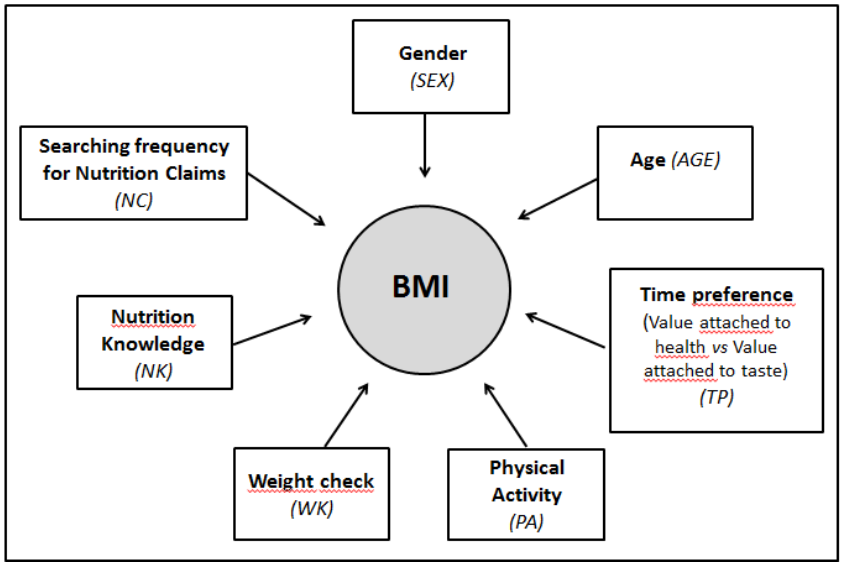

Figure 1. Conceptual framework

3.1 Socio-demographic conditions

Some studies concerning the causes of obesity have shown a correlation between obesity and gender. In detail, men seem to have a higher tendency to become overweight or obese (Banterle and Cavaliere, 2009). Moreover, in 2012 the Organisation for Economic Co-operation and Development (OECD) stated that the percentages of obese men are growing more rapidly than that of women (OECD, 2012b).

The economic literature also shows a positive correlation between BMI and age. Baum and Ruhm (2009) made an in-depth analysis on the relationship between obesity rates, socioeconomic status and age, founding that body weight grows on the average by 0.12 kg/m^2 per year of age. Their results are consistent with that of Miljkovic *et al*. (2008) who also reported that consumers tendency to put on weight increases with ageing. These highlights could be due to the fact that older people generally reduce their physical activity and their energy expenditure favouring weight gains (Maennig *et al*., 2008). Moreover, getting older might lead consumers to attribute less importance to long-term investments in health, since future is seen as something brief.

3.2 Time preference

As we fully discussed in the second section, consumers characterized by high levels of time preference attribute less importance to future health benefits. This attitude can significantly influence food-purchasing behaviour, as it is able to determine the direction of consumer food choices: taste oriented or health oriented.

This can be explained using the intertemporal discount rate theory. According with Chapman *et al*. 2001, the two terminologies discount rate and time preference are equivalent. The discount rate represents consumer willingness to undertake a short-term cost in order to obtain an improvement in the future. That is, that the highest a person discounts the future, the highest is the importance attributed to the present utility.

A cost and benefit analysis connected to food choices comes into play during purchasing, since consumers have to decide between tasty foods or healthy ones. In particular, for those individuals with a high tendency to depreciate the value of future outcomes the cost of the renounce (e.g. avoid to buy a fatty but tasty snack) exceeds the value attached to the future health benefit (Mazzocchi *et al*., 2009). On the contrary, consumers having a low time preference will attribute more value to the future outcomes (better health status) then to the current utility (pleasure deriving from eating a tasty snack).
The importance of healthy food habits in preventing weight-related problems is well known and many studies highlight this relationship. Schroder *et al.* (2004) reported the existence of an inverse correlation between obesity and the Mediterranean diet, based on a balanced consumption of cereals, fruits and vegetables and on a reduced intake of fats and salt. Nevertheless, consumers are often unable, or unwilling to prefer healthy foods instead of tasty but generally fatty ones. The reasons of consumer irrational behaviour are multiple, but among these, time preference has a significant role.
It must also be considered that the effects of an unhealthy diet on health do not appear immediately, reducing consumer risk-perception and leading to depreciate future consequences (Fuchs, 1991; Blaylock *et al.*, 1999; Frederick *et al*., 2002). The evaluation of the costs and benefits of food choices is always linked to uncertainty. During food purchasing, consumers have no certainty that health-oriented choices could be reflected in future health improvements.

