Mechanisms between Time Scarcity and Healthfulness of Food Choices: Evidence from a Lab Experiment

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Mechanisms between Time Scarcity and Healthfulness of Food Choices: Evidence from a Lab Experiment[1]

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1 Introduction

Health is shaped not only by biology and genetics, but also by social status which determines resources, exposure to health risks, and the ability to engage in healthy behaviors and practices (Graham, 2004; Strazdins et al., 2011). It is easy to think of income as the cause of social status differences. However, just like income, time can be a valuable and finite resource for health (Strazdins et al., 2011). Time is an input to all activities, crucial to both production and consumption, and therefore, saving time is equivalent to making a profit (Adam, 1998; Becker, 1965; Brown and Warner-Smith, 2005; Castree, 2009).

Time scarcity has contributed to negative changes in food consumption patterns: decreases in the number of family meals and food preparation at home, and increases in the consumption of fast foods and convenience foods (Bowers, 2000; Gills and Var-Or, 2003; Gleick, 1999; Jabs and Devine, 2006; Jeffery and French, 1998; Neumark-Sztainer et al., 2003). These changes increased rates of obesity and lifestyle-related chronic diseases such as diabetes and cancer (Gills and Var-Or, 2003; Jeffery and French, 1998; Roberts and Barnard, 2005). This phenomenon can be partially summarized by a stylized fact: Time pressures and time constraints are strongly linked to poorer diet quality (Jabs and Devine, 2006; Rahkovsky, Jo, and Carlson, 2018; Scharadin and Jaenicke, 2020).

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With the right data, such as scanner data that contain information on food choices and factors influencing the opportunity cost of time, portions of the stylized fact can be explained by a standard neoclassical utility framework. From a neoclassical point of view (Baral, Davis, and You, 2011; Becker, 1965; Davis and You, 2010; Hamermesh, 2007), households with a higher opportunity cost of time will prefer less time-consuming means of preparing and consuming food, and this preference for convenience would be consistent across all foods, conditional on the households' opportunity cost of time. On the other hand, Fiese (2018) suggests that time scarcity may lead to stress and strain that is separate from a simple lack of time. Although scanner data do not contain strong indicators of stress, strain, or time spent making food decisions, these behaviors can be controlled in a lab setup, making the mechanisms potentially testable.

This study aims to investigate how time scarcity affects consumers' food choices by implementing a multipart experiment and an accompanying survey. The first part of the experiment involves a snack and beverage selection with two time-related treatments. The first treatment exogenously varies the "consumption time". In the control group, we give participants a 20-minute break to consume a beverage and snack of their choice (long). In two other groups, we induce time scarcity either by reducing the snack time to three minutes (short) or by asking participants to complete a mathematical and a typing task in the 20 minutes while consuming the snack (long with tasks). The second treatment varies the time available to make the food and beverage selection "selecting time" treatment. Participants in the control group are asked to select a snack and a beverage to consume during the long or short break, choosing between 10 pairs of items, with no limit of time. In the treatment group, participants are asked to select their snack within 3 seconds for each pair of items. The second part of the study uses a sealed-bid second-price auction mechanism (Vickrey, 1961) with three product categories (soup, oatmeal, and mac & cheese) to elicit willingness to pay (WTP) for healthfulness attributes in foods that require different preparation times. To induce time pressure and/or limit rationality during the decision-making phase as the snack selection, we also create a randomly assigned "bidding time treatment" that limits participants' time available to submit their bids: the treated participants need to bid on each product within 5 seconds in order to avoid deductions

while the controlled participants have no limit to bid. The experimental participants are also surveyed to analyze factors that influence WTP for healthfulness or snack selection.

2 Experimental design

The experiment is conducted from May to August 2023 in the Laboratory for Economics, Management, and Auctions (LEMA) Lab at the Pennsylvania State University. We invite approximately 400 subjects to participate in the experiment, expecting 12-22 participants in each session. The lab experiment consists of three parts: 1) Snack selection, 2) Auction, and 3) Survey questionnaire.

