

Constrained Volition and Healthier School Lunches

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ABSTRACT

School lunch programs are criticized for not encouraging students to make nutritious food choices. Building from a behavioral economic perspective, we suggest that small restrictions to existing school lunch payment systems could subtly lead a student to choose healthier food, and it may also alter how they interpret their behavior. Consistent with this, a controlled field study of 151 students showed that those using a restricted debit card (versus an unrestricted debit card) ordered healthier food and ate fewer calories, but they also altered their evaluation of the food and discounted the value of the money remaining on their card. Restricting prepaid lunch cards to foods marked as healthier might dramatically improve school lunch food choices without unduly restricting perceived choice or diminishing cafeteria revenue.

Key words: School lunch nutrition, food choice, childhood obesity, school lunch payment systems, restricted debit cards, behavioral economics, constrained volition

Constrained Volition and Healthier School Lunches

The National School Lunch Program (NSLP) began in 1946 after an investigation into the health of young men rejected in the World War II draft showed a connection between physical deficiencies and childhood malnutrition. The purpose of the NSLP was to act as a “measure of national security, to safeguard the health and well-being of the Nation's children” (Just 2006). Today, the problem of malnutrition remains not because children are undernourished, but because away-from-home environments may encourage overeating foods that are less nutritious and more caloric (Wansink, 2004).

Childhood obesity has doubled since the early 1980s (Oliveira and Variyam, 2003), and some critics have attributed part of this problem to the content of school lunches (Nestle 2002). School lunches are eaten by 75% of children and they account for approximately 1/3 of the weekday calories – 40-120 calories more than bagged lunches (Schanzenbach, 2005). Over time, the accumulation of unhealthy choices could easily contribute to weight gain and obesity (Moore, 2007).

School lunch programs have substantial freedom over many aspects of their operations, including content, portion size, price, eating environment, payment, and the extent of parental control. In particular, high schools (and many middle schools) allow a wide array of food choices. These food choices are often facilitated by the use of prepayment accounts which are in the form of debit cards or pre-charged ID cards.

Much scrutiny has focused on the content of school lunches and how students could be encouraged to eat better, such as eating more fruits and vegetables (French and

Stables, 2003) or less fat (French, *et al.* 2004). One proposed solution is to ban unhealthy food, and a second is to raise its price or reduce the price of healthier food through subsidies (Brownell and Battle-Horgen, 2004). Neither has proven consistently effective. One survey reported that banning less healthy foods decreased their consumption but may have led students to instead eat more fast food off-campus and to eat more snacks at home (Vecchiarelli, Takayanagi and Neumann, 2006).

The challenge is how to encourage healthier choices while still having these choices not appear to be unduly influenced. One solution may be to change the payment system in a way that makes it less convenient to purchase less healthy foods. By limiting the foods that can be bought on a prepaid account, it may draw more attention to the foods they select. Such a system might be useful in quietly—almost invisibly—guiding students to seriously consider healthier trade-offs they might have otherwise ignored. By still providing students the option of purchasing whatever they wish, however, this payment system could leave the students with a choice even though this choice was constrained. It might also have favorable consequences for their perceptions of the food and of their interpretation of their behavior.

The policy-relevant research question is this: Are restricted debit accounts a promising way to encourage healthier food selections in school? Such a volition-preserving restriction could have important health, economic and practical implications.

BACKGROUND

Understanding how behavioral interventions influence food choice can inform school boards as they design wellness policies to combat obesity and promote healthier

eating. For example, knowing how changes in payment mechanisms affect food choice may help them design programs that encourage better eating without alienating students, potentially reducing profitability of these partially subsidized programs.

The National School Lunch Program

Schools participating in the National School Lunch Program (NSLP) receive cash and commodities from the USDA. In return, these schools provide free or reduced price lunches to needy schoolchildren, and these lunches must meet Federal dietary requirements (Oliviera, 2006; Ralston et al, 2006). One element of the program that is particularly relevant for this study is the various payment options available to students (and their parents).

