Measuring the Effects of Parental Food Control on Childhood Obesity: An Experimental Economics Approach

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May 13, 2007

Working Paper:
Please do contact the authors before citing.

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Abstract

This research uses experimental economics to measure the effect of parental generosity and child response on childhood overweight and obesity. The experiment uses the 'Carrot-Stick' experiment, an adaptation of the standard dictator game in which the respondent (the child) can punish or reward the dictator (the parent) based on the dictator's generosity. Two treatments are run which allow the child to spend his or her earnings on non-food and food items. We find significant relationships between parental weight and their level of generosity regarding food items. We also find significant relationships between child response behavior, obesigenic factors in the household, and the child's tendency toward overweight and obesity.

Key Words: Overweight, Obesity, Childhood, Family, Bargaining, 'Carrot-Stick,' Dictator, Experimental Economics

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Introduction

Over the last 30 years, childhood overweight and obesity has increased from four to 17% among children and adolescents between six and 11 years of age in the United States (Centers for Disease Control and Prevention/National Center for Health Statistics (CDC/NCHS) 2004; 2004; Institute of Medicine (IOM) 2004; 2006; National Center for Health Statistics 2006; Ogden, Carroll et al. 2006).[2] While family genetics do influence individual's susceptibility toward childhood overweight and obesity, the rapid change in its prevalence is evidence of changing environmental and behavioral factors affecting individual weight outcomes (Hill 1998; French, Story et al. 2001; Friedman 2003; 2003; 2004). Overweight children are at higher risk for heart disease, face a higher probability of sleep apnea, and social and psychological problems, including low self-esteem. Studies indicate childhood obesity tends to persist into adulthood, which increases the risk of a multitude of chronic disease health risks that are related with high costs to the individual and the society (Mokdad, Sedula et al. 2000; Finkelstein, Fiebelkorn et al. 2004; Centers for Disease Control and Prevention 2007) .

[2] Overweight and obesity is categorized by the Body Mass Index (BMI), which is determined by the formula: weight (in kilograms)/height^2 (in meters). Among adults, overweight is classified by a BMI between 25.0 and 29.9, while a BMI greater than or equal to 30.0 defines obesity (Center for Disease Control and Prevention. (2007). "Defining Overweight and Obesity." Retrieved May 13, from http://www.cdc.gov/nccdphp/dnpa/obesity/defining.htm.) Overweight in children is typically not referred to as "obesity", though these terms will be used interchangeably in this proposal. Overweight in children is defined as a body mass index that surpasses the 95th percentile of a fixed distribution for a child's age and gender. Children who are above the 85th percentile are considered at-risk of overweight (Centers for Disease Control and Prevention. (2007). "About BMI for Children and Teens." Retrieved May 11, from http://www.cdc.gov/nccdphp/dnpa/bmi/childrens_BMI/about_childrens_BMI.htm#What%20is%20BMI%20percentile.)

One of the challenges to understanding childhood overweight and obesity is determining the roles economics and economic behavior play in creating an obesigenic household environment. Macro-level economic analysis of obesity finds several significant economic indicators of childhood overweight and obesity in the household including mother's education, ethnic origin, family size, use of food assistance programs, income, and other socioeconomic variable (Anderson, Butcher et al. 2003; Ruhm 2004). Microeconomic studies dealing with childhood overweight and obesity are limited. Those studies related to obesity use relative changes in food prices, income, and time constraints to explain changes in the family's diet composition (Drenowski 2003; Mancino and Kinsey 2004; Schroeter, Lusk et al. Forthcoming). These microeconomic studies provide evidence that changing income constraints and prices are changing the choices that consumers make. However, there is need for studies that explain *why* certain economic changes (such as prices and income) and demographic characteristics lead to increased incidence of childhood obesity in some families and not in others. For example, while one of the most obesity-susceptible populations appears to be low-income families (Drenowski 2003; Sigman-Grant 2003), not all low-income families have overweight children. Further, while adults regularly act as direct price takers in the market place, children do not. Their consumption depends upon economic behavior relationships within the household.

The increased presence of childhood overweight and obesity in low-income households reveals that overweight and obesity are not necessarily a problem of over-abundance, but one of food insecurity (Drenowski 2003; Sigman-Grant 2003; Hofferth and Curtin 2005). Whether or not a child is overweight or obese depends on the complex choices their parents make over the given quantity, quality, and variety of food available. Thus, families' ability to navigate

obesigenic environments may be influenced by their economic behavioral decision-making processes.

