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Nudging parental health behavior with and without children's pestering power: Fat tax, subsidy or both?

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Abstract: Using a discrete choice experiment with real economic incentives, this paper studies one of the most well-known governmental mechanisms of nudging consumers towards a healthier way of eating, namely food fiscal policies. The experimental design varies food prices of healthier and unhealthier alternatives of food products for children as part of specific food fiscal policies. We also examine the interplay of children's pestering power as well as information about the fiscal policies. Results from our lab experiment suggest that (a) implementing a fat tax and a subsidy simultaneously can nudge parents to choose healthier food products, (b) that providing information regarding the food fiscal policies in place can further increase the impact of the intervention, and (c) kid's pestering power is one of the causes of the policies' moderate effectiveness as it strongly affects parents in making unhealthier choices.

Keywords: Choice experiment; Fat tax; Subsidy; Information; Pestering power

JEL codes: C9; D12; I10

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1 Introduction

Overconsumption and excessive intake of sugar and fats along with sedentary lifestyles have been partly blamed for the worldwide obesity prevalence trend. Individual food choices are influenced by a wide variety of biological and environmental variables. Biological variables include hunger, taste, appetite; while environmental variables include economic determinants (cost, availability, income, access, and time), social determinants (socio-cultural status, meal patterns, peer and social networks), psychological determinants (mood, stress, guilt) and perceived nutrition determinants (knowledge about food, beliefs, attitudes) (The European Food Information Council (EUFIC), 2005). Individuals place different levels of importance on each of these evaluative dimensions.

However, when transferring this framework from adults to children, an additional dimension must be taken into account. The food environment created by parents for children likely plays a more important role. Although adults have the freedom to make their own choices over energy intake and expenditure, the child's choice set is limited by the environment created by their parents (Barlow and Dietz, 1998). In this respect, Cawley (2006) stresses that parental control and bounded rationality are of great importance for childhood obesity. Thus, nudging healthy behaviors at home could play an important role in helping children develop healthy eating habits at a young age and adopt them throughout their adulthood. Evidence shows that habits are formed early on in life and are then kept into adulthood (Kelder et al., 1994; Resnicow et al., 1988; Singer et al., 1995). Therefore, interventions that focus on nudging parental food choice behavior may help in this direction.

Due to the substantial negative externalities for society involved with increasing obesity rates, several governments worldwide have intervened with various policies with the goal of influencing dietary habits. These include fiscal (OECD, 2012), marketing/informational (Beaudoin et al., 2007; Maes et al., 2012), and educational policies (Cross-Government Obesity Unit, 2008; New York City Department of Health and Mental Hygiene, 2008) that aim to nudge people to make healthier food choices. In the literature, fiscal policies (i.e., those that limit access and provide price incentives and disincentives) have received great attention with respect to their effectiveness in improving dietary patterns (Thow et al., 2010). Generally, three types of price strategies have been applied: increasing unhealthy food prices (fat tax), decreasing healthy food prices (often called a thin subsidy) and a combination of both (Waterlander et al., 2012a).

Among the three fiscal policies mentioned above, great political as well as scientific attention has been given to examining the effect of price increases of unhealthy products. This price increase can be levied either by increasing the value added tax (VAT) or by imposing an additional (fat) tax. Leicester and Windmeijer (2004) note that this policy can be implemented in two ways. One way is by taxing certain types of products of low nutritional value such as soft drinks and snacks (Bowman, 1999). Another way is by taxing a variety of products based on their nutritional composition, i.e. percentage of fat, salt, calories, etc. The first way of taxation has been applied to alcohol and tobacco ("sin taxes") which are taxed based on their effects on human health. Those who support the first way of taxation, i.e. taxation of certain food categories which are widely recognized for their low nutritional value, argue that it is more politically feasible or practical for the legislative bodies than the second one (Jacobson and Brownell, 2000). Moreover, Jacobson and Brownell (2000) claim that the implementation of the second way of taxation could affect consumers unfairly. For example, some nutrient contents such as lipids/fat are classified as unhealthy even though they can be important components of a daily diet when consumed in recommended amounts. However, opponents of this policy also claim that the policy is ineffective and unfair (Salois and Tiffin, 2010). It is ineffective because wealthy consumers are not very responsive to food prices and because of its regressive nature which costs the poor relatively more than the rich. The argument is that taxing food would further reduce the disposable income of the poor as taxation is implemented on foods with high percentages of fats, sugar and calories, which are consumed disproportionately by low-income households (Frazao et al., 2007). This happens because unhealthy foods are generally cheaper than healthy foods (Waterlander et al., 2010), which makes them more affordable for low socioeconomic status households (Pieroni et al., 2013). In addition, this policy is unfair because it punishes both those who are obese as well as those who are not.

The second fiscal policy, i.e. reducing the price of products considered healthy, can be applied in a similar manner. This would be possible either by reducing the prices of specific product categories that are considered healthy (such as salads, fruits, etc.) or by reducing the prices of products which have lower amounts of certain nutrients such as fat and sugar. These reductions can be made directly on product's price or through discount coupons. Thus, healthy products could become more accessible to the average consumer and researchers conclude that this could lead to increased consumption of healthy products as well (Andreyeva et al., 2010; Ni Mhurchu et al., 2000; Waterlander et al., 2012b). Some evidence, however, shows that this policy leads to more calorie purchases because consumers buy larger quantities of healthy products (Epstein et al., 2010; Waterlander et al., 2012a) or that it is counterproductive because consumers use the saved money to purchase unhealthier products (Giesen et al., 2012). This behavior could be explained using the familiar concepts of income and substitution effects (McInnes and Ozturk, 2011). Subsidizing healthy products, *ceteris paribus*, makes the consumer wealthier and thus the consumer has proportionately more disposable income to spend (either on more calories or less healthy products). The reduced efficacy of this policy compared with the taxation of unhealthy products could also be explained using insights from behavioral economics such as reference dependence and loss aversion (McInnes and Ozturk, 2011). Specifically, reference dependence refers to options being valued as gains and losses relative to a reference point while loss aversion refers to people's tendency to strongly prefer avoidance of losses than acquiring gains (Kahneman and Tversky, 1984). Therefore, consumers weigh losses more heavily from the purchase of a taxed unhealthy product than equivalent gains from the purchase of a subsidized healthy product.

Given the pros and cons of the two policy options discussed above, a third policy that combines these two policies could be considered. This policy can be designed to be revenue neutral so that the subsidy exactly offsets the revenue from the fat tax (Salois and Tiffin, 2011). Furthermore, this policy seems to combine the benefits of the two previous policies (i.e., reduction of sales of unhealthy products and increased sales of healthy products) and overcomes the negative side effects (purchase of more calories, use of the saved money to purchase unhealthier products and being regressive to the poor) (Powell and Chaloupka, 2009; Waterlander et al., 2012a).

