THE MANY FACES OF FOOD SUSTAINABILITY: THE OBESITY ISSUE

JEL classification: D18; I18; M31

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Abstract. *The paper focuses on the issue of obesity, which has become one of the most insidious world epidemics and a serious threat to global health. The aim is to highlight the relationships between obesity and the sustainability of the food system and to discuss the effectiveness of different policies that could be implemented to address the problem. An empirical analysis has been carried out, aimed at assessing the relationship between price and energy density of foods and price premium for low-calorie foods. The main conclusion of the paper is that the aim of reducing obesity, which is a priority for food sustainability policies, cannot be achieved without regulatory intervention designed to reverse relative prices between obesogenic and healthy foods.*

Keywords: *obesity, energy density, diet cost, state intervention.*

1. Introduction

A very general definition of sustainable food is a food which is healthy for people and the planet, with reference to both the present and the future (Reisch, 2010). The concept of sustainable food brings to the fore various health, environmental, social and ethical concerns in the food chain. The non-sustainability of the present food system is documented by many data, among which: the high contribution of the food system to global warming (the global food system is accountable for nearly 50% of total world GHG emissions, according to Grain (2009); the enormous food waste and loss, i.e. food that is discarded or lost uneaten, which annually accounts for 1.3 billion tons of food, namely about one third of global food production; the health emergency related to hunger and obesity, with over a billion people in the world who go hungry and about the same number who are overweight (the WHO calls this "the double burden" of world food insecurity).

The paper focuses on the issue of obesity, which has become one of the most insidious world epidemics and a serious threat to global health. The aim is to highlight the relationships between obesity and the sustainability of the food system and to discuss the effectiveness of different policies that could be implemented to address the problem.

The paper is organized into two sections. In the first section, obesity is framed as a problem of food consumption sustainability and the different policies designed to prevent and control obesity are assessed accordingly. In the second section, the case of low calorie food price is addressed. Through the results of an empirical research recently carried out at the University of Naples, it

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is shown that the price differential between obesogenic and healthy foods is an important factor which may offset public efforts to tackle obesity.

The main conclusion of the paper is that the aim of reducing obesity, which is a priority for food sustainability policies, cannot be achieved without regulatory measure designed to reverse relative prices between obesogenic and healthy foods.

2. Obesity and food consumption sustainability: a policy agenda

In a broad perspective to be sustainable must be safe and healthy in amount and quality; and has to be carried out through means that are economically, socially, culturally and environmentally sustainable – minimizing waste and pollution and not jeopardizing the needs of others (Reisch *et al.*, 2010). According to this definition, obesity is clearly at odds with food consumption sustainability. Obesity is highly correlated with many non-communicable diseases, and therefore provides evidence of unhealthy food consumption. Moreover, it has been proven that obesity has a negative impact on the environment. Fatter populations need 19 percent more calories to survive and an obese person produces one ton more of carbon emissions than a thin person. Edwards and Roberts (2009) estimated the impact on greenhouse gas emissions of increases in the population distribution of body mass index (BMI). They found that, compared with a normal population distribution of BMI, a population with 40% of obese persons requires 19% more food energy for its total energy expenditure. They estimated that greenhouse gas emissions from food production and car travel due to increases in adiposity in a population of 1 billion are between 0.4 Giga tonnes (GT) and 1.0 GT of carbon dioxide equivalent per year.

While obesity is a multidimensional phenomenon, affected by many factors (socio-cultural, individual-psychological, economic, political, structural, and so on), nonetheless it arises directly from consumption decisions; therefore policies aimed at tackling obesity must modify consumption behavior, either directly or indirectly.

As shown in figure 1, obesity policies are generally targeted towards consumers, trying to change consumer preferences and habits with at least four types of intervention: communication campaigns and food education; market incentives, directly to consumers and indirectly to producers; regulations, in the field of labeling, advertising and junk food sales; infrastructure measures to promote physical activities and the availability of healthy foods.