It is becoming more common for schools to offer pre-payment options for school meals, where parents are able to make payments into a debit account from which the value of their child's food choices are deducted. These individual accounts can be quite flexible and can allow for restricted use. For instance, when a child has food allergies (say to wheat, peanuts, or shell fish), administrators can put purchase restrictions on a card to disallow them from purchasing a food to which they are allergic

Starting in 2006, each school district participating in the National School Lunch Program was required to have a local school wellness policy. Such policies serve as tools to address obesity and to promote healthy eating and physical activity through changes in local school environments. Because intervention policies like nutrition education or changing relative food prices have been shown to have only modest influences on food choice, psychological and behavioral tools are worth considering (Just 2006). An

advantage of leveraging behavioral influences is that they would typically require only slight modifications to existing programs. As such, the right changes would have the added benefit of having the desired impact without reducing perceived choice or generating reactance.

Two overlapping perspectives on food selection are economic and psychological. After reviewing both, we summarize predictions they would make regarding the use of restricted and unrestricted debit cards.

The Economics of Food Selection

The standard economic model provides specific hypotheses regarding spending behavior when using a debit card. The restricted debit cards we discuss in this paper modify choices through two key mechanisms: time and restriction. Until the debit card can be reclaimed, the consumer can only use the card to purchase a restricted set of items. For example, a gift card restricts the user to purchases within a specific retail store. If the debit card may be reclaimed for cash after a period of time, then the consumer must trade off future unrestricted purchases with current restricted purchases.

A typical economic model of inter-temporal choice supposes that the utility of money in the future is discounted relative to money that can be used now. For example, a person may be willing to take \$90 now instead of a promise of \$100 one year from now. The proportionate discount is often referred to as the discount factor (0.9 in this case). Thus, an individual is more willing to make choices that will reduce future wealth than current wealth.

Additionally, individuals facing a constraint on the use of a dollar will discount the utility of that dollar relative to the use of an unrestricted dollar. For example, an individual may be willing to trade a \$10 dollar gift card that must be used at McDonald's for \$9. This discount is often referred to as option value – or the value of the option to spend the dollar on items not available at McDonald's.

In the case of a restricted debit card that can be redeemed at some future point (like a lunch account), the individual is trading off current restricted consumption (at an option value discount) for unrestricted future consumption (at a time discount).

Given this basic model of debit card behavior, variation in an individual's behavior will depend on one's monetary endowment, one's discount value of money, and the individual's enjoyment from items that can be purchased with the debit card relative to those things that cannot. For example, if the individual does not discount future money, they will simply delay the purchase of non-debit items. Alternatively, if future purchases are not considered, the individual will increase the purchase of foods available on the debit card until all the money on the card is exhausted. Rational choice theory would then predict that an individual's purchase patterns would correspond to the degree with which they discount the future purchases they intend to make. This discount value, along with any taste evaluations of the food, is typically thought to be exogenously determined and fixed. Because the assumption of discount values being exogenously determined, the traditional economic model can be characterized as follows:

- Those using a card should spend more on the items allowed by that card. This occurs because the individual's opportunity cost is multiplied by a time discount factor, thus making the restricted items relatively more attractive.

- The discount value should be the only driver of this increased spending between card and cash treatments. Given identical consumers within each of these treatments, the discount factor applied to future consumption is the only model parameter that has changed.
- The discount value of unspent money should be stable across treatments. Money that is unspent after any restricted purchases can be made is then unrestricted future money. While the money is subject to a discount, all money is now fungible and should face the same discount.
- Evaluations of foods should be potentially worse in the restricted card treatment. Food items are identical across treatments and should not be influenced by treatment. However, those using a debit card may be purchasing food they dislike more given the discount applied to their opportunity cost.
- Increasing the discount value should decrease purchase incidence of items that can be purchased with the debit card. Increasing the discount value makes money and consumption in the future worth more relative to current consumption. This will reduce current consumption.