3.3 Physical activity

Significant associations between physical activity and health have been amply demonstrated. Exercise is related to a decreased probability to fall into cardiovascular events (strokes, hypertension, coronary heart diseases), and even in some types of cancer (colon and breast cancer in particular) (Fuchs, 2011), but above all, physical exercise is positively associated with a decreased risk to be overweight or obese (Lakdawalla and Philipson, 2002). BMI increases when a prolonged situation of positive energy balance occurs, that is, that the calorie intake exceeds the calorie expenditure. Engagement in physical activity is effective in increasing the energy expenditure, reducing the probability to gain weight. For these reasons, regular exercise can be considered a health behaviour.

3.4 Weight check

Another independent variable included in in our framework is represented by consumer periodical weight-checks. This behaviour is generally more common in people who attribute high attention to health. Regular weight checks could be associated both with a high attention to health and a heavy determination not to incur in overweight or obesity problems.

3.5 Nutrition knowledge

Since the awareness of food characteristics is the first step to make healthy food choices, consumer nutrition knowledge has a determinant role on food behaviours. Many studies show that a high level of nutritional knowledge is positively related to a reduced risk to become overweight or obese (Blaylock *et al.,* 1999; Kim *et al*., 2000; Nayga, 2000; Drichoutis *et al*., 2006; Nayga, 2008; Drichoutis *et al.,*2009; Mazzocchi *et al.,* 2009; Barreiro-Hurlè *et al.,*

2010; Chang and Nayga, 2011). We may argue that, the higher is the consumer knowledge about food issues, the higher is the probability to make healthy choices.

3.6 Searching frequency for nutrition claims

Food labels are considered the most important instruments through which consumers can learn the properties and attributes of foods. Varyam and Cawley (2006) in their analysis conducted on American consumers compared the changes in body weight before and after the implementation of the nutritional labelling in the USA in 1990. They found that those who usually read nutritional information showed a lower tendency to gain weight, reducing the risk to become obese. The presence of such information, if used, can lead consumers to make better food choices (Drichoutis *et al.,* 2005; 2008).
A particular way to communicate food properties trough labels is constituted by nutrition claims. This kind of claims represents a tool trough which consumers can obtain short information about food composition or about beneficial properties (Dean *et al.,* 2012).

4. Data and description of the variables

To empirically test our conceptual framework we conducted a consumer survey based on personal interviews using an *ad hoc* questionnaire, from November to December 2011. The questionnaire was pre-tested trough a pilot test on a small sample of 40 consumers in order to ascertain the questions' interpretability. The survey was carried out in the city of Milan in northern Italy, where we totally collected 240 observations. Consumers were interviewed outside the stores and the retailers' selection was based on a random sampling stratified with respect to geographical distribution. Moreover, the selection took into account the shop sizes: 18 retailers were selected, including 12 supermarkets and 6 hypermarkets. Considering the bigger dimensions of the hypermarkets rather than that of supermarkets, we interviewed 20 consumers for each hypermarket, and 10 for each supermarket.
The questionnaire was organized in a multiple-choice format with rating or dichotomous scales. The variables included in the questionnaire were in line with the search areas of the conceptual framework depicted in Figure 1.
Table 1 describes the variables employed in the model, with their means and standard deviation.