However, the literature provides contradictory results on the efficacy of these policies as a health intervention tool. In fact, even though fiscal policies may be beneficial in nudging healthier choices, it may not be sufficient by itself to alter long-term overall purchasing behavior as any reduction in taxed products may be offset by consumption of calories from other sources (Fletcher et al., 2010b). Results from a number of studies suggest that rising price through taxation or decreasing price through subsidy could be an effective means of shifting food consumption away from unhealthy food towards healthier alternatives not only among adults (Andreyeva et al., 2010; Dong and Lin, 2009; Epstein et al., 2012; French, 2003; Goldman et al., 2011; Powell and Chaloupka, 2009; Waterlander et al., 2012a) but also among young children and adolescents (French et al., 2001; French et al., 2003; Hannan et al., 2002).

However, fiscal policies have provoked many opposing opinions among researchers regarding their effectiveness on obesity prevalence. One reason is that substantial price changes (from taxes and subsidies) have to be implemented in order to detect significant associations between fiscal policies and weight outcomes (Fletcher et al., 2010a; Lin et al., 2011; Powell and Chaloupka, 2009). For example, Smith *et al.* (2010) found that a 20% tax included in the price of soft drinks would reduce the child at-risk-for-overweight prevalence from 32.2% to 27.0% and the overweight prevalence from 16.6% to 13.7%. In contrast, Schroeter *et al.* (2008) demonstrated a case where a tax on food away from home could actually increase weight. These controversial results suggest the need for further research that evaluates whether changes in prices influence not only short term consumption behaviour but also body weight (Jacobson and Brownell, 2000; Schroeter et al., 2008).

While there is an extensive literature on the impact of information on demand for food, there is scant literature on the causal effect of information on the effectiveness of food fiscal policies. It is well established that information can help consumers better evaluate the value of goods and services they are interested in, resulting in more appropriate purchases. It can also significantly help buyers choose which market to participate in, and it can affect demand elasticity (Johnson and Myatt, 2006; Lewis, 2011; Tadelis and Zettelmeyer, 2011). Ashraf *et al.* (2013) examined information and subsidy as complements in health interventions and found that information can significantly increase the impact of price subsidies on purchases of healthy products (the impact of price subsidies was 60% larger among the informed households).

All the above evidence on the effectiveness of health related food price incentives and disincentives comes from three sources: natural experiments, controlled trials of price changes in closed environments, and modelling studies (Mytton et al., 2012). To our knowledge, there are only a handful of studies that performed controlled experiments over food purchases under different fiscal policies and these studies come with some caveats. For example, two such studies (Epstein et al., 2010; Nederkoorn et al., 2011) lack enforcement of real incentives since both the purchases and the budget for the purchases were hypothetical. Another set of studies (Epstein et al., 2006; Epstein et al., 2007) lacks sufficient statistical power since they employed small sample sizes (10 and 47 couples of mother-child, respectively). Our emphasis on experimental research is based on our belief that this kind of research can further enhance the contribution of economics on evaluating public interventions and hence improving public health.

Our aim in this study is to identify some factors either inside or outside the home environment that can either weaken or enhance the expected outcomes of fiscal policies on food choices, through a controlled laboratory experiment. We focus on how parents choose between healthier and unhealthier food items for their child under different fiscal pricing policies. Furthermore, we evaluate how factors like the provision of information on fiscal policies and child's pestering power, may influence parental food choices. Our experiment further contributes to the literature by providing an empirical examination of parents' choices between healthier and unhealthier alternatives when it comes to children's food products. To our knowledge, this is the first time a study has examined children's pestering power on parents' choices in the context of a lab experiment on food choices. This allows us to examine how fiscal pricing policies and external influences can affect food choice behavior.

The question we ask in this paper is whether incentives can affect parental food choice behavior. We examined these effects through the recruitment of 189 parent-child pairs in a controlled laboratory choice experiment where we created an experimental market with real food products where parents actually had to purchase products presented under different pricing schemes. Our sample consisted of four within subject treatments and four between subject treatments. In the within subjects treatments, each participant faced 12 choice tasks. In each choice task, we displayed two food-for-kids products with different levels of healthiness and a no-buy option. The participants chose their preferred alternative in each choice task. Between choice tasks, the prices varied according to a base (market price) level and three different fiscal policies levels (i.e., fat tax, subsidy, fat tax and subsidy at the same time). To induce real economic incentives, one of the choice tasks was randomly drawn as binding at the end of the experiment and the participant had to buy the food product chosen in the binding task. In addition to the within subjects treatments, there were four *between subjects* treatments. The control treatment was as described above. The second treatment (the information treatment) was similar to the control treatment but with the addition of information regarding the food fiscal policies. The third treatment (the pestering power treatment) was similar to the control treatment but now the parent chose *together* with their child in each choice task while the final treatment was like the pestering power treatment but we also added information to the participants about the food fiscal policies (pestering power + information treatment).

Our results make three substantive contributions to the literature. We found that the intervention by itself has a moderate effect on parent's food choices. In particular, a fat tax or a subsidy can increase healthier choices but the simultaneous implementation of both fat tax and subsidy can further improve healthier choices among parents. Our second result is that when information regarding the applied food fiscal policies is available, healthier choices can increase the impact of the intervention even further. Therefore, it appears that the lack of proper provision of information is one of the causes of the policy's moderate effectiveness. Third, we find that kid's pestering power strongly affects parents in making unhealthier choices.

The rest of article proceeds as follows: first, we present the design of the experiment and the experimental procedures as well as information about our sample and products used in the study (section 2). Section 3 illustrates the results drawn from the descriptive and econometric analysis, and we conclude with the importance and the implications of the findings in the last section (section 4).

2 Experiment

2.1 Experimental Design

Table 1 exhibits the four within and four between subjects treatments used in the study, along with the number of parent-child pairs that participated in each treatment. Each cell in the table represents a between-subject treatment. Within each cell, the four within subjects treatments are listed which correspond to the price variations caused by the four fiscal policies: (1) a baseline scenario of market prices, (2) a fat tax, (3) a subsidy, and (4) a fat tax and subsidy applied simultaneously (the both treatment). The between subjects treatments vary the decision environment (parent goes through the choice tasks with or without the presence of the child which corresponds to the with and without pestering power treatments) and information provision (where the parent is provided with information about the fiscal policies or not, hereafter referred to as the info and no info treatments). All sessions were conducted by a single experimenter i.e., one of the authors and the experiment was conducted using the z-Tree software (Fischbacher, 2007).

Table 1. Experimental design

	No information for fiscal policy	**Information for fiscal policy**
Without pestering power	47 Market price, Fat tax, Subsidy, Both	47 Market price, Fat tax, Subsidy, Both
With pestering power	47 Market price, Fat tax, Subsidy, Both	48 Market price, Fat tax, Subsidy, Both

2.1.1 The role of food fiscal policies

Our experiment allows us to study the role of food fiscal policies as a tool that can influence healthier food purchasing behavior. We varied within subjects the posted prices of the products according to four within-subjects treatments. The market price (MP) treatment was always displayed first in order to create a common reference point to all subjects. In this treatment, the healthier and unhealthier versions of a product on any given choice task were set to the same level. The price level was set to the average value of market prices we found in major supermarket chains prior to the experiment. After the MP treatment, the three food fiscal policies (three treatments) followed in random order to avoid order effects. The only thing that was varied in these treatments was prices for the products (see Table 2). One of the treatments imposed a fat tax on the price of the unhealthier product (as judged by the fat or sugar content) while keeping the price of the healthier product constant at market price (FT treatment). Another treatment imposed a subsidy on the price of the healthier product keeping the price of the unhealthier product constant at market price (SB treatment).