Despite the clarity of these economic predictions, behavioral lab studies underscore areas of possible divergence. For example, underlying preferences or decision mechanism may change with the payment method. This is emphasized by studies suggesting that discount values may not be exogenous (e.g., Soman and Cheema, 2002; Chen and Rao, 2002). In addition, mental accounting can lead consumers to view different types of money allocations in fundamentally different ways (Thaler, 1995; Thaler 2004; Heath and Soll 1996; Henderson and Peterson 1992).

Consider the use of a debit card. Debit card use can endogenously lead consumers to view available money more liberally (Hirschman 1979). Wertebroch, Soman, and Nunes (2002) find that those who are purchasing for immediate consumption are more likely to use a debit card or cash than a credit card. Additionally, Prelec, and Lowenstein (1998) find that cash payments are more closely associated with the pain of payment than other payment methods, such as the use of a credit or debit card. Thus, individuals may seek more hedonic goods when using a debit card.

In contrast to using a debit card, paying with cash may increase one's involvement in the decision because trade-offs are more visible (McClure et al 2004; Kivetz, 2003). With cash, there is a salient and immediate reduction compared to a debit card, where reductions are not as visible. While most of these studies have involved adults, it seems reasonable that they would have similar effects on teenagers with discretionary income. These behavioral influences could be important in considering the recent move by schools toward debit card-based purchases. This behavioral evidence lays the foundation for a modified perspective on the psychology of constraints in a lunchroom.

2.3. Constrained Volition and the Psychology of Food Choice

There is a subjective dimension to food that makes people equally susceptible to environmental influences. Small environmental cues – such as the name of a food or how many others are eating it – can alter how one interprets its flavor, calorie content, and healthfulness (Wansink 2004). If an invisible hand were to lead a person to choose one food over another, it might also alter how they interpret their behavior and evaluate their

choices. Even in the face of constrained choice – which is choice nonetheless – people might interpret their decision in a way that downplays economic influences and favors their own volition.

Constrained volition involves misinterpreting one's behavior as less constrained than it actually was. While the results would appear similar to a “opt in or opt out” scenario (Susstein and Thaler 2007; Wertenbroch, 1998), it could lead to very different inferences about behavior. This behavioral effect is disproportionate to one's level of awareness. In the case of one's meal selections, it would involve not fully acknowledging the larger set of constraints (such as the restrictions of a debit card) that might have led to one's behavior. Just as presenting a child with bedtime options of either 8:00 or 8:30 gives them the attribution of self-control, so might presenting a person with a menu of affordable food options, some of which can be purchased on a debit card and others only with cash.

If labels or green dot markings were to lead a person to select foods they might not have otherwise selected (based on implied restraints), there is psychological precedence that one may not even acknowledge their influence. Over 90% of the people involved in food intake studies routinely claim they were not influenced by the environmental cues such as package sizes or glass shapes. Indeed, Nisbett and Wilson (1977) concluded that individuals “are sometimes (a) unaware of the existence of a stimulus that importantly influenced a response, (b) unaware of the existence of the response, and (c) unaware that the stimulus has affected the response” (p. 231). Because of either an unawareness of these environmental cues (such as green dots) or an unwillingness to acknowledge their influence, there is a fundamental attribution error that

occurs (Ross 1977). This fundamental attribution error leads people to over-attribute their behavior to themselves and to downplay the influence of environmental constraints.

Because people tend to believe in the volition of their choices, they might attribute their choice to past preferences (cf. Bem 1972). In sensory evaluations, they might even rate them more favorably, or they might rate non-targeted alternatives as less favorable. For example, it has been shown that giving or even lending an individual with a product leads him or her to subjectively rate it as more appealing than when it is sampled prior (Strahilivitz and Loewenstein 1998; Sen and Johnson 1997). Furthermore, any choice that ran counter to a monetary trade-off might be met by discounting the importance of money in this decision, leading them to claim “It wasn’t about the money” (Kahneman, Knetsch and Thaler 1991).