Table 1. Variables definition

Variable name	Scale	Description	Obs	Mean	SD
Dependent variable					
Body Mass Index (BMI)	scale (1-4)	Body Mass Index (Kg/m^2) 1 underweight, 2 normal weight, 3 overweight, 4 obese	240	2.43	0.74
Independent variables					
Gender *(SEX)*	dummy (0-1)	1 female, 0 male	240	0.54	0.5
Age *(AGE)*	scale (1-6)	The interviewee's age group (18-24; 25-34; 35-44; 45-54; 55-64; >64)	240	3.81	1.64
Time preference (Value attached to health VS Value attached to taste) (*TP*)	dummy (0-1)	Respondents choose their dietary patterns paying attention to health=1, or taste=	240	0.6	0.49
Physical activity *(PA)*	dummy (0-1)	Respondent practices sport once a week 1, otherwise 0	240	0.71	0.45
Weight check *(WK)*	scale (1-5)	Respondent checks their weight from never = 1, to every day=5	240	3.25	1.26
Nutrition Knowledge *(NK)*	scale (0-5)	Nutrition knowledge levels from very low =0, to very high =5	240	3.47	1.16
Nutrition claims *(NC)*	scale (1-5)	Searching frequency for nutrition claims from never=1, to always=5	240	2.5	1.45

The first variables of the questionnaire looked upon the socio-demographic conditions: gender *(SEX)* and age *(AGE)*. These information are necessary to accurately describe the profile of the sample interviewed.

Concerning consumer time preference *(TP),* we created a proxy asking the interviewed to reveal which is the prevailing factor affecting their dietary patterns choosing between health or taste. The variable assumes value '0' when the answer is taste, and value '1' when answer is health. This proxy differentiates from others used to estimate time preference in relation to BMI, because it directly relates to consumers dietary choices. Indeed, some studies have measured time preference using consumer savings or dissaving rates information (Smith *et al*., 2005), or also using hypothetical monetary choices (i.e. 100 dollars now or X dollars in 6 months) (Fuchs, 1991; Borghans and Golsteyn, 2006; Adams and Nettle, 2009; Ikeda *et al*., 2010). The main limitations of these measurements are that saving rates may be influenced by other elements than time preference, and that monetary-time preference could be different from health-time preference.
In the attempt to solve these limitations we construct our time preference proxy basing on consumer motivations in food choices.
To investigate consumer health-attitude, we asked them about some healthy habits like practicing physical activity *(PA)* and undertaking regular weight checks *(WK)*.
Concerning the nutritional issues, we inserted in the survey some questions on nutritional knowledge and others on the searching frequency for nutrition claims.
To test the different level of consumer nutritional knowledge we take into account five questions on different macro nutrient categories of food products (carbohydrate, fibre, fat, cholesterol and protein). At each questions the answers could assume values from 1 to 3. Then, we construct an index *(NK)* from 0 to 5, in which value '0' corresponded to the lowest nutrition knowledge and value '5' to the highest.
We also included questions on searching frequency for nutrition claims *(NC)*. Since claims represent information about food properties, their searching may denote a high interest for nutrition attributes of food products.
We used Body Mass Index (BMI) as a measure of obesity condition. It is defined as the weight in kilograms divided by height in meters squared: BMI= Kg/m^2. Both these measures were self-reported. According with WHO classification, we divided the sample into four BMI categories. Each one assumes a different value of the dependent variable: value 1 corresponds to underweight consumers (with BMI levels <18.5), value 2 to normal-weight consumers (with BMI levels from 18,5 to 24,9), value 3 groups overweight individuals (with BMI levels from 25 to 29.9), and value 4 identifies obese persons (with BMI level > 30).
The data were analysed through an Ordinal Regression Model (ORM), since the dependent variable was discrete and ordered. The ORM takes the following form (Liao, 1994):

$$\theta_j = \frac{\Pr(y \le j|\mathrm{x})}{\Pr(y > j|\mathrm{x})} = \frac{\Pr(y \le j|\mathrm{x})}{1 - \Pr(y \le j|\mathrm{x})}$$

$$c_j(\mathbf{x}) = \ln(\theta_j) = -[\beta_1 x_1 + \ldots + \beta_k x_k + \ldots + \beta_n x_n] + \tau_j$$