In addition to economic conditions and choices, other environmental and behavioral factors are known to increase the likelihood of child overweight and obesity in the household. For example, the number of televisions in the family household and the child's TV-viewing time positively influence the child's weight status (Dietz 1991; Storey, Forshee et al. 2003). Behaviorally, elements of the parent-child relationship and interaction may have significant effects on child's weight status (Agras and Mascola 2005). Overly controlling or authoritative parenting around food may limit a child's ability to make healthy food choices for his or herself and result in higher child weight outcomes. At the same time, overly permissive parenting or parenting that lacks in sufficient food oversight may also result in higher likelihood of child overweight and obesity because children do not learn to limit their intake of unhealthy food choices. An authoritative style or one in which parents encourage healthy eating, but the children are given ultimate food choice results in the healthiest child weight outcomes (Birch and Fisher 1998; Patrick and Nicklas 2005; 2005).

The goal of this research is to use economic experiments to measure how parental generosity around food is different from that related to non-food items. In addition, the experimental design allows us to further explore behavioral dynamics between parent and child and to examine the degree to which the child may punish, reward, or manipulate the parent. These measures are analyzed along with survey measurements of family food and fitness behavior to determine the role economic behavior may play in building an obesigenic household environment. The findings from the experiment and analysis suggest the need for increased

parent awareness about the consequences of food resource allocation decisions, as well as better improved nutritional knowledge for both parent and child.

Literature Review

Family Food and Fitness Behavior

Research outside the field of economics shows that attitudes and behaviors towards food and eating are significantly influenced by behavioral factors in the family (Birch and Fisher 1995; Strauss and Knight 1999; Gable and Lutz 2000; Stang, Rehorst et al. 2004; Patrick, Nicklas et al. 2005; Fiore, Travis et al. 2006). Families influence when and what is eaten, how much is eaten, and where food is eaten even when the children are school aged (Birch and Fisher 1998; Faith, Scanlon et al. 2004; Stang, Rehorst et al. 2004). Families also model behaviors and attitudes towards food and provide and encourage different foods based on a range of factors, including nutritional knowledge (Variyam, Shim et al. 2001; Davison and Birch 2002; Cooke, Wardle et al. 2003; Davison, Francis et al. 2005; Wardle, Carnell et al. 2005) .

Parental control of feeding behavior has a significant influence on child weight status (Agras and Mascola 2005). Parents control the diet of their children by restricting what and when they eat and in what amounts. The role of parental control is not limited to young children, but also influences school aged and older children (Stang, Rehorst et al. 2004). Control can be negative if parents limit children's abilities to self-regulate their food intake. Extreme control over what children eat can also "backfire" and actually cause children to desire the foods that parents are attempting to limit (see Ritchie, Welk et al. 2005 for a review). This ultimately can lead to disruption of normal energy intake, overeating, and subsequent weight gain. Of course, on the flip side, parental control can be viewed as healthy when parents model and promote

healthy eating choices, and provide for a range of dietary options. It is recommended that parents provide healthy (nutrient-dense) foods and beverages, and limit their access to unhealthy (nutrient-poor foods). However, it is also important not to be excessive in restricting access to unhealthy foods, to not overly encourage the eating of certain foods, and to limit the use of food as a reward (Ritchie, Welk et al. 2005). This style of feeding has been defined as "authoritative" – parents encourage healthy eating, but the children are given the ultimate choice in deciding what they ultimately eat (Birch and Fisher 1995; Patrick, Nicklas et al. 2005).

Parents have a significant role to play in the amount of physical activity of their child (see Epstein, Paluch et al. 2004; Lindsay, Sussner et al. 2006 for a review). Families create "obesigenic" environments by their behaviors and actions regarding what they eat, how active they are and by the activities they allow or discourage (in particular, television viewing) (Davison and Birch 2002; Davison, Francis et al. 2005; Lindsay, Sussner et al. 2006). Parents who are not physically active have children who are not active (see Strauss and Knight 1999 for a review). Reviews of the research support the notion of parents serving as "gatekeepers" in how much time their children spend outside, how they model and encourage participation in healthy activities (Ritchie, Welk et al. 2005) and also how important they believe physical activity to be (Kimiecik and Horn 1998). Of course, as with parental control of eating behavior, too much or too little encouragement can result in negative consequences for the child. Parents need to support and encourage physical activity, not demand it. Research also supports the notion that these parental beliefs and attitudes may vary by ethnicity (McGuire, Hannan et al. 2002).

Environmental Factors

All of the previously discussed elements of family life contribute to the family environment. However, we have not discussed the influence of the physical structure of the environment on child well-being. We plan to control for other, physical environment factors in our analysis. These include child television viewing, neighborhood characteristics, and school and number of meals at school. We will briefly review the literature pertaining to these environmental factors in this section.