In the psychology of food choice, one may be motivated to believe in his or her own volition even when that volition is constrained. Whereas constrained volition does not predict different choices than economic theory, it does underscore a number of collateral consequences. Perceiving one’s decision as volitional could lead a person with a restricted debit card to downplay the importance of money (discounting money at a steeper rate) and alter their taste evaluations of food by rating targeted foods as relatively tastier and nontarget foods as relatively less tasty. It might also make them unlikely to notice the impact of a restricted debit card and to not believe they took less preferred foods because of it. Table 1 underscores the different predictions of traditional economic theory versus a more behavioral theory of constrained volition.

[Insert table 1]

METHOD

During Tuesday, Wednesday, and Thursday of the following week, 151 students were recruited from college freshman lecture courses and invited to a cafeteria lunch. They were told they would be asked preference questions following the lunch. To control the amount of money they would have available for lunch, each student was paid a total sum of \$20 for being involved in the study. This \$20 value was presented to them in the form of the payment condition to which they had been randomly assigned. They were either given 1) \$20 cash (control condition), 2) \$10 cash plus \$10 on an unrestricted debit card, or 3) \$10 cash plus \$10 on a restricted debit card that could be used to purchase items marked as with a green dot. Their selection of food and their calorie intake of this food was measured (preweight of food less plate waste), and follow-up questions were asked.

Menus listed the name of food and beverage choices within each category and their corresponding price. The 14 menu items (entrees, side dishes, desserts, and drinks) chosen for this experiment are typical of cafeteria menus and were familiar to students. Based on the results of a prestudy, half of the items were selected to be representative of nutritionally healthier choices (such as a turkey sandwich, peaches, and skim milk) and the other half represented less healthy choices (such as bacon cheeseburgers, French fries, and soft drinks). On average, the less healthy choices contained 119% more calories in them. Healthier food options were indicated by a $\frac{3}{4}$ inch green circular dot on the menu board and again in front of the item at the serving area. They were not explicitly referred to as healthier. Prices were taken from the existing menu at the cafeteria, and rounded to the nearest half dollar for the ease of computation.

Participants for the experiments consisted of 18 to 19-year old college freshman who had been in high school less than a year earlier. The majority were recruited from introductory college courses and given extra credit for being involved in the study. Each of the 151 students was randomly assigned to a pre-payment treatment and asked to participate in a lunchtime study. Lunch took place in a section of one of the dining facilities at a large university cafeteria. This part of the cafeteria was separated from the rest of the eating facility by temporary walls made of opaque material. The layout of the room and presentation of the food was closely controlled so that differences in behavior would not be ascribed to inadvertent changes in presentation.

A standard script was read to each person entering the cafeteria. To track individual purchases, all students in all three conditions were given a magnetic identification card that was the size of a standard credit-card.

Students in the pre-paid conditions were informed that the card would serve as a debit card upon which they had been given \$10. They were informed that all cash not used that day could be kept, and all money left on the card could be conveniently redeemed after class two weeks after the close of the experiment. Students assigned to the restricted debit card condition were given identical plastic cards resembling standard credit cards except that the cards had circular green stickers placed on their non-magnetic side. The menu board had similar green stickers placed next to each of the healthier items, as did cards placed in front of each item in the serving area. They were instructed that their debit card could only be used for these items, and their cash could be used for any unmarked item.

Students would order their food as they passed through the serving area. After ordering their food, they were served their food at the cash register and they paid using either cash, debit card, or a combination of both. Following the completion of their lunch they were asked to complete a survey that contained socio-demographic questions, food rating questions, and open-ended questions. The weight of any food remaining was recorded as they left the dining area.