The third treatment combined a fat tax on the price of the unhealthier product with a subsidy on the healthier product (BO treatment).

Table 2. Overview of the within subjects treatments

Treatment	**Description**
Control Treatment	Prices are set to the average value of market prices we found in major supermarket chains prior to the experiment. Prices are equal between the healthier and unhealthier alternative.
Fat tax (FT) Treatment	Fat tax on the unhealthier alternative (25% increase on the market price)
Subsidy (SB) Treatment	Subsidy on the healthier alternative (25% decrease on the market price)
Both (BO) Treatment	Fat tax on the unhealthier alternative and subsidy on the healthier alternative at the same time (25% increase on the market price of the unhealthier product & 25% decrease on the market price of the healthier product)

The full list of choice tasks displayed in the four within-subjects treatments is listed in Appendix A.

2.1.2 The role of provision of information

Our rational for including a (between-subjects) provision of information treatment is that information regarding the relation of a price change and the healthiness of a product can potentially alter purchase behavior. Such information provision can be enacted using several methods, including mass media, governmental/community-level agents' announcements and informative labels on the shelves next to the price. In the context of our laboratory experiment a labeling scheme was more realistic. Therefore, in the information treatment, subjects were informed on the actual reason on why a price change occurred (e.g., implementation of a fat tax or a subsidy or both) using a descriptive label on the top of the screen. In the no-information treatment, subjects remained unaware of the actual reason of the price increases/decreases.

2.1.3 The role of kid's pestering power

Our second between-subjects treatment examined the role of making food purchasing decisions together with the child. While a parent may rationally choose to purchase a healthier product for their child, the mere presence of a child could adversely affect purchase decisions if the parent decides to give in to the child's demands (which may be motivated by factors other than nutrition). To vary the child's ability to potentially pester the parents on their choices (i.e., hereon referred to as child's pestering power), we allowed children in half of the sessions to seat next to their parent while the parent was going through the choice tasks. The child and the parent could freely communicate and discuss about the choice options[1]. In the no pestering power treatments, the parent decided on their own without any external influence from the child. Hence, in these treatments, the child did not participate in the choice tasks and was kept engaged in the lab's lobby where he/she could watch cartoons or draw using paper and pencils.

2.2 Participants

A random sample of families (one adult who is the primary grocery shopper and makes the household meal decisions and one child) from the general population of Athens, Greece, was recruited by a market recruitment research company based on random digit dialing. The research company ensured that the interested families met the following study criteria: (1) the child in the family was between the ages of 6 and 10[2] (if there was more than 1 child in the family in this particular age range, the company randomly picked one child) and (2) the family consumed the products used in the study moderately or more often (parents were screened for consumption patterns from a large list of food and stationery products, which included the products used in our study, so that we would avoid any prior associations with the aims of the study. Subjects were offered a fixed fee of 30€ per family to participate in a "children's snack and stationery preference study", conducted in the experimental economics laboratory of the Agricultural University of Athens. A total of 189 families

[1] We observed that in the pestering power treatment all children interacted with their parent.
[2] We chose this specific age range because, on the one hand, children of this age range have almost no pocket money and are totally dependent on what their parents purchase for them while, on the other hand, they are old enough to accompany parents at the supermarket.

participated in the experiment. Subjects participated in one of the 4 between subject treatments and they were randomly assigned to a time slot between July 2012 and September 2012. Experimental sessions were split between morning (97 sessions) and afternoon (92 sessions) snack time hours, i.e., from 9.00-13.00 o'clock and 16.00-20.00 o'clock each day of the week except Sundays[3]. All subjects were given a short orientation and training before the experiment begun.

2.3 Experimental procedures

Each experimental session consisted of four tasks. It included a real choice experiment (RCE), a manipulation check questionnaire, a socio-demographic questionnaire and anthropometric measurements. Each session lasted approximately 40 minutes. In each session a single parent-child pair participated. Depending on the treatment, the child could have an active role in the choice experiment or not.

In the RCE task, participants faced different choice tasks where they had to choose between two similar products of the same brand (e.g., cheese) differentiated by their healthiness status (healthier vs. unhealthier alternative) and price (three levels). The healthiness or unhealthiness status was not explicitly labeled as such. Choices also included a no-buy option in the event that subjects did not prefer any of the products[4].

The experiment was conducted as follows: first, each parent was assigned a unique ID number to guarantee his/her anonymity and s/he was informed that their fixed participation fee of 30€ would be given to them at the end of the experiment. In addition, subjects could examine the products offered for sale in a display section in the lab. They were given enough time to see and inspect all products. Subjects were then seated in front of a computer and they were informed that they will go through 20 choice tasks showing various combinations of the products on display in the lab. They were also informed that when they complete all choice tasks, one of these would be chosen as binding and they would have to purchase the product of their choice at the indicated price. The price of the product would be deducted from their

[3] Lunch and dinner time in Greece are usually later than other parts of Europe or North America. Lunch is usually served between 13.30 and 15.00 o'clock while dinner between 20.00 and 21.30. Two parent-child pairs participated in the experiment at 14.00 and 14.45 o'clock because they were late and early, respectively.

[4] According to Louviere and Street (2000) it is not realistic to force participants to choose one of the available options and therefore including a no-buy option is to be preferred.

participation fee. To determine the binding round, subjects had to draw a number from a jar with folded papers listing numbers from one to twenty (as many as the choice tasks). To make sure parents were choosing products for their child, they were told that the product would be given to their child right away to consume while s/he would be filling out the socio-demographic questionnaire. We emphasized to subjects that actual payment would occur for the binding choice task and that they should evaluate each choice task carefully, since all tasks were equally likely to become binding. Subjects were also told that choosing the "none of these" option (i.e., the no-buy option) is an acceptable choice and that if they had chosen the no-buy option in a binding task, no purchase would be made and they would keep their full endowment. The exact instructions given to the participants are provided in Appendix B.

In order to confirm that our experiment worked well, that there was no experimenter demand effect and participants adhered to the experimental instructions, we incorporated a manipulation check questionnaire right after the choice experiment was finished (see Appendix C for more details)[5].

The socio-demographic questionnaire, which elicited parental perceptions about their child's weight status, family's dietary habits, and family's socio-demographics, were addressed to parents.

Each session concluded with anthropometric measurements of the parent and the child. Physical measurements of body weight and height were obtained from all children and their parents (light summer clothing, no shoes). Body weight was measured on a levelled platform scale with a beam, movable weights and body height on a wall-mounted stadiometer, to the nearest 0.5 kg and 0.5 cm, respectively. Body Mass Index (BMI) was computed as weight (in kilograms) divided by height (in meters squared) and it was used for participants' classification as normal-weight, overweight or obese (Cole et al., 2000; Cole et al., 2007; WHO, 1995).