In the first part of the experiment, the snack selection, we investigate the relationship between time scarcity and healthfulness of food consumption. We randomly assign the time available to consume a snack and let participants select the snack to consume in our lab.

In the second part, the auction, we study the link between time scarcity and healthfulness of food purchases, and we focus on preparation time as the form of time scarcity in this experimental design. Based on an auction mechanism, we elicit participants' WTP for healthfulness in foods that require different preparation times. Under neo-classical assumptions, the WTP for the health-related attributes of foods should not differ for different preparation times.

Alternatively, the impact of time on food choices might be mediated by the time available to make the decision. In both parts of the experiment, we randomly vary the time available to state the WTP and to select the preferred snack option. It is possible that with little time to decide, individuals could dismiss the value of the healthy attribute, thus leading to the selection of a less healthy food option.

In the last part of the experiment, participants are asked to answer questions about their sociodemographic characteristics, time uses, and eating habits. Their answers are used to control factors affecting snack selection or WTP for healthfulness other than time to consume, time to decide, and time to prepare.

The following sections describe the three parts of the experiment in detail.

2.1 Snack Selection

In the first part of the experiment, we study the impact of time available to consume a snack on the healthfulness of food choices. Participants in the experiment are offered healthy and unhealthy snack options (food items and beverages) and asked to select the snack which they will consume during a break.

We developed a menu composed of obviously healthy versus unhealthy option pairs, with products in a pair that have a similar eating time. The snack options are shown in Table 1. Participants are asked to select one product in each pair. Only one pair from each of the food item pairs and beverage pairs are then randomly selected, and participants receive their preferred product in the selected pairs. After snack consumption, we measure how much of the selected snack and beverage participants consumed.

Table 1. Snack Options

Healthy Snacks	Unhealthy Snacks
Lay's Baked Original Potato Crisps	Lay's Classic Potato Chips
Pop Secret Popcorn, 94% Fat Free Butter Flavor	Pop Secret Popcorn, Extra Butter Flavor
Triscuit Original Whole Grain Wheat Crackers	RITZ Original Crackers
Fiber One Chewy Bar, Oats & Chocolate	Snickers Chocolate Candy Bar
Banana (1 NLEA serving)	Entenmann's Little Bites Banana Muffin
Dole Fruit Bowls No Sugar Added Diced Peaches	Dole Fruit Bowls Diced Peaches
Yoplait Light Harvest Peach Fat Free Yogurt Cup	Yoplait Original Harvest Peach Yogurt Cup
DASANI Purified Water	Pure Leaf Sweet Real Brewed Iced Tea
Vitaminwater Zero Sugar, Lemonade Flavored	Minute Maid Lemonade Pop Soda
Gatorade G Zero Sugar	Gatorade

We randomly assign participants to two time-related treatments: 1) “consumption time” treatment, where the time available for snack consumption is short for the treated and long for the control, and 2) “selecting time” treatment where the treated participants are asked to select their snack within 3 seconds for each pair of items while the controlled participants have no limit to select. For the “consumption time” treatment, we use two means to shorten the time available for snack consumption: 1) Give the treated participants the

same amount of time as the control group (20 minutes), but with tasks to do. The tasks we ask the treated to do are solving 50 math problems (two-digit addition and subtraction) and typing a 1-page document shown in Figure 1. In this case, the cognitive load does not influence the participants' decisions because the selection is made before performing the given tasks. 2) Give the treated participants a physically shorter amount of time (three minutes) than the control group to consume the snack.

Declaration of Independence

In Congress, July 4, 1776

The unanimous Declaration of the thirteen united States of America,

When in the Course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness.--That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed, --That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same Object evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security.--Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this, let Facts be submitted to a candid world.