We used a Becker-DeGroot-Marschak (BDM) auction mechanism to learn how their time discounting of money may affect the use of the debit card (Becker, DeGroot, Marschak, 1964). It asks individuals to articulate how much money they would forgo to have cash-in-hand versus a greater amount at a future date. The BDM mechanism is widely used in experimental economics because it has been shown to reveal individual preferences under a wide set of circumstances (Davis and Holt, 1993, p. 461). Upon entering the experiment, individuals were instructed that they could reclaim the money after class two weeks after the conclusion of the experiment. The necessity of waiting before the money on the debit card could be used in an unrestricted fashion should lead individuals to value the money on the card less than the equivalent amount in cash in hand. Based on earlier findings (Just 2006), two weeks was determined the appropriate length of delay to induce an appropriate variance in the level of discount without seeming too distant.

At the conclusion of the experiment, each student was asked the minimum percentage of the remaining money they would be willing to accept that day in lieu of collecting all the money two weeks in the future. Their choices were limited to multiples of 5%. Consistent with the BDM auction mechanism, students were asked to draw a

poker chip out of a bag containing 20 chips marked in increments of 5%. If their draw was lower than their stated minimum acceptable amount, they would be able to pick the money up in two weeks. If the amount drawn was above the number they had specified, they would receive their reduced percentage immediately. This allowed us to measure the discount value applied to money on the debit card. All analyses were performed using STATA statistical software (version 8.1, STATA Corp., College Station, TX).

RESULTS

As would be expected because of random assignment, the students in each of the three conditions were similar. There were no differences in their body mass index, age, weight, hours since their prior meal, education, and sex (all $ps > .20$). On average, 88.4% of the food purchased was consumed, with 55.4% of the students eating all of their food. Because of this general plate-cleaning tendency, the pattern of calorie intake was generally consistent with food purchases (table 2).

[Insert table 2]

Do Debit Cards Influence the Purchase and Intake of Food?

Comparing Cash vs. Unrestricted Cards. Recall that behavioral lab studies have suggested that the use of debit cards may encourage more hedonic consumption (i.e., purchasing less healthy foods) than would cash. To examine this, a ratio was created for each student that compared the calories they purchased of less healthy food to the calories

they purchased of healthier food. In the context of lunch, a student's ratio represents an index of their hedonic purchase and consumption.

The ratio of unhealthy to healthier calories purchased was significantly greater for those with unrestricted cards versus those paying with cash, $t(99) = 1.96, p = .05$.

Consistent with this, those with unrestricted debit cards consumed a higher ratio of less healthy foods (38.2% vs. 33.0%; $z = 1.93, p = .05$). For instance, those using an unrestricted debit card were much more likely to consume soda than those using cash (36.5% vs. 18.3%; $z = 2.1, p = .03$).

Comparing Unrestricted Cards vs. Restricted Cards. Both economics and psychology predict that a restricted debit card will encourage one to purchase and consume the targeted foods that can be purchased by the card. Although students in both the restricted card condition and the unrestricted card condition spent similar total amounts of money on food (\$6.63 vs. \$6.39; $t(105) = .52, p = .61$), there was wide variance across the types of foods they purchased (see figure 1). Consistent with both economic and psychological predictions, students spent an average of \$5.23 versus \$3.03 on healthier foods, $t(105) = 3.7, p < .001$, and \$1.40 versus \$3.36 on less healthy ones, $t(105) = 3.9, p < .001$.

[Insert figure 1]

To compare the incidence of ordering specific foods across conditions, a series of difference-in-proportion tests were conducted. As shown in table 3, those with restricted debit cards were more likely to purchase healthier foods such as a chicken sandwich (45% vs. 20%; $z = 2.6, p = .01$), salad (23% vs. 12%; $z = 1.7, p = .09$), baked potato chips (43% vs. 14%; $z = 3.2, p < .01$), peaches (34% vs. 16%; $z = 2.6, p = .02$), and bottled

water (59% vs. 33%; $z = 2.5, p < .01$). They were also less likely to take a bacon cheese burger (8% vs. 26%; $z = 2.6; p = .02$), chicken fingers (8% vs. 22%; $z = 1.8, p = .08$), French fries (15% vs. 31%; $z = 1.8, p = .08$), and a full calorie soft drink (13% vs. 35%; $z = 3.0, p < .01$).