[5] The results of the manipulation check questionnaire reinforce the validity of our experimental results. All subjects in the information treatment responded that their responses were based on the information given at the beginning of the session along with what s/he and/or their child wanted; not based on what they thought the experimenter wanted from them. All subjects in the no-information treatment responded that the purpose of the study was to examine consumption patterns on food and/or stationery products for kids.

2.4 Products and choice tasks

The food products chosen were products commonly purchased by Greek families as snacks for children. In each product category (choco milk beverage, cheese, and yogurt) there were two products of the same size and weight that differed only on the basis of percentage of calories, fat and sugar and so it was easy for parents to distinguish between the healthier and the unhealthier alternative (for example all healthier products carried nutritional claims such as "free", "2%", "light"). We did not explicitly mention, however, if a product would be considered more or less healthy. We also did not label any of the products as such. Each choice task depicted the alternative products using photo stimuli. To mute any brand effects, we chose products of the same brand in each product category, that is, each pair of healthier and unhealthier products were of the same brand[6]. One week before the official start of the experiment, the experimenter visited supermarkets of the four largest chain stores in the city and collected prices for the products of the experiment. The average of these prices was used in the baseline control (market price) treatment and prices for the other within-subjects treatments varied accordingly.

To cover up the aim of the study and preclude subjects from potentially succumbing to experimenter demand effects, two additional non-food categories were added to the list of choice tasks. We used stationery products (colored markers, pens/pencils) as a decoy. The prices of the decoy products in the market price treatment were the average of prices observed in the same four supermarkets as the food items. Decoy products were selected so that their price range lied between the lowest and the highest price of the market prices of food products, in order to avoid exposing subjects to any irrelevant price anchors. Prices did not change for the decoy products under the fat tax, subsidy and both treatments since the fiscal policies were irrelevant for stationery products.

In all, the real choice experiment incorporated 20 different choice tasks [4 within subject treatments (MP, FT, SB and BO) × 5 product categories (3 food and 2 non-food)]. The choice tasks pertaining to the stationery products will not be further analyzed. Appendix D shows sample choice screens from the market price treatment. In the rest of the within-subjects treatments, prices were adjusted accordingly.

[6] The products were: milko vs. milko free, babybel vs. babybel light, delta yogurt vs. delta yogurt 2%.

3 Results

3.1 Descriptive analysis

Before proceeding with testing our hypotheses, insights can be gained by looking at some descriptive statistics. We first explore whether randomization to treatment worked by testing whether observable characteristic are balanced across the between subjects treatments. With respect to the socio-economic status of families, results from an ANOVA test indicate that the parents' age (mean=40.48 years old) as well as children's age (mean=8.16 years old) do not differ significantly between treatments (p-value=0.41 and 0.86 respectively). Kruskal-Wallis tests produce similar results with respect to parents' and children's age. In addition, Pearson's χ^2 tests indicate that the distribution of parents' gender as well as children's gender are not significantly different between treatments (χ^2 =2.51, p-value=0.47 and χ^2 =2.35, p-value=0.50, respectively).

Given that parent-children pairs would have different compositions (i.e., father-son, father-daughter, mother-son, mother-daughter), a question that might arise is whether the proportions of parent-child gender combinations differ across the treatments. We cannot reject the null of no difference between treatments (Pearson's χ^2 =10.85, p-value=0.29).

In addition, our between subject treatments do not differ in terms of income level (Kruskal Wallis χ^2=1.15, p-value=0.77), education level (Kruskal Wallis χ^2=1.37, p-value=0.71), family's geographical location residence (Pearson's χ^2=6.95, p-value=0.96), working status (Pearson's χ^2=7.35, p-value=0.83), marital status (Pearson's χ^2=9.66, p-value=0.38) and smoking status (Pearson's χ^2=5.51, p-value = 0.79). We also classified individuals according to parental weight status using Body Mass Index (WHO, 1995). Results show that 31% of those in our parent sample have a healthy weight status, 37% are overweight and 32% are obese. A Pearson's χ^2 of whether the distribution of weight status differs between treatments does not reject the null (χ^2 =3.86, p-value=0.69). We get a similar null effect if we use the raw BMI measurements (instead of the BMI categories) with an ANOVA test (p-value=0.85) as well as a Kruskal Wallis test (p-value=0.78). As far as child's weight status is concerned, we used the International Obesity Task Force (IOTF) cut offs (Cole et al.,

2000) to categorize children into weight categories. Our children sample consists of 61% children of healthy weight status, 28% of overweight children and 11% obese. None of our results changes when we use Centers for Disease Control (CDC) cut offs (CDC, 2009) since the distribution of weight categories did not significantly change. In particular, a Fisher's exact test of whether the distribution of weight status according to Cole measurement differs between treatments does not reject the null hypothesis (p-value=0.61). Similar results are given by a Pearson's χ^2 test when we use the weight status classification according to CDC (χ^2=4.29, p-value=0.64). Results from the use of the raw BMI (instead of BMI categories) produces the same null effect (ANOVA test, p-value= 0.33, Kruskal Wallis test, p-value=0.19).

Before moving to the econometric analysis, it is also important to have a first look at the raw choices of subjects. Subjects had to choose among three alternatives in each choice set. They could select the unhealthier alternative, the healthier alternative or none of the two alternatives. Our priors are that if parents are aware that a product for children has been taxed because it is unhealthier compared to others, it may discourage purchases of it; or if they are aware that a product has been subsidized because it is considered healthier than other products, it may enhance purchases of it. Overall, we expect that when information is provided about products whose price has been changed according to some fiscal policy, the purchasing behavior of parents would shift to healthier product choices. This hypothesis is confirmed by a proportion test when we test for differences in choices when information about fiscal policies is provided. For example, while 36% of choices are allocated to the healthier alternative in the "No pester - No info" treatment, the proportion rises to 72% in the "No pester - Info" treatment. This difference is statistically significant when we test using a proportions test (p-value<0.001). Similar behavior is observed in the "pester" treatments where choices shift from 21% to 58% to the healthier alternative when information about fiscal policies is provided. These are clear cut evidence that communicating the nature of the fiscal policy has a positive and significant effect on healthier choices. In both cases, the percentage of healthier choices increases more than twice.

On the other hand, children's pestering power has a negative effect on healthier choices. In the "No info" treatment, allowing the child to be able to communicate its preferences to the parent results in a significant decline of healthier purchases from

36% to 21% (p-value<0.001). Similarly, in the “Info” treatment, healthier choices decline from 72% to 58% (p-value<0.001) when children can exercise pestering power. In sum, we find that information about fiscal policies and pestering power can have opposite effects. The incidence of healthier choices increases when information is provided and children cannot exercise their pestering power.

To illustrate this further, Figure 1 graphs the proportion of healthier and unhealthier choices by treatment. The graphs ignore non-choices given the low number throughout our experiment (only 20 choices were non-choices out of 2268 choices that the 189 subjects did in our experiment).