Fig. 1 - Policies to counteract obesity

Communication policies	Market incentives	Regulations	Others
Communication, social marketing, public information campaigns	Market incentives for consumers (taxes and subsidies)	Mandatory labeling (nutrition facts and menu labels)	Improving infrastructures to increase physical activity
Education (mainly as school food education programs)	Farmers market incentive programs for increasing fruit and vegetable consumption	Regulation of junk food sales (mainly in school and hospitals)	Regulating retail food establishments for improving the availability of full-service supermarkets
Point of purchase, marketing, and advertising policies		Advertising regulation (targeted mainly at children)	

Policies so far experienced in the United States (see figure 2) have focused on consumer information and on children's food education. Other tools, -such as economic incentives, infrastructure support and regulation- relate to a small number of measures (Gostin *et al.*, 2009; European Commission, 2007; Faulkner *et al.* 2011; Sacks *et al.*, 2008). In the European Union also -where interest in obesity policy is, however, small compared to the USA-, the attention has been directed mainly to children, including measures such as: nutritional education campaigns, promotion of physical activity and proposed regulations for unhealthy food advertising aimed at children (EU Platform on Diet, Physical Activity & Health).

Obesity policies so far implemented have given scant results. Over the last twenty years, a period in which many obesity policies have been implemented, the obesity rate in US has continued to grow. Such a failure may be interpreted in several ways. Two main sets of problems can be identified: the first related to the predominance of communication policies with respect to regulation and market based instruments; the second related to some important mechanisms which prevent communication policies from giving the expected results.

2.1. The predominance of communication policies with respect to regulation and market based instruments

There is wide consensus that in order to tackle the public health burden of obesity effectively it is necessary to combine a large array of measures. Therefore, together with information and educational campaigns, regulatory and market-based instruments should be used. Even if the existing literature is quite limited in quantity and scope, studies carried out so far have shown the positive effects of regulatory and market intervention (Sacks *et al.*, 2009). There is broad agreement on the deleterious impact of agricultural policy on the prevalence of obesity in North America (Schaffer *et al.*, 2007). As a consequence, an important priority for obesity policy should be to modify agricultural support policies and food subsidies so as both to lower the prices, and to increase the availability of fruit and vegetables. There is also consensus on the effectiveness of the imposition of a tax on high calorie sweetened beverages and subsidies for fruit and vegetable consumption for children and low-income households. In general there is evidence that lower prices of fruit and vegetables are associated with lower child weight. In general, imposing substantial taxes on fattening foods may improve health outcomes such as body weight and chronic disease risk (Thow *et al.*, 2010). Notwithstanding the positive expected effects of regulations, taxes and subsidies, these measures have been applied very rarely and to a limited extent, due principally to the following reasons: 1- these forms of intervention directly interfere with the functioning of markets, and this is at odds with the neoliberal ideology which has been dictating food policy over the last 25 years (Sodano, 2012); 2- even supporting a more interventionist state, some measures, such as taxes on fats and sweet beverages, may be opposed because of their regressive effects; 3- producers' lobbies, at farm, manufacturer and retail level, strongly try to block any form of regulation and tax; 4- consumers may also disagree, when they perceive the state as paternalistic and their freedom of choice at risk.

2.2. Mechanisms which prevent communication policies from producing the expected result

When designing consumer communication policies, it is generally taken for granted that the more information consumers have on the negative impact on health of their current consumption and on healthier alternatives, the more they will switch to healthy diets. Instead, it has been documented that this is often not the case. The failure of consumer communication

policies is due to the same three arguments generally used for explaining the failure of sustainable consumption policies: the knowledge-to-action gap; the behaviour-impact gap problem; the rebound effect;