The dependent variable is expressed in terms of BMI. All the other variables described above take part into our model as regressors. The equation is the following:

$$BMI = \beta_0 + \beta_1 SEX + \beta_2 AGE + \beta_3 TP + \beta_4 PA + \beta_5 WK + \beta_6 NK + \beta_7 NC$$

With the aim to obtain a detailed profile for each consumer group, after the ORM, the marginal effect computation has been made separately for each BMI category included in the model. This technique is helpful to better understand the differences in predicted probabilities between the observations in one category, and the relative observation in the reference category.
Hence, for instance, the computation of the marginal effect for the second consumer category (normal-weight) allows to estimate how much more (or less) likely normal-weight were to succeed than were underweight; similarly, the marginal effect for overweight would show us how much more (or less) likely overweight were to succeed than were normal-weight, etc.

5 Results

5.1 Descriptive analysis

The sample, composed by 240 consumers, consists of 54.6% of women and 45.4% of men. Referring to age, 10% of the sample is aged between 18-24, 17% between 25-34, 18% between 35-44, 15% between 45-54, 20% between 55-64 and 20% over 65. These percentages are in line with the data concerning the Milan population distribution provided by the Italian Central Institute of Statistics (ISTAT). Regarding the level of education, the most part of the sample (43%) has a high school diploma, 35% has a high level of education, and 22% has a secondary or primary education.
With respect to the household income, the greater part of the sample (42.9%) declares a net income for month between 1500-3000 €, 24.2% between 800-1500 €, 17.9% between 3000-5000 €, 10.4% over 5000 €, and only 4.6% under 800 €. Moreover, concerning the households size, most part of the sample (36.0%) is composed by households with 2 components, 24.6% with 3 components, 23.3% are single and 16.1% with 4 or over 4 components.
Figure 2, depicts the distribution of the sample with respect to BMI. The most represented category is that of the normal-weight consumers.

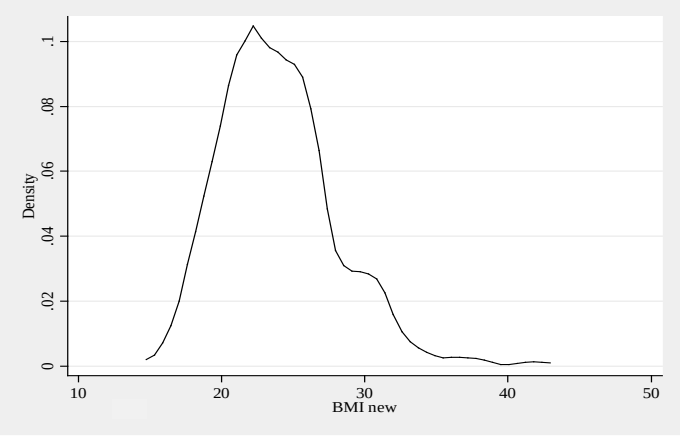

Figure 2. BMI distribution of the sample**.**

5.2 Estimation results

Table 2 reports the results of the estimation of the ORM used to analyse the link between BMI and the variables employed in the model. With regard to gender (-1.205), it appears that, *ceteris paribus*, the highest BMI levels are registered among men. Moreover, the

results show a positive correlation between BMI and age (0.300) highlighting that the highest BMI levels in the sample are observed among the oldest consumers. These findings are in line with those of recent findings in the economic literature (Miljkovic *et al*. 2008).
According with our hypothesis, time preference seems to have an important role on BMI values variations. A decrease in the value of this variable (more importance to taste than to healthy features) is associates with an increase of BMI levels (-1.146). On the contrary, when health is the prevailing motivation in determining food behaviours, consumers have low BMI levels. Therefore, we can confirm our hypothesis that a high time preference could be associated with an increased probability to become overweight or even obese.
Moreover, as expected, the variable physical activity is negatively associated with BMI (-0.490). Since engagement in physical activity is effective in increasing the energy expenditure, consumers who regularly practice exercise are less likely to gain weight. Many studies support this empirical evidence, demonstrating that physical activity is positively associated with a decreased risk to become overweight or obese (Lakdawalla and Philipson, 2002).
The variable concerning consumer habit to check body weight is negatively related to BMI (-0.214). This result can be seen as an attitude to care about health, since regular weight checks could be associated both with a high attention to health and to a heavy determination not to incur in overweight or obesity problems.
Concerning the searching frequency for nutrition claims, the analysis reveals a negative correlation between these information and BMI levels (-0.217). This relation is confirmed by several studies, which report that those who use nutritional information show a low tendency to gain weight, reducing the risk to become obese (Varyam and Cawley, 2006).