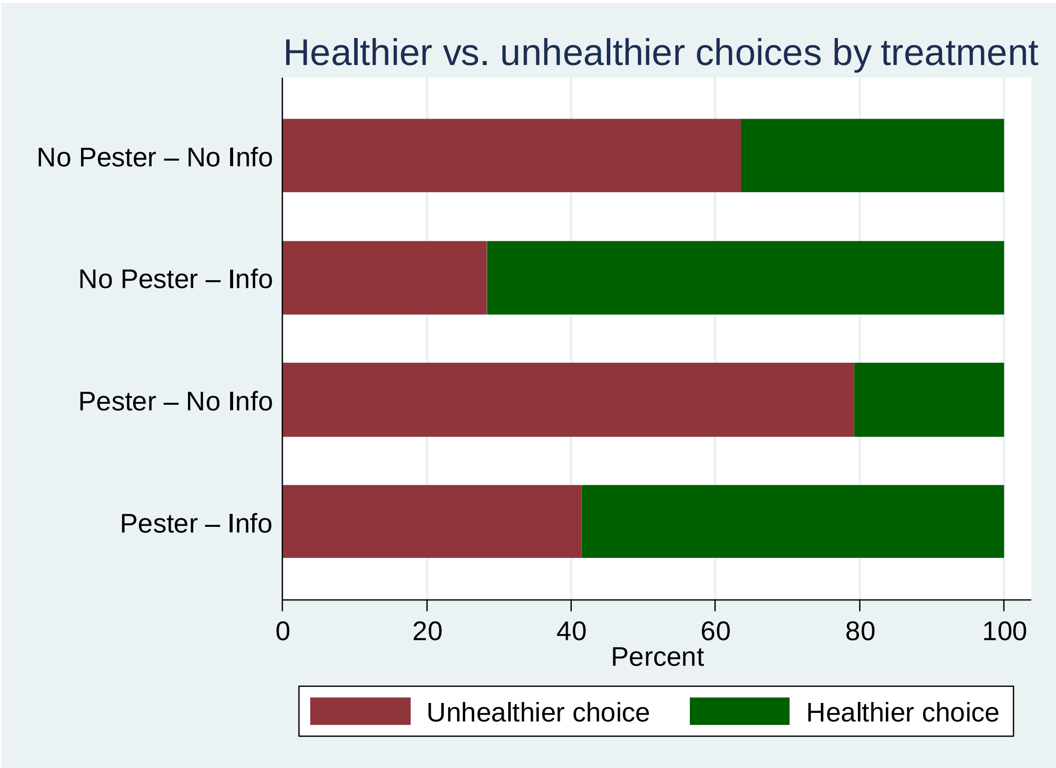

Figure 1. Healthier and unhealthier choices by (between-subjects) treatments

To examine the effect of specific fiscal policies (i.e., fat tax, subsidy or both) on healthier choices, Figure 2 displays the proportions of healthier and unhealthier choices by fiscal policy. The market price treatments are the benchmark (control treatments). It is clear that a) imposing fat tax *or* subsidy leads to increased healthier choices and b) imposing fat tax *and* subsidy at the same time can further improve healthier choices. We should pinpoint that healthier choices can go up to 83% of all choices when a fat tax and a subsidy are combined, when subjects receive information about fiscal policies, and children cannot exercise pestering power. In the case when information about fiscal policies is provided and there is pestering power, healthier choices go down to 71%. Finally, it is important to mention that even when information is not available and the kid is present (the two factors that favor unhealthier purchases), the combination of a fat tax and a subsidy produce the largest percentage of healthier choices when compared with the other fiscal policies (which amounts to 28%).

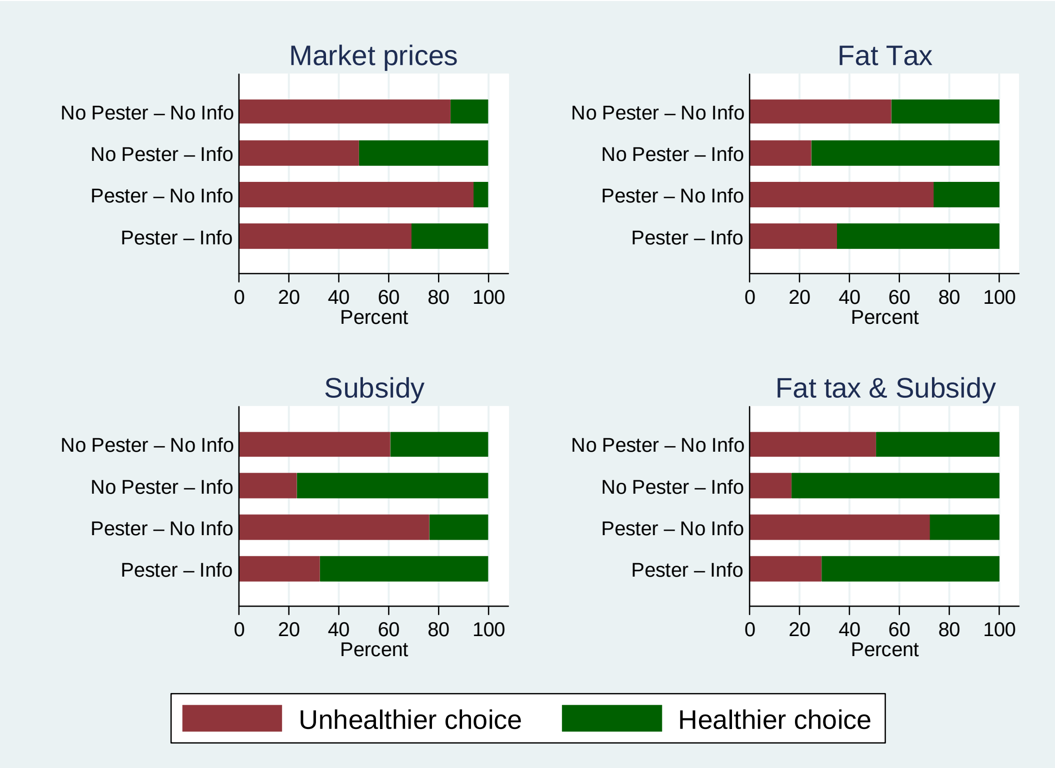

Figure 2. Healthier and unhealthier choices by (within-subjects) treatments

3.2 *Econometric analysis*

To check whether the insights gained from the descriptive analysis above hold under the scrutiny of conditional analysis, we estimated a mixed logit model [also referred to as the "random parameter logit model" or "mixed multinomial logit model" (Hensher et al., 2005)]. The mixed logit model solves three primary limitations of the standard logit model. It allows for random taste variation, unrestricted substitution pattern and correlation in unobserved factors over time (Train, 2003). McFadden and Train (2000) showed that under mild regularity conditions, a mixed logit model can calculate to any degree of accuracy any random utility model of discrete choice.