[Insert table 3]

The ratio of money spent on less healthy compared to healthier foods was significantly greater for those with unrestricted debit cards versus those with restricted debit cards, $t(99) = 3.0, p < .01$. The average amount of money spent on healthier foods was proportionately more for those with restricted cards versus unrestricted cards (79.6% versus 47.4%, $z = 12.4, p < .001$). Consistent results were found with calorie intake (figure 2). Students with restricted debit cards consumed greater average proportion of their calories from healthier foods than did those with unrestricted debit cards (68.2% versus 32.9%, $z = 12.5, p < .001$).

[Insert figure 2]

How Do Debit Cards Alter Choice Perceptions?

Debit Cards Alter the Discount Value of Money. In addition to altering the types of foods purchased, the restricted debit card also appears to lead individuals to place less value on the unused money that remained on their card. This is counter to economic theory, implying that discount values may not be exogenous and fixed when faced with making choices that are contextually constrained. Those with the unrestricted card more highly valued the remaining dollars on their card than those with restricted cards – their

average discount value is 83.5% as opposed to 71.7% for the restricted, $F(1,104) = 4.21$, $p = .04$. The cumulative distribution functions in figure 3 show that the discount factor for the unrestricted card dominates the discount factor for the unrestricted card.

[Insert figure 3]

Further analyses show that students with restricted debit cards appeared to over-react in cutting their consumption of less healthy foods. For instance, those who consumed bacon cheeseburgers in all three conditions were asked how much of a price increase in the burgers would be required before they would not order this less healthy food. By combining this information with their discount values, we can calculate an empirical demand curve for those students with restricted debit cards. As Figure 4 illustrates, estimated demand from those using cash and unrestricted cards 1st order stochastically dominates (Bawa 1975) the empirical demand for burgers when using a restricted card. In other words, unrestricted card holders did not believe that the response to the discount rate would be as substantial as empirically shown with restricted cards—close to 5 times higher.

While economic theory predicts that unrestricted and restricted demand curves should coincide, figure 4 shows this is not the case. Instead, the much lower demand curve under the restricted card condition implies a 75% reduction in demand at the level of a median price increase. Because of this dramatic shift, the economic model is able to explain very little of the observed behavior. Similar results hold for other less healthy items.

[Insert figure 4]

Debit Cards Alter the Taste Ratings of Food. Contrary to predictions of economic theory, it was believed that students with a restricted card might tend to overrate the taste of the healthier foods they selected and to underrate the less healthy foods. To examine this, a measure of taste rating (1 = not very tasty; 9 = very tasty) was analyzed across each of the 14 foods. As expected, with less healthy (nontarget) foods, students with restricted cards rated six of seven as less tasty (6.0 versus 7.0), $t(52) = 12.2, p < .05$). This result, however, was not as strong with the healthier foods. While four of seven healthier foods were rated as directionally tastier by those with restricted cards, these ratings were not statistically different either individually or in the aggregate (6.2 versus 6.0), $t(74) = .53, p = .60$).

Do Debit Cards Bias Perceptions of Monetary Influence?

Compared to the economic perspective of debit card use (Table 1), it was believed that those with restricted cards would downplay the role that the restrictions had on their selecting a possibly less favorite food because of its price. We can assess a student's awareness of being influenced by the way they answered the following debriefing question: "Do you think the payment system influenced you to eat healthier foods?"

Across both card conditions, a majority of students (63%) claimed that the cards did not influence them to eat healthier. The percentages were similar for those using unrestricted cards and those using restricted cards (65.3% versus 61.5%; $z = .39, p = .69$). Twenty-three percent (12/52) of those with restricted cards stated that the payment system did influence them to eat healthier foods, but this was significantly less than the 61.5% who claimed it did not ($z = 4.3, p < .001$). While it is not clear how many

participants were eating in a “healthy” way prior to the study, random assignment would have distributed them similarly across the three conditions.