One of the first environmental factors to consider is technology in the household. Technological change influences how children use their time. Several studies have explained the contribution of TV-watching on childhood obesity (Dietz 1991; Storey, Forshee et al. 2003). The issue of television viewing and its link to childhood obesity has been receiving particular attention in the research literature. Research is beginning to support the notion that television viewing (and, to a lesser extent, video game playing) may be a significant contributor to the increase in childhood obesity in our society. Researchers have found that as the hours of television watching a day increases, so do the odds of becoming overweight as a child (see Strauss and Knight 1999; Agras and Mascola 2005 for a review). This is believed to be due to the "activity" of television watching supplanting the possibility of other more active activities. This notion has received some support in the research literature (Salmon, Timperio et al. 2005). Eating meals in front of the television may also negate some of the positive aspects of family meal times in terms of health. For example, having the television on during meals has been found to be related to lower fruit and vegetable consumption and higher fat consumption in adults (Boutelle, Birnbaum et al. 2003). Parents can play a role by limiting television and video games or other sedentary activities (Ritchie, Welk et al. 2005; Lindsay, Sussner et al. 2006).

Furthermore, many television shows targeted at children also feature advertising for high-calorie, high-sugar and energy-dense foods which is believed to be related to an increase in consumption of such products (see Strauss and Knight 1999 for a review). The issue of advertising of "unhealthy" foods may be all the more relevant for some ethnic minority groups, in particular, African-Americas. Content analyses of advertising has found that shows popular among African-Americans feature more advertising than do other prime-time shows in general (see Kumanyika and Grier 2003 for a review).

The physical structure of the neighborhood also affects weight outcomes. Children with access to safe, open areas to play are less likely to be overweight and obese. This is problematic for children in poor neighborhoods where there are fewer parks and playgrounds in which they could exercise. Often these same areas have stores which stock less fresh food at higher prices, while fast food outlets proliferate (The Economist 2002).

The school that a child attends is a factor of import to explain childhood overweight and obesity. This is due to a number of school characteristics, but an important one is the availability of sodas and snacks from vending machines (Anderson and Butcher 2006; Anderson and Butcher 2006). Furthermore, the child's food consumption at school has implication for weight status. Often, children who consume federally subsidized school lunches are more likely to be overweight and obese (Hofferth and Curtin 2005).

Economic Approaches

Historically, children in households with limited incomes were malnourished. However, in recent years, the problem has been reversed. Compared to high-income households, low-income households in high-income countries tend to consume lower quality diets, consisting

mainly of high-calorie foods, leading to problems of overweight and obesity (Townsend, J. et al. 2001; The Economist 2002; Drenowski 2003). The highest rates of obesity occur among population groups with low income and low education levels (Sobol and Stunkard 1989; Jeffery, S.A. et al. 1991; Gortmaker, Must et al. 1993; Jeffery and French 1996; Galobardes, Morabia et al. 2000; Wang 2001; Cutler, Glaeser et al. 2003; Chou and Grossman 2004). The prevalence of obesity is also disproportionately high among children from ethnic minority groups, especially African-American and Hispanic children (e.g., Galuska, Serdula et al. 1996; Flegal, M.D. et al. 2002; Kumanyika and Grier 2003) .

Looking beyond the traditional structural economic variables (such as prices and income), aspects of familial economic behavior may affect child overweight and obesity in the household. Following the seminal work of Becker (1976), family, household economic behavior has been modeled but not in regard to childhood overweight and obesity. Further, we now have the ability through economic experiments to measure and understand economic behavior which may influence food allocation in the household, such as familial time preference, risk preference, and generosity and negotiation norms (Eckel and Grossman 2002; Harrison, Lau et al. 2002; Holt and Laury 2002; Andreoni, Harbaugh et al. 2003) .

Despite the abundant availability of economic tools to understand individual economic behavior and behavior within the household, there have been limited attempts to use them in relation to current childhood obesity problems in the United States. Household modeling has been used with secondary data (e.g., Mancino and Kinsey 2004) . However, we believe such studies' reliance on secondary data may be limiting our understanding of childhood obesity and the role of lower-income in its prevalence.

In his 2003 Nobel Laureate address, Vernon Smith points out that over the last 20 years, experimental economic methods have made great gains in understanding individual behavior, bargaining interaction between individuals, and market mechanisms (Smith 2003). Since then, a rising trend is to use experimental economic methods to understand household-level interaction. This is mainly seen in the development economics literature (Ashraf 2005; Eckel, Hotz et al. 2006). Economic experiments are a useful tool to understand what types of contextual variables influence subject behavior through laboratory control. In addition, experiments are a means to obtain snapshots of behavior that is endemic to certain types of groups and individuals. For example, Henrich et al. (2001) use the ultimatum bargaining experiment across fifteen small-scale, culturally diverse societies, to determine how culture shapes individuals' ideas of fairness. In this study, we believe economic experiments may be a method to extract differences in economic behavior which underlie family decisions regarding nutrition and fitness.

In order to understand the family's decision making process, it is important not only to access the parent's decision behavior, but also the influence of the child on those decisions. Harbaugh *et al.*(2003) use economic experiments to determine how bargaining expectations develop in children. In these experiments, the ultimatum bargaining game is played between child pairs. He finds that children do have developmental differences in their ultimatum bargaining expectations that are influenced by culture. This idea has yet to be examined in a parent-child context. Adapting this or a similar experiment to a parent-child context may provide insight into parent child dynamics related to parenting styles. Experimental methods allow us to vary the context of the parent-child bargaining process. In order to understand the dynamics of the child's role in bargaining for food, we propose a bargaining experiment where the child has two different options to spend his or her earnings in the laboratory across two different

treatments: one where his or her earnings may be spent on non-food and another where he or she may spend the earnings on food items.