We assume that a sampled individual (n = 1,…, N) faces a choice among i alternatives in each of s choice tasks. The utility associated with each alternative i, as evaluated by each individual n in choice task s, is represented by the following model:

$$U_{nis} = \beta'_n x_{nis} + \varepsilon_{nis} \tag{1}$$

where x_{nis} is the full vector of explanatory variables that are observed by the analyst; β'_n is a vector of fixed and random coefficients across individuals parameters; and ε_{nis} is an i.i.d. extreme value error term.

In our experiment, the participants were asked to make 12 choices between dairy products offered at various pricing levels. The choices can be analyzed using the following mixed logit model:

$$U_{nis} = \beta_{0ni} + \beta_1 ChocoMilk + \beta_2 Cheese + \beta_{3i} Price + \beta_{4ni} Info + \beta_{5\mathrm{ni}} Pester + \varepsilon_{nis} \tag{2}$$

where β_{0ni} is the alternative specific constant (ASC) for alternative i; *ChocoMilk* and *Cheese* are product dummies (*Yoghurt* is the excluded category); *Price* is the price of the products; *Info* is a dummy variable for when information about the fiscal policies are provided to subjects; and *Pester* is a dummy variable indicating the treatment where the parent-child pair choose together (allowing the child to exercise pestering power).

The coefficient β_{0ni} captures parents' sensitivity to the health attribute and we model this as a random parameter that is triangularly distributed[7]. The coefficients of *Info* and *Pester*, which capture consumers' sensitivity to information provision and child's pestering power, are modelled as random and triangularly distributed as well. The parameters $\beta_1, \beta_2, \beta_3$ are non-random and capture consumer sensitivity towards product category and price changes. Finally, the alternative-specific constant for the "none-of-these" alternative is normalized to zero.

Table 3 shows the estimated coefficients of the parameters and respective standard errors from the estimated model of equation (2) (mixed logit (1) columns). For

[7] We tried several other distributions for the random coefficients of our model like the normal and the uniform distribution. Differences between models with different distributions for the random coefficients are negligible. We only report results from the models with triangular distribution because it is a limited distribution and therefore it does not imply that anyone has an unlimited high willingness to pay for snacks (Alfnes et al., 2006). See Hensher and Greene (2003) for a discussion on the various distributions in mixed logit models.

comparison, a multinomial logit model is also displayed as well as a mixed logit model for which only the alternative specific constants are modeled as random (mixed logit (2) columns). We can see that both the mixed logit models (LL= -1127.017 and LL= -1126.947) are an improvement to the more restrictive multinomial logit model (LL=-1394.050). Likelihood ratio tests indicate the mixed logit model (1) is to be preferred than the multinomial logit model (χ^2=534.07, p-value<0.001). A similar result is obtained when we compare the mixed logit model (2) with the multinomial logit model (χ^2=534.21, p-value<0.001). On the other hand, the two mixed logit models do equally well (χ^2=0.14, p-value=0.998). AIC values support these conclusions. Note that the two mixed models are qualitatively and quantitatively indistinguishable in terms of the estimated coefficients[8].

The alternative specific constants represent the utility of the alternatives (unhealthier-healthier) at base level and the alternative with the highest utility on the base level is the unhealthier alternative, namely ASC_U, which is significantly higher than the healthier alternative (Wald test-statistic: χ^2=46.69, p-value<0.001). The product dummies have no effect on the utilities of the alternatives. Furthermore, the coefficient of the *Price* variable for both the healthier and unhealthier alternatives is negative, as one would normally expect.

The coefficient of the information variable for the healthier alternative is positive and statistically significant at the 1% level, while for the unhealthier alternative, it is not statistically significant and of small magnitude. This means that providing information about fiscal policies affects the utility of the healthier alternative much more than the utility of the unhealthier alternative. A similar pattern in terms of statistical significance is observed for the child's pestering power coefficients. The pestering power dummy has a negative statistically significant effect for the healthier alternative but is not significant and is of small magnitude for the unhealthier alternative.

[8] We also estimated models that included a time of the session dummy (morning vs. afternoon sessions) to control for time of the day differences. The dummy was never statistically significant and of small magnitude. In addition, likelihood ratio tests indicate that the model with the time of the day dummy does not significantly improve the fit of the model (χ^2=0.928, p-value=0.629).

Table 3. Estimated parameters for the multinomial logit and mixed logit models

Multinomial logit			Mixed logit (1)			Mixed logit (2)		
Variable	**Coefficient**	**S.E.**	**Variable**	**Coefficient**	**S.E.**	**Variable**	**Coefficient**	**S.E.**
ASC_U	8.251***	1.056	$ASC_{U\ (R)}$	10.388***	1.120	$ASC_{U\ (R)}$	10.434***	1.121
ASC_H	7.040***	1.054	$ASC_{H\ (R)}$	8.197***	1.121	$ASC_{H\ (R)}$	8.196***	1.125
ChocoMilk	-1.621	1.052	ChocoMilk	-1.235	1.060	ChocoMilk	-1.237	1.060
Cheese	0.121	1.074	Cheese	1.566	1.099	Cheese	1.562	1.099
$Price_U$	-2.178***	0.179	$Price_U$	-3.505***	0.249	$Price_U$	-3.504***	0.249
$Price_H$	-2.348***	0.217	$Price_H$	-3.756***	0.294	$Price_H$	-3.755***	0.294
$Info_U$	0.970	0.631	$Info_{U\ (R)}$	0.662	0.703	$Info_U$	0.606	0.694
$Info_H$	2.683***	0.632	$Info_{H\ (R)}$	3.803***	0.742	$Info_H$	3.781***	0.743
$Pester_U$	0.061	0.456	$Pester_{U\ (R)}$	0.210	0.540	$Pester_U$	0.201	0.540
$Pester_H$	-0.673	0.459	$Pester_{H\ (R)}$	-1.239**	0.603	$Pester_H$	-1.238**	0.593
Log likelihood	-1394.050			-1127.017			-1126.947	
AIC	2808.100			2286.034			2277.894	
N				2268				

Note: ***, **, * denotes statistical significance at the 1%, 5% and 10% level, respectively.
(R): Denotes random coefficient for the respective variable.

Given that the estimates of the coefficients from the mixed logit model are meaningless for quantitative interpretations, we also calculated the effect of changes in prices on the choice probabilities for each of the alternatives (see Table 4). Since market prices between the three products differ, we simulated the fiscal policy changes separately for each product. Results show that changing the food fiscal policy for the choco milk beverage from a basic level of market prices to imposing a 15% fat tax, increases choices of the healthier alternative by 6.8% and decreases choices of the unhealthier alternative by 7.07%. The effect is proportional to a 25% fat tax and results in a 11.25% increase in healthier choices and a 11.8% decrease in unhealthier choices. The results from a corresponding subsidy of the healthier alternative show that the effect is even stronger in increasing the incidence of healthier choices. For example, a 25% subsidization of the price of the healthier cheese alternative results in a 19.6% increase in the healthier choice share while the equivalent fat tax imposed on the unhealthier alternative results in a 15.6% increase in the healthier choice share. This indicates that the implementation of a subsidy is more effective than the implementation of a fat tax in increasing healthier choices, at least in the context of our experiment.