Classical theory would suggest that those with a restricted card would be more influenced by price and more likely to choose less favorite foods based on pricing considerations (i.e., “the food can be purchased with my card”). Neither of these results were found. When asked whether the price of the foods influenced their purchase, both those with the unrestricted card and those with the restricted cards rated price as having a similar influence (4.6 vs. 4.2; $t(105) = .87, p = .38$). Furthermore, there was no difference in their agreement ratings (1 = strongly disagree; 9 = strongly agree) with the statement “I chose less favorite foods in order to make more cash” (4.4 versus 3.8), $t(105) = 1.10, p = .28$). This basic set of results is consistent with what the notion of constrained volition would suggest.

Does Total Spending and Profitability Vary Across Payment Conditions?

Any health-related change to the operations of a school lunch program would be met with combined policy considerations of nutrition, revenue, and profitability. The results in table 2 indicated that those in the cash condition, the unrestricted debit card condition, and the restricted debit card condition all spent a similar amount of money on their lunches (\$6.83, \$6.39, and \$6.63; $F(2,148) = 1.22, p = 0.30$). The average amount spent on restricted card was \$5.98. Of the 104 observations of individuals using cards, only twice did an individual spend all of the money on the card.

[Insert figure 4]

It has been alleged that the contribution margin of less healthy items (such as French fries) is far higher than that of healthier foods. To account for possible differences across food items, the ingredient costs of each food item was determined with the help of school cafeteria management. Food ingredient costs were then subtracted from the retail price of the item to determine its contribution margin.

An analysis of the resulting profitability showed no difference across the three payment conditions (cash, unrestricted, and restricted) to the bottom line of the cafeteria (\$5.20, \$4.80, and \$4.99; $F_{2,148} = 1.38$, $p = 0.25$). When analyzing the resulting contribution margin, it was nearly identical across conditions (74.9%, 75.1%, and 75.3%, $X^2 = 0.32$, $p = 0.85$).

DISCUSSION

Are restricted debit accounts a promising way to encourage healthier food selections in school? To answer this important question, this research took the initial step of evaluating different payment methods in a lunch study involving a single consumption incident. We find that food choices were greatly influenced by restricting the types of food that can be purchased with a given payment method. Restricted pre-paid cards discouraged the purchase of less healthy foods that could only be purchased with cash, and it encouraged the purchase and intake of healthier foods.

Contrary to classic economic thought, this change in single occasion behavior was disproportionate to what would be expected (recall figure 4). Rather, it appears the change in behavior is partly due to the way in which they evaluate the food and the value they place on the money remaining on their card. By changing their underlying

preferences in this manner, small changes in payment structure could leverage large changes in behavior.

Adjusting the payment method available for various foods appears to be a surprisingly effective tool for influencing choice – perhaps more effective than direct price manipulations. By excluding less healthy foods from being purchased with the restricted debit card, there was a substantial reduction in the consumption of these foods. Importantly, this was achieved without the corresponding reactance that could have occurred if the choice was perceived as being unduly limited. Such behavioral economic tools may be important in a policy context as they can align the drivers of rational (traditional economics) and behavioral decision-making (constrained volition), thereby inducing larger changes in behavior than policies targeting only the rational or behavioral mechanisms.

Constrained Volition

Both economic theory and psychology would predict that restricted debit cards would have influenced behavior in a similar way. After that point, their predictions diverge. The notion of constrained volition suggests that a minimally invasive system may guide one to a different choice, but it also leads them to interpret their choice as volitional. A restricted debit card altered their taste evaluations of food and their perception of the money on their card. It also led them to downplay the monetary influence (61.5% said it had no influence), and it led them to believe they did not compromise by buying a less favorite food.