A knowledge-to-action gap exists to the extent that the knowledge and the awareness of health problems is not sufficient to change consumer behavior and lifestyles. This gap depends mainly on four factors. Firstly, there may not be adequate alternative consumption options; these might be unattractive, due to dominant tastes and social norms, too expensive, or requiring a high "purchasing effort" (i.e. hard to find). Secondly, consumers might not be adequately motivated to change their habits. Consumption decisions are influenced by a multitude of values and criteria competing with health goals. Consumption is strongly influenced by socio-economic conditions, leading to a conflict between different personal attitudes and values (Gastersleben *et al*., 2002). Furthermore, business communication strategies often confuse consumers, soliciting purchasing motivations which contrast with healthy and sustainable diets. Thirdly, the knowledge-to-action gap may be due to the discursive confusion faced by consumers when striving for better consumption practices (Markkula, Moisander, 2012). When the informative and socio-cultural frameworks become too complex and imbued with contrasting opinions and value judgments, consumers tend to stick to dominant habits, unable to make radical changes. Finally there is the phenomenon of akrasia, i.e. a weakness of will that prevents consumers from "not eating the wrong food", even if this is at odds with their utility function (Mann, 2008).

The behaviour-impact gap is confronted whenever the required behavioral change is achieved, but the observed effect on weight and health is minor or missing. In other words: "even when the required behavior changes do happen, the results may lag far behind what was originally expected; inconsistencies can be found between the behavior of consumers and the outcomes observed" (Csutora, 2012). The gap can be due to a miscalculation of the effective weight reduction resulting from diet-improving behaviors because of bounded rationality or external unexpected interference (for example a reduction of physical activity consequent on job and/or family constraints).

Finally, the rebound effect refers to a behavioral or other systemic response to a measure taken to reduce environmental impact (in the case of obesity the weight or health impact) that offsets the effect of the measure (Hertwich, 2005).[1] In the case of food education and communication policies to contrast obesity a rebound-type of effect is related to the strategic response of food companies to the new consumer preferences and cognitive attitudes created by these policies. Companies can take advantage of the induced higher preference for "healthy food" by launching new lines of low-calorie (light) products, thereby carrying out differentiation and price discrimination strategies, with consequent increase in market power and social welfare losses. The same companies will continue to sell low price high-calorie foods to low-income consumers (and to the same rich consumers buying the expensive light products, but affected by akrasia) and will use their higher profits and power to oppose other obesity policies such as regulations and taxes. The net final outcome might be higher average food prices and higher average weight among the population.

[1] The typical example is the case of energy-saving devices which, while reducing the marginal cost of energy, determine an increase in the demand for services such as heating, lighting or transport. Moreover, the economic growth promoted by energy-efficiency may entail a further increase in energy demand. Thus efficient devices may lead to a net increase in energy use (Greening at al., 2000).

Concluding, obesity is part of the general problem of food consumption sustainability, either because a healthy diet is part of the very definition of food consumption sustainability, or because the same diet which allows for sustainability, namely the Mediterranean diet (MD), helps to prevent obesity. As a matter of fact, literature on food consumption sustainability has demonstrated that the most sustainable diet (including environmental, economic and health dimensions) seems to be the Mediterranean diet, defined as a diet rich in fresh fruit and vegetables and low in meat, added sugar, salt and saturated fatty acids (Duchin, 2005). MD sharply contrasts with the current food habits of most developed countries, with the prevailing consumption of processed, ready to eat and animal-derived foods. While shifting to a MD would be the most simple and affordable solution for contrasting obesity, nonetheless it is not viable because of the strong resistance of the most powerful food companies which would see their demand reduced (just think of the meat sector and all the activities involved) together with the possibility of taking advantage of the market for light food and products and services targeted to people who want lose weight. Also consumers are likely to show a strong resistance to drastically changing their food habits, because of the many "pleasures" (food variety, strong tastes, convenience, and so on) which the current food model entails[2].

The previous considerations support the idea that as consumer communication policies alone are not sufficient to stop the obesity epidemic and that regulatory and market-based instruments need to be used as well. As long as prices for low-calorie foods are higher than prices of high-calorie food, consumers encounter further obstacles in their effort to shift towards a healthier and more sustainable diet (Drewnowski, Darmon, 2005; Monsivais, Drewnowski, 2007). Moreover, as long as food companies are able to segment the market in order to make extra-profits on the market for light foods, they will not have the incentive to change their supply in such a way as to satisfy the general need for healthier foods. The next section presents the results of a study which tries to estimate the relationship between price and energy density of foods and price premium for low-calorie foods, in order to highlight cost obstacles hindering the affordability of a better diet on the part of consumers.