Methods

The primary null hypotheses to be tested in this paper include the following:

H_{01}: There is no significant difference in parent giving based on the child's weight status for either the non-food or food treatments.

H_{02}: There is not significant difference in parent giving based on the parent's weight status for either the non-food or food treatments.

H_{03}: There is no significant difference in child response based on child overweight status in the food and non-food treatments.

H_{04}: There is no significant difference in child response based on family food behavior and environmental factors.

The research methods combine the use of an economic experiment, a survey, and physical fitness measurements (e.g., step test, skin-fold test, and heart rate measurement). The economic experiment is referred to as the "carrot and stick" experiment (Andreoni, Harbaugh et al. 2003). This experiment uses an adaptation of the dictator game often used in economic experiments (Camerer 2003). The experiments begin as a standard dictator game. The parent is given an endowment of $5 worth of tokens or 20 tokens worth $.25 a piece. The parent's task is to determine how many of these tokens he or she will give to the child. The child's spending opportunity in this experiment follows general methods developed in previous economic experiments for children by Harbaugh et al. (2002). The child has the option to spend these tokens in an experimental toy store in the first treatment of this experiment. Following Andreoni

et al. (2003), the experiment deviates from the standard dictator game after the child receives the tokens. The child counts the tokens that his or her parent sent. Then, the child has three options, they can 1) increase the number of tokens their parent has, 2) decrease the number of tokens their parent has, or 3) make no change to the number of tokens their parent has. If the child chooses options one or two, he or she must make a payment of one token to the experimental bank for his or her parents to either receive or lose any tokens. To measure the effect of food on parents giving behavior and children's control, the experiment is repeated one more time. This time, everything is the same, except that the child will spend the tokens he or she receives in a snack store. The snack store is stocked with food similar to that one would find in a vending machine or convenience store. Parental generosity and control around food may then be measured from treatment one to treatment two. While it is expected that many parents may change their giving from the first to second treatment, parents with greater (or less) control may change their giving behavior more (or less) from treatment one to treatment two. The power of the child's role in the bargaining relationship is measured by his or her tendency to make any change to his or her parent's giving decision.

After the parents and child complete the economic experiments, the parent fills out a questionnaire that consists of three different parts. The first section includes a series of questions designed to measure attitudes and behaviors known to be related to childhood overweight and obesity. This section includes questions related to food habits (e.g., consumption of soda pop at meals, importance of family meal times), environment (e.g., presence of television and video games in the home, distance of home from nearest park), nutritional knowledge (e.g., Does the parent read food labels?), food purchasing behavior (measures role of price versus health concerns versus child preferences versus taste in food purchasing decisions), household food

security (e.g., Is having enough money to buy food ever a problem?), and physical activity (e.g. How often do they play outside with child?). The nutritional knowledge questions are based on those in the United States Department of Agriculture's Continuing Survey of Food Intakes by Individuals and Diet and Health Knowledge Survey (1994-1996) (Agricultural Research Service 2007). The second part of the survey measures parental feeding behavior and it is based on the Caregiver Feeding Styles Questionnaire (Patrick, Nicklas et al. 2005). This instrument was originally designed for use with preschool aged children, but will be adapted for use with school aged children for the purposes of this study. The third part of the survey includes questions designed to collect basic demographic and socioeconomic variables (e.g., age, ethnicity, yearly income, etc.).

The final task the subjects complete is a physical fitness assessment. At the end of the economic experiments and questionnaire, the physical weight and height of all of the family participants is measured using standard medical scale. In addition, a skin-fold test and three minute step test is measured by using a tool that gently squeezes various areas of the body (such as arm, thigh, back, and stomach) to calculate the amount of fat stored beneath the skin. Fitness levels are estimated using a 3-minute step test. During this test the subjects are asked wear a heart rate monitor while stepping up and down a step box to a beat set by a metronome. Heart rate and blood pressure are measured before, immediately after, and 3 minutes after the test. Blood pressure is measured similar to how it is measured in a physician's office.

Data Summary

Data collection took place from May to December 2006 in Laramie, Wyoming. It focused on low-income families with children between the ages of 6 and 10.[3] The primary feeding parent and one child between the ages of 6 and 10 were asked to come to the laboratory.[4] Each family was guaranteed a $10 show-up fee for their participation. A total of 39 families participated in the study. They each participated in three economics experiments (a time preference experiment, risk preference experiment, and the current 'carrot-stick' experiment) and their expected earning from all of the activities ranged from $70 to $150.