Table 4. Two scenarios of fiscal policies and their effects on choice probabilities (%)

		Choco Milk			**Cheese**			**Yogurt**		
		FT	**SB**	**BO**	**FT**	**SB**	**BO**	**FT**	**SB**	**BO**
25%	**U**	-11.79	-12.16	-24.57	-21.41	-18.14	-38.52	-9.09	-9.65	-19.03
	H	11.25	12.25	24.29	15.61	19.62	35.97	8.96	9.68	18.95
	N	0.54	-0.09	.028	5.80	-1.48	2.55	0.13	-0.3	0.08
15%	**U**	-7.07	-7.35	-14.65	-12.49	-10.51	-23.09	-5.36	-5.68	-11.31
	H	6.81	7.42	14.48	9.36	11.39	21.77	5.29	5.70	11.28
	N	0.26	-0.07	0.17	3.13	-0.88	1.32	0.07	-0.02	0.03

Note: H: Healthier alternative, U: Unhealthier alternative, N: Non of these
FT: Change price from market price to fat tax, SB: Change price from market price to subsidy, BO: Change price from market price to both policies.

The combined effect of a fat tax and a subsidy is even more robust. The most prominent case is for the cheese product where a 25% fat tax on the unhealthier alternative and a 25% subsidy on the healthier alternative increase (decrease) the choice share of the healthier (unhealthier) alternative by 36% (38.5%).

4 Conclusion

Given the rapid rise in obesity especially among children, policymakers and academics have proposed a large number of policy measures to halt or reverse this trend. Some of the most well known mechanisms are food fiscal policies which may be used to nudge consumers towards a healthier way of eating. In this paper, we studied the effects of such policies within the family environment which is extremely important given that adult eating habits are acquired during childhood (Birch, 1988; Kelder et al., 1994; Lien et al., 2001). Thus, children are more apt to adopt healthier eating behaviour while they grow up under a healthy parental food “umbrella”. We focus on parental food choices since young children’s choices are normally constrained by what their parents provide them. In this study, we perceive food fiscal policies as a promising incentive mechanism that could create a parental environment that supports healthy eating in the family. However, specific factors that influence the effectiveness of food fiscal policies have to be taken into account.

From an economics perspective, this study tries to simulate the choices parents face in real world using real choice experiments, which is an incentive-compatible method that is easy for consumers to understand. In our experiment, subjects were tested in a “closed environment” as they could choose between three alternatives: a healthier and an unhealthier product of the same product category, brand and size, or the no-buy option. Although in real life, far more many options (brands, sizes, substitutes) are available in a grocery store that can create more complex substitution patterns resulting from fiscal policies, our small scale choice environment provides a clean illustration of the effects of these policies.

In terms of policy making, our study also illustrates that the magnitude of the effect of any fiscal policy can be weakened or enhanced by several other factors. For example, our study shows the significant (negative) influence that kids could exert on parental choice decisions (i.e., with their pestering power) when it comes to healthier foods. On the other hand, our findings suggest that if proper provision of information regarding the cause of the price increase/decrease is provided (e.g., on the shelf close to the price), the effect of a food fiscal policy can be enhanced. This finding implies that food fiscal policies should be accompanied by information campaigns to become more effective. More importantly, our results indicate that although there is an impact on healthier choices after the implementation of a fat tax or a subsidy, the simultaneous implementation of fat tax and subsidy can further improve healthier choices.

Overall, one of the ways for a fiscal policy that increases the price of some products to gain public acceptance is to convince consumers that the revenues from the difference in the payable price will be returned to them. This could be done with the implementation of subsidies to products considered healthier ensuring that food taxes are not more regressive to poor consumers; through educational programs related to healthy eating behavior among adults and children; through public information campaigns and fitness equipments/parks available to public; as well as through funding of the public health system. For example, Reger et al. (1999) reported that after a six-week mass media campaign and implementation of media public relation strategies in east Virginia to encourage consumers to switch from whole-fat milk (2%) to low-fat milk (1%), there was a 17% rise in low fat milk purchases. This effect lasted at least six months after the intervention ended.

Given the context upon which this study was conducted (i.e., in Greece), future research should test the robustness of our findings in other places where parenting styles, family structures, and eating culture could be different.

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Appendix A: Full list of choice tasks

	Price of unhealthier alternative	Price of healthier alternative	No-Buy Alternative	Product category
Choice task 1:	1.3	1.3	None of these	Choco Milk Beverage
Choice task 2:	1.62	1.3	None of these	
Choice task 3:	1.3	0.98	None of these	
Choice task 4:	1.62	0.98	None of these	
Choice task 5:	2	2	None of these	Cheese
Choice task 6:	2.5	2	None of these	
Choice task 7:	2	1.5	None of these	
Choice task 8:	2.5	1.5	None of these	
Choice task 9:	1	1	None of these	Yogurt
Choice task 10:	1.25	1	None of these	
Choice task 11:	1	0.75	None of these	
Choice task 12:	1.25	0.75	None of these	
Choice task 13:	1.5	1.5	None of these	Decoy Markers
Choice task 14:	1.5	1.5	None of these	
Choice task 15:	1.5	1.5	None of these	
Choice task 16:	1.5	1.5	None of these	
Choice task 17:	1.2	1.2	None of these	Decoy Pencils
Choice task 18:	1.2	1.2	None of these	
Choice task 19:	1.2	1.2	None of these	
Choice task 20:	1.2	1.2	None of these	

Appendix B: Experimental Instructions

[This is an English translation of the original instructions written in Greek. Text in brackets was not shown to subjects.]

Thank you for taking the time to participate in this survey. This study is a children's snack and stationery preference survey.

You have been randomly assigned a participant identity number (ID). You will use this ID to identify yourself. The ID must be written on the computer screen and on all papers handed in today. All information collected is strictly confidential and will only be used for this specific project.

Your participation fee is 30€. You will receive a voucher with a value of 30€. The voucher can be exchanged for money when you have completed all parts of the study. During the study you will be able to make real purchases if you wish to. I will give you more details on this part later on. The cost of any purchases you make will be deducted from the 30€ participation fee.

If you have any questions you may ask the moderator.

[Depending on the treatment, the experimenter enters the computer lab with the parent only or with the parent and the child together. Children that are not participating in the real choice experiment in treatments 1 and 3, spend their time in the lobby of the computer lab within eye contact distance from their parents. These children can watch cartoons or draw using paper and pencils.]

The first thing I want you to do is to examine all the products in this product display. You can see 5 product categories: milk drink, cheese, yogurt, pencils and markers. As you can see the products within a product category are of the same size and of the same brand.

[For treatments 2 and 4, where fiscal policy information was made available, the following paragraph was read to the participants while they were examining the products:]

“As you can see there are five product categories and each category has two products of the same size and brand but with different fat and sugar ingredient content. Now imagine that the health minister makes the following announcement on mass media: Due to the alarming obesity prevalence rates among children in our country we decided to apply the following food fiscal policies on dairy products that are commonly consumed by children. From next week, we will impose 3 different fiscal policies. The one, which is called fat tax, will increase the price of the product that is considered unhealthier by 25%; the second, which is called subsidy, will decrease the price of healthier products by 25%; and the third will combine a fat tax with a subsidy i.e., there will be a simultaneous increase of the price of the unhealthier product by 25% and a 25% decrease of the price of the healthier product.]