3. Obesogenic and healthy foods: a price comparison

The survey was carried out in April 2012 in the Naples area at Italy's three main food retailers (Auchan, Carrefour and IperCoop). It considered food products belonging to the following categories: yogurt, frozen vegetables, savoury snacks, sweet snacks, breakfast biscuits, fresh-cut vegetables, fresh-cooked vegetables, ready-to-eat dishes. For each of the above categories, prices and label information were recorded for all the items found on the shelf. Only those products not being promoted were considered eligible for the survey. Data were collected on a total of 967 items (tab. 1)

[2] A shift to the sustainable MD meets the same problem documented by scholars in the case of the general shift towards more sustainable consumption and named the "double dividend" issue, i.e. the opposition between weak and strong sustainable consumption. Scholars endorsing this argument suggest that a kind of "double dividend" is inherent in sustainable consumption: the ability to live better by consuming less while reducing the impact on the environment of all consumption activities (Jackson, 2005). Accordingly, what is needed is a strong sustainable consumption perspective (Fuchs, Lorek, 2005), questioning the level of material consumption as a meaningful measure of well-being and calling for a radical change in levels and quality of consumption. The weak sustainable consumption approach instead, endorsed by policy makers and environmentalists so far, focuses on eco-efficiency and product "green innovation" assuming a business as usual and a continuous economic growth scenario.

Tab. 1 - Number of products by food categories					
	No. of items	**No. of producers**	**Items/ producers**	**PL**	**PL/items**
Yogurt	236	25	9.4	56	23.7
Frozen vegetables	204	11	18.5	101	49.5
Fresh-cut vegetables	91	8	11.4	62	68.1
Fresh-cooked vegetables	13	4	3.3	3	23.1
Savoury snacks	75	12	6.3	14	18.7
Biscuits	167	23	7.3	57	34.1
Sweet snacks	146	23	6.3	55	37.7
Ready-to-eat	35	6	5.8	22	62.9
Total	**967**	**82**		**370**	**38.3**

As observed in table 1, the product category with the most items was that of yogurt with over 230 products and 25 producers. The product category of fresh-cooked vegetables is still under-represented on the shelves of the large distributors, and at the retail outlets in question only 13 items were found.

Tab. 2 - Energy content by food categories				
	Kcal/100g	**Standard deviation**	**P/100g**	**P/100 Kcal**
Fresh-cut vegetables	30.2	24.2	1.00	4.36
Frozen vegetables	50.4	36.1	0.54	1.52
Fresh-cooked vegetables	55.9	31.2	0.63	1.47
Yogurt	82.9	23.6	0.58	0.61
Ready-to-eat	145.2	27.6	1.20	0.88
Sweet snacks	410.0	36.2	0.67	0.17
Biscuits	457.4	25.5	0.47	0.10
Savoury snacks	522.7	28.0	1.16	0.19

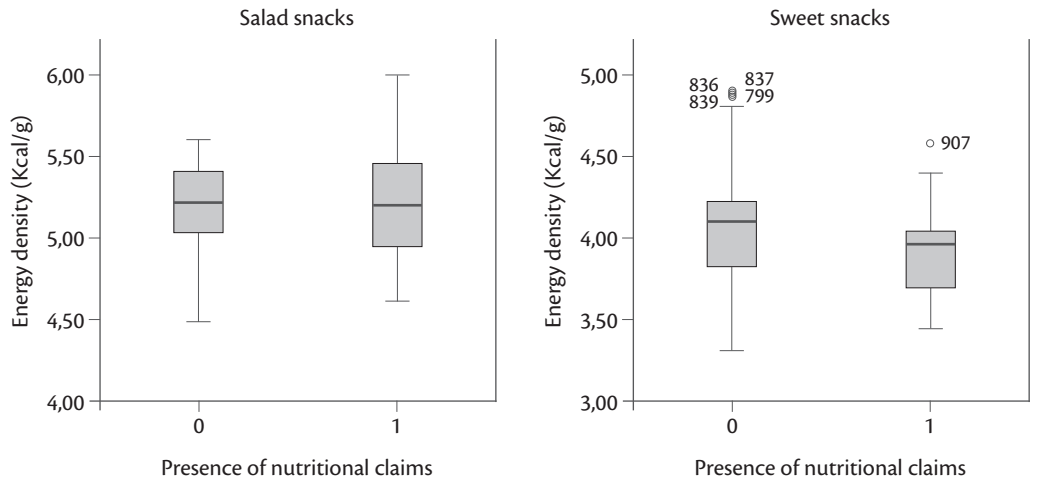
The information regarding some indicators is reported in table 2. In particular, the calorie content per 100g represents the energy value index. A glance at the index shows that the eight product categories may be distinguished into two sets. The first, which may be termed *low energy density,* comprises fresh-cut vegetables and frozen vegetables, pre-cooked vegetables, yogurt and ready dishes. The second set may be termed *high energy density*, and consists of sweet snacks, biscuits and savoury snacks.