He has refused his Assent to Laws, the most wholesome and necessary for the public good.

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He has excited domestic insurrections amongst us, and has endeavoured to bring on the inhabitants of our frontiers, the merciless Indian Savages, whose known rule of warfare, is an undistinguished destruction of all ages, sexes and conditions.

In every stage of these Oppressions We have Petitioned for Redress in the most humble terms: Our repeated Petitions have been answered only by repeated injury. A Prince whose character is thus marked by every act which may define a Tyrant, is unfit to be the ruler of a free people.

Nor have We been wanting in attentions to our Brittish brethren. We have warned them from time to time of attempts by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations, which, would inevitably interrupt our connections and correspondence. They too have been deaf to the voice of justice and of consanguinity. We must, therefore, acquiesce in the necessity, which denounces our Separation, and hold them, as we hold the rest of mankind, Enemies in War, in Peace Friends.

We, therefore, the Representatives of the united States of America, in General Congress, Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the Name, and by Authority of the good People of these Colonies, solemnly publish and declare, That these United Colonies are, and of Right ought to be Free and Independent States; that they are Absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Britain, is and ought to be totally dissolved; and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do. And for the support of this Declaration, with a firm reliance on the protection of divine Providence, we mutually pledge to each other our Lives, our Fortunes and our sacred Honor.

Figure 1. Document for Typing Task

2.2 Auction

In the second part of the experiment, we elicit participants' WTP using a sealed-bid second-price auction mechanism introduced by Vickrey (1961). The Vickrey auction works as follows: Each subject simultaneously submits a sealed bid without knowing the bids of others to purchase a good; Each bid is rank-ordered from highest to lowest; The participant who submits the highest bid wins the auction; The winner receives the item but pays an amount equal to the second highest bid among the bidders in the auction. The strength of the Vickrey auction is that it incentivizes participants to report their true evaluation of the product.

We aim to investigate the impact of preparation time and time pressure when making decisions on the WTP for several food products. We elicit participants' WTP for foods that differ in two dimensions: (a) time required for preparing the meal: fast versus slow, and (b) healthfulness of the meal: healthy versus unhealthy. This allows us to investigate whether WTP for healthfulness is different for foods with different preparation times. To study the impact of time scarcity when making decisions, we vary the time available for participants to submit their bids with a randomly assigned "bidding time" treatment: the treated participants need to bid on each product within 5 seconds in order to avoid deductions while the controlled participants have no limit to bid.

We auction twelve products in three product categories: soup, oatmeal, and mac & cheese. For each product category, we identified four products that vary in the two dimensions of healthfulness and preparation time as shown in Table 2. Participants are asked to simultaneously bid on the four products in each product category. Participants can bid up to $20 for each product. The bidder placing the highest bid is the winner and purchases the product at the price corresponding to the second highest bid.

Table 2. Products in Product Categories

Product Category	Fast & Healthy	Fast & Unhealthy	Slow & Healthy	Slow & Unhealthy
Soup				
Oatmeal				
Mac & Cheese				

Only one of the twelve products is randomly selected to be sold in this study. This means that only the winner of the auction for the randomly selected product receives the selected product, paying the second-highest bid. In order to assure participants understand the auction mechanism, we ask some review questions after providing the instructions and do not allow participants to move on to bid on the products until they are correct to all the questions.

2.3 Survey Questionnaire

At the end of the experiment, participants are asked to fill in a survey questionnaire. Data from the survey are used as covariates in our analysis to study heterogeneous effects across participants. Specifically, we not only collect sociodemographic characteristics such as age, gender, education, income, race/ethnicity, presence of children, employment status, etc. but also ask questions in American Time Use Survey (ATUS) that are related to participants' time use, health, and diet, and examine whether our sample defers from the population.