Table 2. Ordinal regression model and marginal effects**.**

	ORM	**MARGINAL EFFECT after ORM**			
		Under-weight	Normal-weight	Over-weight	Obese
α_1	-4.627				
	(0.828)				
α_2	-0.834				
	(0.758)				
α_3	1.308				
	(0.769)				
Gender *(SEX)*	-1.205 ***	0.043 **	0.236 ***	-0.199 ***	-0.079 ***
	(0.277)	*(0.042)*	*(0.054)*	*(0.046)*	*(0.023)*
Age *(AGE)*	0.300 ***	-0.011 **	-0.059 ***	0.052 ***	0.018 **
	(0.084)	*(0.004)*	*(0.174)*	*(0.015)*	*(0.005)*
Time preference (Value attached to health VS Value attached to taste) *(TP)*	-1.146 ***	0.038 **	0.231 ***	-0.189 ***	-0.080 **
	(0.291)	*(0.013)*	*(0.060)*	*(0.049)*	*(0.026)*
Physical activity *(PA)*	-0.490 *	0.016 *	0.101 *	-0.084 *	-0.033 *
	(0.286)	*(0.009)*	*(0.608)*	*(0.049)*	*(0.025)*
Weight check *(WK)*	-0.214 **	0.005 *	0.042 *	-0.037 *	-0.013 *
	(0.108)	*(0.004)*	*(0.022)*	*(0.019)*	*(0.007)*
Nutrition knowledge *(NK)*	0.126	-0.004	-0.025	0.013	0.008
	(0.118)	*(0.004)*	*(0.024)*	*(0.020)*	*(0.007)*
Nutrition claims *(NC)*	-0.217 **	0.008 **	0.043 **	-0.038 **	-0.013 **
	(0.097)	*(0.005)*	*(0.0120)*	*(0.017)*	*(0.006)*
Observation	240				
Pseudo R2	0.110				

Note: Robust standard errors in round brackets . ***,** ,*: significant at 1, 5 and 10 percent level, respectively.

In the second step of our analysis, after the ORM, we computed the marginal effect to emphasize some interesting results and highlight the differences in each value assumed by the dependent variable.
The most interesting differences concerning marginal effect analysis emerge when shifting from normal-weight to overweight consumers. Indeed, the marginal effect computation for overweight shows an opposite pattern of signs and magnitudes in comparison with the normal-weight one.
Contrary to the normal-weight consumers, the probability to be in the class of overweight is higher for men and for older people. Being overweight is also associated with infrequent weight checks and with a scarce searching frequency for nutrition claims. The predicted probability to be overweight decreases by 8.4% when physical activity is practiced regularly, confirming that exercise plays an important role in the reduction of BMI. Moreover, according with our hypothesis, the predicted probability of being overweight decreases by 18.9% when consumers base their food habits on the health aspect. This finding is particularly relevant in our study. This seems to establish the role of time preference in food behaviours, showing that low time preference could be strictly associated with improvements in health due to a reduced probability to incur in overweight problems.
The same pattern of signs is shown in the last category. The marginal effect estimation for obese consumers reveals that men are much more obese than women, and that obesity increases with age. As like as overweight, also obesity condition seems to be associated with infrequent weight checks and nutrition claims searching. This underlines, in some ways, the scarce interest of this consumer category in health maintenance and in food information. The predicted probability of being obese decreases by 0.3% when physical activity is regular, and also time preference is negative and significant. Even in this case, the role of time preference seems to be fundamental: the predicted probability decreases if consumers attribute more importance to health than to taste.