With reference to the six product categories, we initially ascertained the relation between mean energy density and the presence of nutritional claims which explicitly or implicitly refer to the concept of "lightness" and low energy density. As may be observed, only in the case of yogurts and biscuits is it possible to reject the null hypothesis of the same energy density with a p-value < 1%. Importantly, in the case of the two categories of sweet and savoury snacks, no statistically significant difference is found in the energy content with respect to the presence of nutritional claims, as shown by the relative box plots in Figure 2.

Tab. 3 - Mean energy density and presence of nutritional claims

Product category	Presence of nutritional claims	Kcal/100g Means	Standard deviation	t	df	sig (2-code)
Yogurt	Yes	75.79	22.91	-5.431	234	0.000
	No	91.66	21.49			
Frozen vegetables	Yes	49	28.64	-0.152	202	0.879
	No	50.53	36.61			
Fresh-cut vegetables	Yes	44.37	41.65	1.75	89	0.083
	No	28.83	21.74			
Savoury snacks	Yes	530	43.98	1.124	73	0.265
	No	520.93	22.54			
Biscuits	Yes	440	25.71	-6.424	165	0.000
	No	464.8	21.53			
Sweet snacks	Yes	397.57	30.18	-1.709	144	0.090
	No	412.07	36.83			

Fig. 2 - Savoury and sweet snacks: Box Plot (energy density vs presence of nutritional claims)



4. The empirical model

To further assess the existence of a relationship between food price and energy value, we used a hedonic econometric model of price. As shown, this model determines the selling price of a commodity as a function of the material and non-material attributes that comprise it.

The first pioneering studies concerning products understood as sets of characteristics date back to 1929. In that year Waugh noted "There is a distinct tendency for market prices of many commodities to vary with certain physical characteristics which a consumer identifies with qual-

ity, and the relationship of these characteristics with prices may in many cases be accurately determined by statistical analysis" (Waugh, 1928, p.187).

In subsequent years, Hauthakker's model (Hauthakker, 1952) and then Lancaster's new approach to consumer theory were to ensure that the hedonic technique had a theoretical framework which would be the basis for future studies. In 1974, Rosen directly tackled the issue of hedonic models, proposing, under the hypothesis of perfect competition, the conditions required to estimate the demand curves of characteristics identified by econometric analysis (Rosen, 1974).

The many empirical applications developed since the 1960s have concerned many classes of commodities. In agriculture and food sectors some of the most recent applications have dealt with wine, fruit juices and genetic properties (Combris *et al.* 1997, Nerlove 1995, Neibergs 2001, Weemaes and Riethmuller 2001).

The hedonic technique entails two separate, conceptually different steps: 1) using the hedonic price equation implicit marginal prices of the properties may be estimated; 2) using such implicit prices we may estimate the inverse demand functions or the functions of marginal willingness to pay for distinct groups of consumers.