3 Empirical Analysis

3.1 Snack Selection

With the data from the snack selection part, we analyze the impact of the randomly assigned time scarcity on the food choices by initially estimating a model of the following form:

$$(1) \qquad Y_{ik} = \gamma_0 + \rho T_i + \gamma_1 X_i + v_k + \varepsilon_{ik}$$

where Y_{ik} is an indicator variable of a healthy snack selection in pair k, T_i is a dummy variable for the randomly assigned experimental treatment, taking value 1 for participants with short time to consume their snack and value 0 for participants with a longer time, v_k is a fixed effect for option pair, and ε_{ik} is an idiosyncratic error term. ρ is the coefficient of interest and captures the impact of time available to consume the snack on its healthfulness. The set of control variables X_i includes variables that will differ significantly between the treatment and the control group such as the amount of food wasted and characteristics of the individual we collect in our survey.

To analyze the relevance of time for making the selection, we further estimate the following model:

$$(2) \qquad Y_{ik} = \delta_0 + \delta_1 T_i + \tau C_i + \delta_2 T_i * C_i + \delta_3 X_i + v_k + \varepsilon_{ik}$$

where C_i is an indicator variable for the randomly assigned experimental treatment, taking a value of 1 for participants with a time limit for making decisions and a value of 0 for participants with no time limit for making decisions. τ is the coefficient of interest and captures the impact of time available to select the snack on its healthfulness. All other variables are the same as equation (3).

3.2 WTP for Convenience and Healthfulness

With the data from the auction part of the experiment, we first compare the average WTP and the standard deviation of the four products in each category and with non-parametric analysis. We then estimate the

WTP for fast and healthy attributes by estimating linear models. The WTP for product j by individual i within the same product category is:

$$(3) \qquad WTP_{ij} = \alpha_0 + \alpha_1 Fast_j + \alpha_2 Healthy_j + \sigma Fast_j * Healthy_j + \alpha_3 Z_i + v_j + \varepsilon_{ij}$$

where $Fast_j$ is an indicator variable of Fast version of product j, $Healthy_j$ is an indicator variable of a Healthy version of product j, Z_i is a vector of characteristics of individual i we collect in our survey, v_j is a fixed effect for the product category (soup, oatmeal, or mac & cheese), and ε_{ij} is an idiosyncratic error term. σ is our coefficient of interest and captures the complementarity between time scarcity and healthfulness.

To analyze the relevance of time scarcity during decision-making, we further estimate:

$$(4) \qquad WTP_{ij} = \beta_0 + \beta_1 Fast_j + \beta_2 Healthy_j + \beta_3 Time_i + \beta_4 Fast_j * Healthy_j + \beta_5 Fast_j * Time_i + \omega Healthy_j * Time_i + \beta_6 Fast_j * Healthy_j * Time_i + \beta_7 Z_i + v_j + \varepsilon_{ij}$$

where $Time_i$ is an indicator variable for the randomly assigned experimental treatment, taking a value of 1 for participants with a time limit for making decisions and a value of 0 for participants with no time limit for making decisions. ω is the coefficient of interest and captures the impact of time available to decide on the WTP for the healthy attribute. All the other variables are the same as equation (1).

4 Conclusion

In this study, we investigate how time scarcity affects consumers' food choices by implementing a multipart experiment and an accompanying survey. We conduct a laboratory experiments with 400 participants. In the first part of the study, we investigate the relationship between time scarcity and healthfulness of food consumption. We randomly assign the time available to consume a snack and let participants select the snack to consume in our lab. In the second part, we study the link between time scarcity and healthfulness

of food purchases, and we focus on preparation time as the form of time scarcity in this experimental design. Based on an auction mechanism, we elicit participants' WTP for healthfulness in foods that require different preparation times. We randomly vary the time available to state the WTP and to select the preferred snack option. In the last part of the experiment, participants are asked to answer questions about their sociodemographic characteristics, time uses, and eating habits, and the answers are used to control factors affecting snack selection or WTP for healthfulness other than time to consume, time to decide, and time to prepare.

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