The physical and demographic characteristics of the experiment participants are displayed in Table 1. On average, the parents in the study were obese (Body Mass Index greater or equal to 30) with a mean Body Mass Index (BMI) of 32.52. The highest BMI was 46. Only five of 37 parents permitting a BMI measurement had a BMI below 25. In other words, 86 percent of the sample was overweight or obese. Eight parent participants had BMI measurements between 40 and 46. Measurements of the child subjects' weight percentiles show the mean child weight percentile is 66.91. On average, the children in this student were normal weight or underweight or fell below the 85th percentile. However, 15 of the 37 children measured were at least in the 85th weight percentile. In addition, consistent with other studies of low-income populations, a number of children were underweight or approaching underweight (e.g., BMI<15). A plot of the child weight percentile data is presented in Figure 1. One will observe that there is break in the distribution of children's weights across the child weight percentiles in the mid-percentile ranges. Children in this sample tend to either have a weight status approaching overweight or underweight. The average primary feeder in this study had an hourly

[3] Low-income is defined as within 185 percent of the poverty line.
[4] The primary feeding parent is the parent involved the most in the child's meal and snack preparation. In families where the role of child feeding is shared, either parent was allowed to be in the study.

wage of $6.52 or approximately $12,500 per year before taxes. Thirty six percent of the primary feeding parents were single. Fifteen percent of households had an additional non-parent member, such as a grant parent, aunt or uncle. Finally, the average education level of the primary feeder was 12.84 years or approximately a high school diploma.

Results

We begin the data analysis with an overview and statistical tests of parent offer behavior and child response data. The mean parent offer behavior is displayed in Figure 2. In the first treatment, the mean parent offer was 56.28 percent (σ = 22.18 percent) of the $5 endowment. This drops to 33.21percent (σ = 22.20 percent) of the $5 endowment in the second, food treatment. This was a significant change in offer behavior across the nonfood and food treatments of the experiment (t-statistic=7.15, p<0.001). In addition, the frequency of parent offers did change (χ^2 =102.2, p=0.0479). The child response, *R*, is measured as the absolute value of the percent of the endowment, *e*, the child pays to have returned to or taken from the parent, *r*. In the non-food treatment, children responded by giving or taking an average of 13.16 percent (σ =21.95 percent) of the endowment. In the food treatment, the children's mean response was to take or give 16.32 percent (σ =25.41 percent) of the endowment. There are no significant differences in average child response from the first to second or non-food to food treatments, but there are significant differences in the frequency of responses (χ^2 =52.75, p=0.0001). In both treatments, the majority children showed agreement with their parent or did not respond. Twenty six and 23 children did not respond in the first and second treatments, respectively.

Given the general results of the experiment, we tested several hypothesis of interest. First, we tested the null hypothesis that there is no difference between the change in parent giving based on the child's overweight status (i.e., the child is in the 85^{th} or higher weight percentile). Then, we tested the null hypothesis that there is no difference on parental giving behavior based on the parent's weight status for either the non-food or food treatments. Summary statistics of the parent's offers across treatments and weight groups are presented in Table 2. We use a Wilcoxon statistic test to test the difference in distributions of parental giving behavior for overweight (85^{th} weight percentile or greater) versus normal and lower weight children (less than 85^{th} weight percentile). We do not reject the null hypothesis that there is a difference in parental offers based on the child's weight category for the non-food or food treatments. We do, however, find there is a significant difference using a Wilcoxon test in offer distributions by parent overweight status in the food treatment. Healthy parents with BMIs below 25 gave an average of 24.3 percent of the endowment to their children to spend on snack food. Overweight and obese parents (BMI greater than 25), on the other hand, gave an average of 35.2 percent of the endowment to their children to spend on snack food. The distribution in these offers was significantly different ($p<0.10$). None of the healthy parents gave their child more than 50 percent of the endowment to spend on the food.

The third hypothesis focuses on the child's response in the food treatment. To test the third null hypothesis, that child response is independent of weight status, we use chi-square and Wilcoxon statistics to tests for distributional differences between responses from overweight and obese children and all other children. The tests are conducted using both the original, r, and absolute value of the child's response (i.e., $|r|$). Initial, non-parametric tests do not reject the null hypothesis.

This third hypothesis is tested again in conjunction with the fourth hypothesis using ordinary least squares regression to control for other environmental and behavioral family characteristics which may influence child response. Two different models are estimated. The coefficient definitions are displayed in Table 3 and the coefficient parameter estimates are displayed in Table 4. The $|r|$ measurement is the dependent variable in the first model and r is the dependent variable in the second model. Both the R-square and F-statistic are more robust in the first than the second model. We first discuss the results of the first model, and then use the results from the second model to further explain key results from the first model.