More formally, let *Q* be a class of products. Each unit of *Q*, say *qi*, may be completely described by an *n*-dimensional vector of its characteristics *xi*. Hence the price of the generic product *qi* is also a function of the level of such characteristics:

$$P_{qi} = P_q\left(x_{i1}, \ldots, x_{ij}, \ldots x_{in}\right) \tag{1}$$

The function *Pq* is the hedonic or implicit function for *Q*. If *Pq* may be estimated by starting from observations of prices and characteristics of the different products belonging to a class, then the price of each possible product variety may be calculated from knowledge of its characteristics. The implicit marginal price of a characteristic may be found by differentiating the implicit price function of that characteristic. For the generic characteristic *xj* we obtain:

$$\partial P_q \Big/ \partial x_j = P_{xj}\left(x_j\right) \tag{2}$$

This supplies the increase in spending on *Q* which is required to obtain a product with one unit more than *xj*, clearly *ceteris paribus*. If equation (2) is linear in characteristics, then implicit prices are constant. When the equation is not linear, then the implicit price of an additional unit of a characteristic depends: a) on the chosen quantity of the characteristic in question; b) on the quantity of the other characteristics; c) on the functional form chosen.

In this study we use only the first stage of the hedonic technique insofar as estimation of willingness to pay for each attribute; the second step, requires knowledge of the socio-demographic characteristics of the purchasers, which is very difficult to acquire and not available for this empirical study. However, the first stage allows the prime objective to be achieved, namely to measure the relative impact of an attribute on the dependent variable, *ceteris paribus*, through an implicit price function for the different characteristics concerning the food products in question.

The general theoretical model may be represented as follows:

$$P_{qi} = P_q\left(x, y\right) \tag{3}$$

where x and y represent respectively the vectors of intrinsic and extrinsic quality indicators.This

means that price is a function of intrinsic and extrinsic attributes, provided that the latter can be easily verified by the consumer prior to purchase.

Starting from the complete dataset of 967 observations concerning eight distinct retail categories, our empirical survey selected the 367 observations relative to all the products in the dataset sold with the retailer's brand. Analysis was thus limited to private label products. The choice was dictated by the need to arrive at a more homogeneous set of items with respect to the large number of variables (presence of organic products, products belonging to the main brand leaders on the market with specific price strategies) which could mask the relation between food price and calorie content. Starting from the set of available data, we obtained the matrix of potential independent variables, each of which contains information on a characteristic of the commodity which may be directly obtained from the label or from observation of the product (nutritional information, format, presence of nutritional claims, etc.)

In the hedonic model proposed, the dependent variable P_{100g} is defined as the mean price in Euros per 100 grams for each product. The independent variables which proved statistically significant are as follows:

- TW = overall product weight in 100 g of each item
- NutClaim = dichotomous variable which identifies whether the product makes claims explicitly or implicitly connected with the idea of well-being, lightness and physical shape:
  1 = claim
  0 = no claim
- D_{Funz} = dichotomous variable which identifies whether the product has added nutritional elements that might be termed *functional*, such as vitamins, mineral salts, fibre or probiotics, given the value 1, and 0 otherwise
- Kcal/g = indicates the content in kilocalories per 100 gram of product

The hedonic model, estimated with the ordinary least squares (OLS) method, may be expressed as follows:

$$P_{100g} = \beta_0 + \beta_1 \, TW + \beta_2 \, Kcal/g + \beta_3 \, Func + \beta_4 \, NutClaim + \varepsilon$$

The model was initially estimated by using Box-Cox transformation to test alternative functional forms. As the likelihood test ratios led us to reject both the double-logarithmic and semi-logarithmic form, we opted for a linear functional form. The latter also displayed some problems which were highlighted by White's test, discussed below. However, it allows, amongst other things, to interpret the coefficients directly as implicit prices and obtain information concerning the influence of each individual characteristic.