6 Concluding remarks

This paper aims at evaluating the overweight and obesity problems, focusing in particular on the role of consumer time preference. The hypothesis tested in this work was that low time preference rates could be associated with a reduced probability to become overweight or obese. For this purpose, we used the Ordinal Regression Model followed by the marginal effect analysis. This technique allowed us to make a comparison between these consumer categories, identifying the main differences among groups.
The results suggest that men are more exposed to obesity than women, and that obesity rates increase with age. Moreover, according with the economic literature, our findings show that physical activity has a central role in preventing consumers from gaining weight. Overweight and obese consumers are less likely to make regular weight checks, and this could be attributed to a scarce concern in health issues. Moreover, the searching frequency for nutrition claims is negatively linked with BMI. This could denote a lower level of interest in food health-related issues by the side of overweight and obese consumers than by the side of normal-weight. It seems that this kind of information is not very effective in catching overweight and obese consumer attention. A possible explanation could be that claims are perhaps more useful for individuals interested to health features of food products.
Moreover, the results show that time preference is negatively related to BMI, meaning that to give more importance to taste than to healthy aspects of foods could lead consumers to increase their probability to put on weight. This finding is remarked in the marginal effect

analysis. Considering the normal-weight consumers, they show a low level of time preference. These consumers seem to be more careful about the healthiness of their food choices. Shifting from normal-weight to overweight and obese consumers, an opposite correlation between BMI and time preference is observed. This seems to reveal that overweight and obese are more taste-oriented than normal-weight ones and this could be due to their high time preference. According with these findings, our starting hypothesis should be confirmed: low time preference rates could be positively related to low BMI, as like as high time preference could be associated with a higher probability to put on weight.

The main aspects that emerge from the analysis regard the scarce interest for nutrition claims and the important role played by individual level of time preference.

Regarding the first finding, to add a specific kind of information vehicle, like the Traffic Light System, to the traditional food label may be helpful to capture overweight and obese consumer attention. This system is a graphic symbol that uses the colours of the classic traffic light to give whole nutritional information of the product and it is able to rapidly and easily inform about the 'nutrition property range' of foods. It seems that this labelling could be able to address consumers to healthier choices (Balcombe *et al*., 2010; Berning *et al*., 2010).

The second evidence regards the important role played by time preference in explaining overweight and obesity problems. A possible intervention could be represented by information campaigns aimed at improving consumer knowledge about the relationship between diet and health. Unhealthy dietary habits have long-term consequences and this leads consumers to depreciate future negative outcomes. In addition, consumers are often insufficiently aware about the disabilities that obesity can cause (Kan and Tsai, 2004). Nutrition education should be focused not only to nutrition concerns, but also to health-related concerns. An improved knowledge about obesity consequences could be helpful for consumers to change taste oriented dietary patterns into health oriented ones. Thus, a health-education intervention could be effective in decreasing the rate at which consumers discount the future, by reducing time preference.

Another measure to induce consumer to healthy food choices, could be represented by a different food-shelves organisation into the supermarkets. Indeed, some studies argue that the spatial proximity to the object of desire, the presence of smells or even sounds could be associated with increased impatience and impulsive behaviours (Frederick et al., 2002). Into the supermarket, lights, music and dedicated corners are designed to emphasize the attractiveness of food products. This can increase consumer time preference leading to instinctive purchasing behaviours. For this reason, it could be very important to modify the arrangement of food-shelves, placing healthier foods in the central lines. Similarly, the presence of snacks or other junk foods near the cash registers should be discouraged.

This work adds some findings concerning the relationship between time preference and BMI. The main strengths of this study regard: first, data collected from vis-à-vis interviews, and second the use of a proxy to measure time preference that is strictly connected to food choices. On the other side, the main weaknesses of this work regard the small sample size, and the fact that we have based our analysis on stated preferences. Thus, the results may suffer from these biases.

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