The absolute value of the child's second response in the food treatment is as the dependent variable in Model 1. The explanatory variables include measurements from the experiment, survey questions about family food and fitness behavior, and the parent's demographic behavior. The child's second response, $|r|$, is the absolute value of the child's response in the food treatment or $|r|$. For example, if the child had 20 percent of the endowment taken from their parents, then $|r|=20$. Likewise, if the child had 20 percent of the endowment given to their parents, then $|r|=20$. The coefficient estimation results indicate there are number of relationships between child's response and the experimental, familial, and demographic variables. First, let us point out the results relating to the family food behavior and environmental variables. The coefficient estimation indicates there is significant, positive relationship between the child's ability to eat as much as s/he wants to and their tendency to respond to their parent in the carrot-stick game. Similarly, children who live in households where television in viewed during meal time were more likely to respond to their parent. The coefficient associated with parental control is highly significant and negative. Its value indicates that children whose parents believe they have control over the child's food consumption responded with nearly 55 percent

fewer tokens than those were the parent's did not report control. There were not significant relationships between the child's response tendency that pleasing the child plays in the family food purchase decision—parents tended to ranked price and taste as more important factors in the actual food purchase decision. Second, it is important to consider parent's offer and how it influenced the child's giving behavior. There is a significant and positive relationship between the parent's offer and the child's giving behavior. A ten percent increase in the parent's offer will lead the child to increase their response by 0.33 percent in magnitude. This is a relatively small effect compared to the coefficients associated with the role of more general, family behavior and environmental variables. Third, we consider general demographic characteristics of the primary feeding parent. If the parent was unemployed (this excluded "stay-at-home" parents), the child increased the size of their response by 27 percent on average. There were three unemployed primary feeders in the study, the children gave them zero to eighty percent of the endowment in response to their offers. There were five Hispanic families in the study. There is not significant difference in child response in the Hispanic families compared to non-Hispanic families. Finally, we consider the parent and child BMIs and their relation to child giving behavior. There was not a significant relationship between parent BMI and child response behavior in the model. There is however, a significant relationship between the child overweight and obesity status and the child's response. The response of children who are overweight and obese increased in magnitude by 15 percent compared to children in less than the 85^{th} weight percentile.

The second model uses the raw or literal measure of child response as the dependent variable, *r*. Fewer explanatory variables are significant in this model, but they add more insight into the meaning of the variables in the first model. The three significant survey measures from the first model—Child Eats, Television, and Control—are also significant in the second model.

The Child Eats coefficient indicates children in households where the parent reported the child eats as much has the child wants gave 11 percent more tokens to their parent for every incremental increase in the parent's response toward "Always". Children in households where the television is watched during meals times gave 9 percent more tokens to their parent for every incremental increase in the parent's response toward "Always." In contrast, the children of parents who reported they (the parents) have control over food consumption gave 40 percent fewer tokens. Finally, the Unemployed coefficient is also significant in this model. Its value is similar to its value in the other model. Like the other variables, the value is slightly higher.

Conclusions

This research offers a unique approach to integrate economic experiments into greater household behavior and environmental dynamics. The analysis of the experiment results using non-parametric statistical and regression analysis may offer a new way to measure parent-child dynamics in the household which relate to obesigenic factors in the household. The results of the non-parametric tests resulted in three main findings: 1) parents' giving behavior differs between food and non-food situations, 2) children's responses change along with changes in parental generosity from non-food to food situations, and 3) the parent's food giving behavior is related to the parent's own weight status. The first finding of this analysis is unsurprising. We expected to see some change in parent giving due to the mere nature and expense of food and non-food items. The second finding was actually less pronounced than expected. Only the distribution of responses changed from the non-food to food treatments. The mean responses were not significantly different. The third finding seemed, at first, somewhat unexpected. However, upon further reflection it was less surprising. Parents with BMIs below 25 are considered healthy.

They themselves have to make healthy food choices to maintain this health status and, undoubtedly, are also more aware of the healthfulness of the food choices their children face. They were less willing to give their children greater proportions of the endowment to spend on the snack food being sold in our study.

The results from the regression analysis indicate the behavior displayed in the carrot-stick game may be indicative of broader familial interactions and child health conditions. The insignificance of the Pleasure variable indicates the children do not have absolute domain over all food decisions—additional analysis shows other factors such as price and taste are more important to the feeding parent in the food purchase decision. However, the significance of the Child Eats, Television, and Control do represent important food-related household behaviors. This may indicate the children that were more likely to respond in the carrot-stick game play a more important role in household decisions than other children. This may be healthy regarding many aspects of the household resource allocation process. However, in the case of food, this may also have significant, unhealthy consequences if it results in poorer nutrition leading to higher probability overweight and obesity. The significance of the child's overweight status (e.g., in the 85^{th} weight percentile or greater) may indicate that children who play too much of a role in decisions, especially those regarding food, are more susceptible to overweight. This may reflect a more permissive parenting style which has previously been shown to lead to greater incidence of child overweight and obesity in the household (Birch and Fisher 1998; Patrick, Nicklas et al. 2005).