Tab. 4 - Implicit price estimates through hedonic model (OLS) Robust standard errors for heteroskedasticity

	Coefficients	Std. error	t-ratio	p-value
Const	0.8603	0.0624	13.7946	<0.01
TW	-0.0475	0.0285	-13.7924	<0.01
NutClaim	0.1145	0.0393	2.9179	<0.01
Kcal/100g	-0.0310	0.0693	-4.4814	<0.01
Func	0.1120	0.0500	2.2373	0.026

Mean dependent var.	0.5434	SQM dependent var.	0.0037
Sum of squared residuals	0.3135	SE regression	0.0029
NutClaim	0.1145	NutClaim	<0.01
R^2-	0.3778	Corrected R^2	0.3709
F(4, 363)	48.88795	P-value(F)	<0.001

The model explains overall about 37% of total variance (corrected R^2 = 0.3709) and the signs of the coefficients are consistent with expectations. Submitted to the White test, the model showed the persistence of inherent heteroskedasticity in the data. The statistic produced by the test is distributed asymptotically as a χ^2 equal to 4.80. The test was clearly run in the unknown variance mode, and to reach a consistent estimate of the coefficient values and the standard errors we proposed White's corrected matrix of variance and covariance. The model presented was thus estimated with standard errors robust to heteroskedasticity.

The dummy associated with the presence of functional elements has a positive coefficient, and thus the functional nature of food results in a price increase. The impact on the sale price, about 0.11€/100g, suggests that the functional choice represents successful strategy for firms, able to guarantee a significant price premium.

The Kcal/100g data represents a variable whose coefficient has a negative sign. This result was obtained by considering overall the items belonging to the eight categories in question. Although the coefficient is very low, the result confirms the inverse relation between food energy value and cost per unit of kilocalorie.

The coefficient of the product format also has a negative sign. In other words, the greater the weight of the package sold, the lower is the unit price of the product. This result, which might appear self-evident, should nonetheless be interpreted in the light of the overall analytical design. One of the factors which contribute to defining the so-called obesogenic environment is indeed represented by the progressive increase in the sales portions and formats. If this trend is combined with the price discount offered on the larger formats, the negative effects in terms of nutritional health become considerable and may be summarised in the slogan: the more you eat the less you pay.

The dummy associated with the presence of nutritional claims that evoke well-being and lightness has a positive coefficient. Hence the products which have such claims receive a price premium from the market. However, in the above analysis there emerged a weak, uncertain – or even non-existent – relationship between the presence of nutritional claims and mean energy value of food (tab. 3 and Figure 2). Our econometric model confirms the presence of an inverse relation between food product prices and energy value, and hence represents further confirma-

tion of the importance of factors of strict economic relevance in leading to the emergence and progressive increase in obesity worldwide.

5. Conclusion

Globally, 1.4bn people are overweight and 500 million obese. Obesity is the fifth-highest global risk for death, accounting for at least 2.8mn adult deaths a year (WHO, 2007; Merrill Lynch, 2012).

Obesity is an important aspect of the current unsustainable model of food production and consumption. Designing policies to fight obesity is a challenging task because obesity has multiple causes -ranging from individual lifestyle factors to general socioeconomic and environmental conditions- which occur in conjunction (Faulkner *et al.*, 2011; Sacks *et al.*, 2008). The debate on government's role in fighting the obesity epidemic sets the supporters of state intervention against the advocates of consumers' freedom of choice and the autonomy of the individual.

So far, the most popular measures have been targeted at stimulating consumer responsibility through communication policies aimed at raising consumers' awareness of the costs of obesity. This research has pointed to the ineffectiveness of such policies when economic incentives are not aligned with the consumer's best nutritional choices. In particular, it has focused on the necessity of removing some important constraints which hinder healthy food consumption choice, such as the lower price of high energy food compared to that of low energy. The survey carried out in Southern Italy was aimed at testing the relationship between price, food energy density and nutritional claims for a selected group of food items. The econometric model confirmed the presence of an inverse relationship between food product prices and energy value, and hence represents confirmation of the importance of factors of strict economic relevance in leading to the emergence and progressive increase in obesity worldwide. Results bring evidence of socio-economic causes of obesity, with the poorest section of society at higher risk, and add arguments in favour of a stronger state intervention.

The main conclusion of the paper is that the consumer communication policies alone are not sufficient to stop the obesity epidemic and that regulatory and market-based instruments need to be used as well. In particular, there is a need for regulatory measures aimed at reversing relative prices between obesogenic and healthy foods.

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