[Subject is then seated in front of a computer]

The products that were shown on display are going to appear on your screen in dyads. In total you will go through 20 choice tasks. Between tasks different products will appear but you might also see the same products at various price levels. In each choice task, you can choose between any of the two products or you can choose the no-buy option by selecting the “none of these” alternative.

When you complete all choice tasks, one of the choice tasks will be randomly selected as a binding task and you will have to purchase the product/alternative that you chose in this choice task. The price of the purchased product will be deducted from your participation fee. If you chose the “none of these” option in the binding choice task, then you won’t purchase any product and the full participation fee will be given to you. The random draw for the binding task will be performed in front of you using this jar. The jar contains folded papers listing numbers from one to twenty (as many as the choice tasks). That is, each choice task has a one out of twenty chance (5%) of being binding. More importantly, all tasks are equally likely to be selected as binding.

Today, you will purchase at most one product. The purchased product will be given to your child to be consumed while you will participate in the second part of this survey which is a socio-demographic questionnaire.

Are there any questions?

[If there are no questions, the experimenter proceeds with starting the computerized treatment and subject is instructed to proceed with the choice task.]

Appendix C: Manipulation Check Questionnaire

1. Did you enjoy participating?

2. Were you bored at any point?

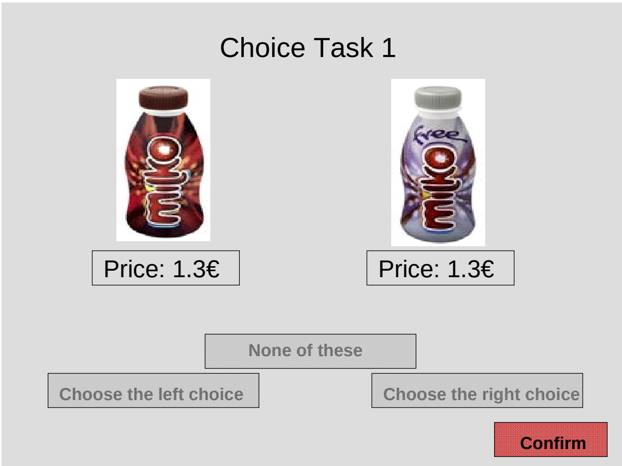
3. Do you have an idea about what was the purpose of the experiment?

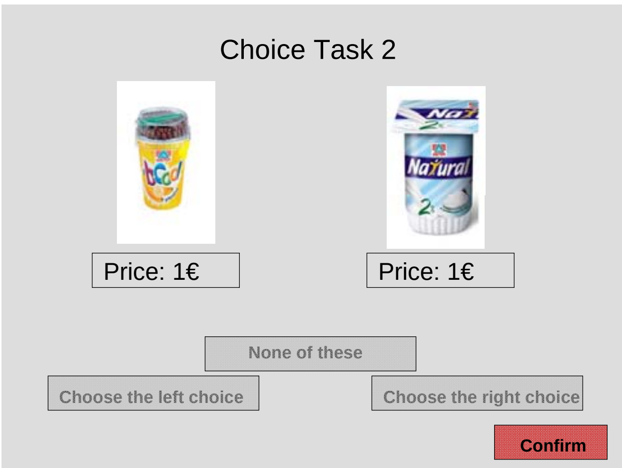
4. Did you choose based on the information provided to you at the beginning of the experiment?

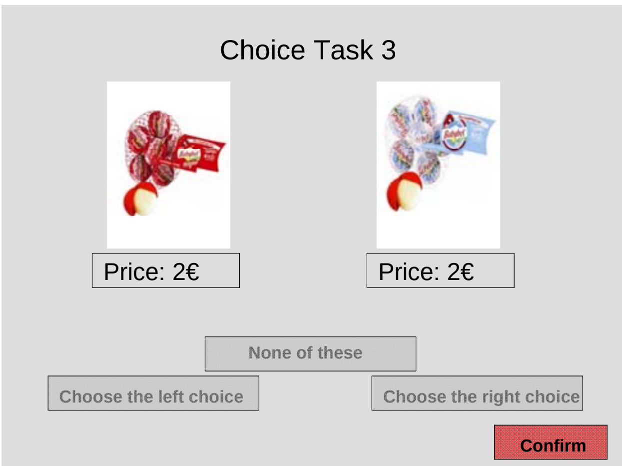
5. Did you respond based on what you think the experimenter wanted from you because you think that the experimenter could see your answers?

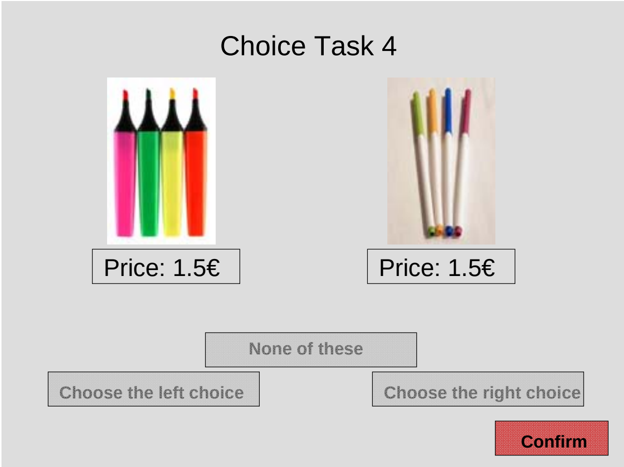
Appendix D: Example decision tasks for the market price treatment.

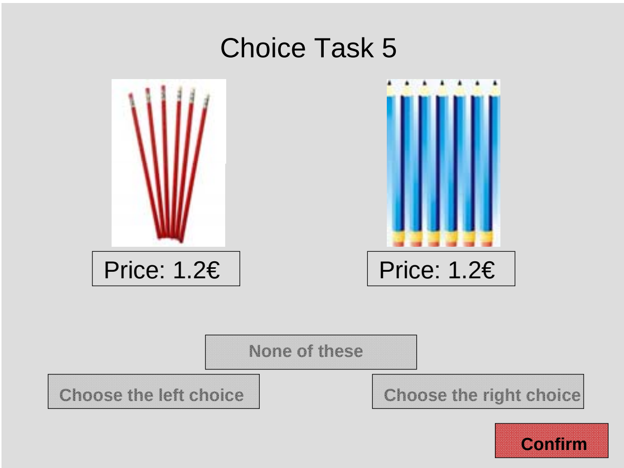
[This is an English version of the original screens that appeared in Greek for the market price treatment. Similar screens were shown for the fat tax, subsidy and both treatments with appropriate price adjustments.]








Choice Task 4
Price: 1.5€
Price: 1.5€
None of these
Choose the left choice
Choose the right choice
Confirm


Choice Task 5
Price: 1.2€
Price: 1.2€
None of these
Choose the left choice
Choose the right choice
Confirm