There are potential policy implications for nutrition education based on this research. These results may indicate that some children are more involved in the household food-related decisions in more obesigenic households. If this is the case, and this involvement leads to

adverse child health outcomes, then parents need to be more aware of the roles they need to play in food purchase and allocation process. However, lack of parent control in food allocation may reflect a number of different constraints including time, energy, and education. To the extent that it reflects a lack of nutritional knowledge and awareness, more education is needed to ensure that parents are able to make health food and environment choices. To the extent that this reflects time and energy constraints, children need to have as much nutritional knowledge as possible to make healthy food choices on their own. Single working mothers may lack the time and energy to make the many decisions around food to maintain their child's diet. In this case, it is important that the children are also aware of nutritious and healthy choices.

The results of this study are preliminary in that this uses pilot data from a soon to be initiated, larger study. The relatively low number of observations do limit the analytical and modeling possibilities for the data. Future research may include a number of adaptations, including multiple rounds of play around the food and non-food items.

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Table 1. Summary Statistics of Key Physical and Demographic Variables

Variable	Number of Observations	Minimum	Maximum	Mean	Standard Deviation
Parent BMI	37	21	46	32.52	7.25
Child Weight Percentile	37	9.50	99.60	66.91	31.34
Parent's Average Hourly Wage	35	0	20	6.52	5.76
Single Parent	39	0	1	0.36	0.49
Married Parent	39	0	1	0.54	0.51
Households with Non-parent Adults	39	0	1	0.15	0.37
Parent's Years of Education	37	8	16	12.84	2.25

Table 2. Parent Offers for the Non-Food and Food Treatments

Variable	N	Mean Offer	Standard Deviation	Minimum	Maximum
Parents' Offers for Non-Food					
Parents with BMI greater than 25	32	56.41	22.66	25	100
Parents with BMI less than or equal to 5	7	55.72	21.49	30	100
Parents with Children in 85th Percentile or greater	23	54.78	22.13	25	100
Parents with Children in less than 85th Percentile	16	58.44	22.78	35	100
Parents' Offers for Food					
Parents with BMI greater than 25	32	35.2	23.4	10	100
Parents with BMI less than or equal to 5	7	24.29	13.36	10	50
Parents with Children in 85th Percentile or greater	23	32.61	23.35	15	100
Parents with Children in less than 85th Percentile	16	34.06	21.15	10	100

Figure 1. Plot of Number of Children across Child Weight Percentiles

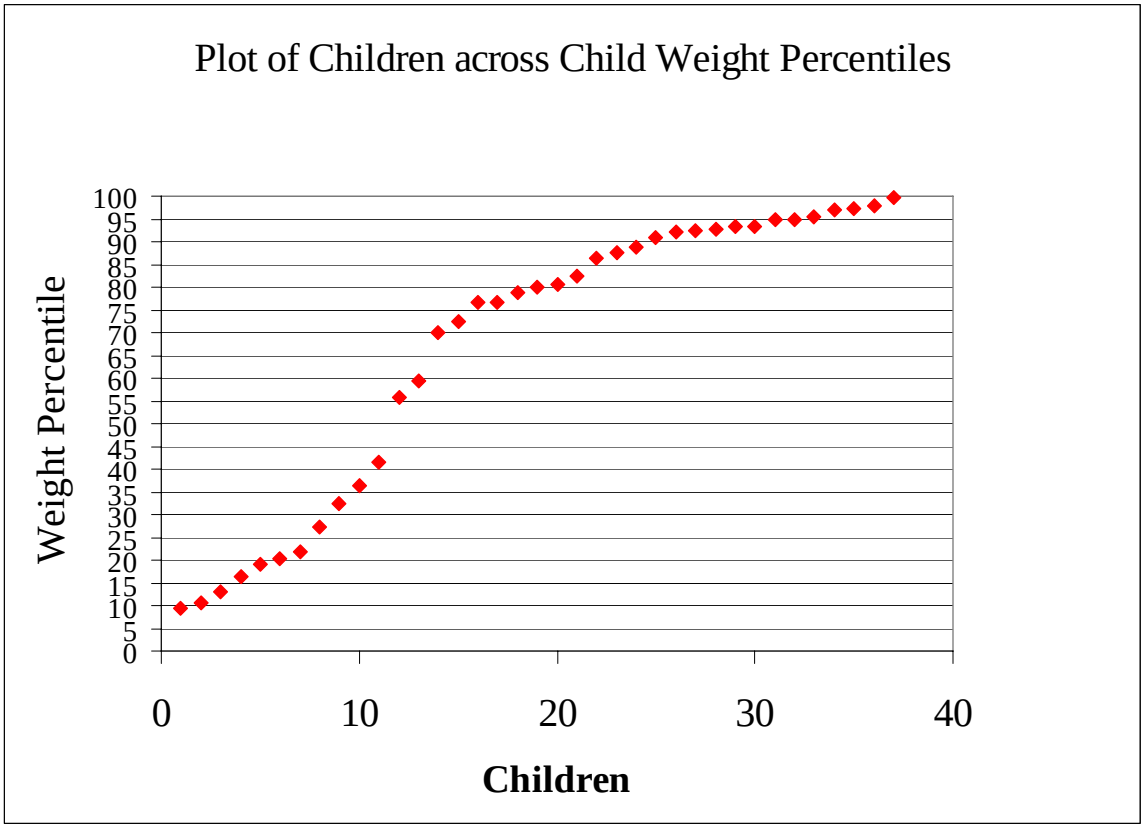

Figure 2. Plot of Parent Offer and Child Response Behavior across Non-food and Food Treatments

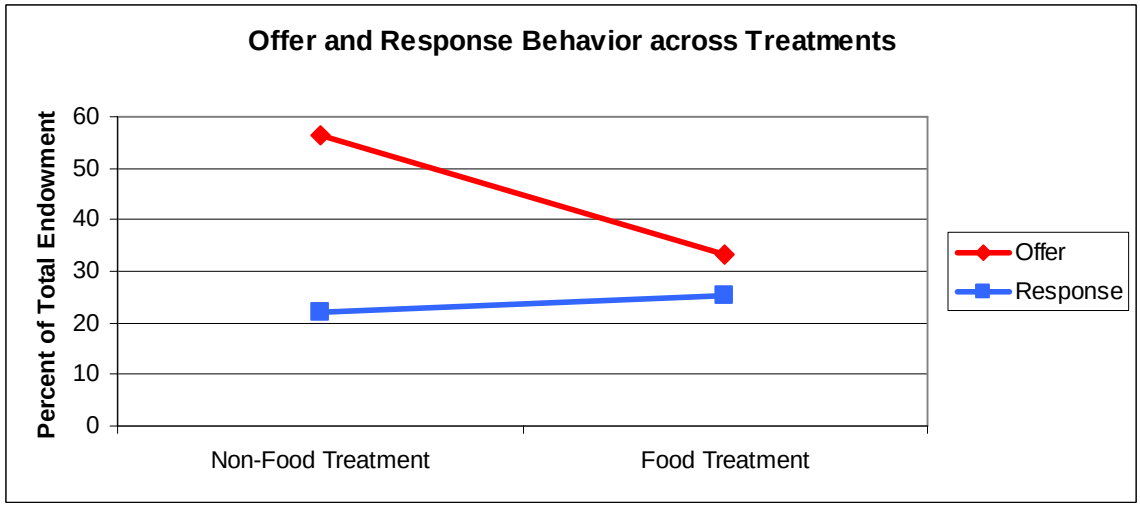

Table 3. Definition of Explanatory Variables used in Regression Analysis

Variable	Definition	Mean	Standard Deviation
Child Eats	The child eats as much as s/he wants (1=Never…5=Always)	4.03	1.04
Television	The family eats their meals with the television on (1=Never…5=Always)	2.47	1.18
Control	The parent feels he or she has control over the child's food consumption (1=Yes, 0=No)	0.95	1.18
Pleasure	The child's pleasure is a factor in the food purchase decisions (1=Never…5=Always)	3.44	0.79
Second Offer	The percent of the endowment the parent offered the child in the food treatment	33.21	22.20
Hispanic	The family is Hispanic (1=Yes, 0=No)	0.13	0.34
Unemployed	The primary feeding parent is unemployed (1=Yes, 0=No)	0.08	0.27
Parent BMI	The measure of the primary feeding parent's Body Mass Index	32.52	7.25
COWO	The child is overweight or obese (1=Yes, 0=No)	0.41	0.49

Table 4. Ordinary Least Squares Regression Results of Parameter Estimates

	Model 1 $\|r\|$ **is Dependent Variable**	**Model 2** r **is Dependent Variable**
Variable	Coefficient Estimate (Standard Error)	Coefficient Estimate (Standard Error)
Intercept	3.5593	-37.5974
	(27.657)	(32.6148)
Child Eats	9.4157**	11.1639**
	(3.686)	(4.3468)
Television	6.1911*	8.9401**
	(3.1306)	(3.6918)
Control	-54.9805***	-39.0839**
	(14.7125)	(17.3499)
Pleasure	2.3246	2.5947
	(4.2275)	(4.9853)
Second Offer	0.3034*	0.2929
	(0.1529)	(0.1803)
Hispanic	12.2842	6.3943
	(10.3036)	(12.1507)
Unemployed	27.1757*	30.8950**
	(12.1956)	(14.3818)
Parent BMI	-0.5224	-.2052
	(0.5024)	(0.5924)
COWO	15.3396*	9.0547
	(7.1705)	(8.4559)
R-Square	0.6117	0.5448
F-Statistic	4.55***	3.46***

*** indicates greater than 99% significant
** indicates greater than 95% significant
* indicates greater than 90% significant