The notion of using constrained volition to influence children while minimizing their awareness or resistance is not new. It occurs whenever a parent allows a child to choose among forced alternatives (such as peas versus beans for dinner). What is new is the suggested application of moderate, non-binding constraints in a larger context – such as a high school lunchroom. This is a context where one’s volition can be expressed, but at such a small personal cost that it leads to altered perceptions of their choice. Eventually, a continued series of choices might even alter preferences and possibly self-perceptions of being a healthy eater.

Until recently, consumer research in the field of economics has been based primarily on the notion of revealed preference. This research supports other emerging findings that individual preferences and perceived incentives change dramatically when visible restrictions are placed on choice (Susstein and Thayer 2008). Such a notion has implications for both research in economics and application to policy. With respect to policy, implementing weak restrictions, such as those we suggest, may do more to leverage behavior than simple incentivising, and without generating the same level of resistance among consumers.

Limitations and Future Research

Walking the line between encouraging healthier choices versus forcing healthy choices is one with which the wellness boards of many local school districts struggle. While the cross-sectional results in this study were remarkable, it is not clear whether such results would be permanent, and the work of Brinberg and McGrath (1985) cautions us to not overproject these results into different environments which involve longitudinal

purchases. Over time, a wide variety of other factors, including food category popularity (i.e., sides, entrees, desserts, and drinks), social norms, and the opportunity to bring a sack lunch or to purchase food off-campus may also influence behavior and could modify the revenue equilibrium. Furthermore, the card balance reimbursement policies differ across schools, and the one used here is more consistent with what can occur toward the end of a semester rather than at the beginning.

The next step would be to introduce restricted debit cards to high schools (and possibly middle schools) and determine if they have a sustained influence on behavior. A controlled random-trial study could be set up at various locations to conduct field trials at a range of high school and middle school cafeterias.

To conduct this current study under controlled conditions, a homogenous group of students were used who were within one year of having graduated from high school. It is important to emphasize that not only is the context different, but the students are also different than the target. While no longer high school students, it was believed their lunchtime meal behavior would have similarities with that of high school students. Furthermore, while there was a wide variance in the amount of discretionary cash the individuals had in this study (other than the cash given to them), their financial situation was probably better than the average high school student. This difference further highlights the strength of these results. If a student who has plenty of discretionary money is still influenced by the use of a restricted debit card, the effects should be even more powerful for a younger student who has less discretionary money.

To increase the relevance and realism of this study, the food items that were selected were the most popular cafeteria items and they were similarly priced. Yet while

their average price was similar, there were slight variations with healthier entrees and drinks being slightly more expensive (4.75 versus 4.50 and 1.25 versus 1.00), and healthier sides and desserts being slightly more inexpensive (1.50 versus 1.75 and 1.00 versus 1.50). The purchase incidence of these findings balanced out across students and any bias that would have otherwise existed would have conservatively worked counter to our findings.

The targeted “green dot” foods were selected because they were similar, but healthier than their counterparts. Nevertheless, we were careful to not refer to them as healthier. The impact of restricted debit cards would have probably worked for any target foods we would have identified (such as low fat, organic, locally-grown, and so forth).

Many factors go in to determining how payment systems influence changes in profitability. It would be preliminary to use these results to make definitive statements about profitability. What this research suggests is that changes in payment systems need not be assumed to result in decreased eating and decreased profitability. They may merely shift calorie consumption from less healthy calories to equally profitable healthier calories.

Implementation Considerations for School Wellness Boards

A seemingly modest adjustment to the existing school lunch payment systems could have a sizable influence on food choice. Over the years, this could significantly impact the weight and health of children. Restricting the use of prepaid debit cards to healthier foods allows parents to reclaim some control over their child’s food choice set, without unfairly restricting them or without decreasing the revenue for school cafeterias.

Lunch debit accounts are prepaid by parents, who often have the option of using an online payment system and a credit card. Changing the system to accommodate wide-scale restrictions to healthier foods could be simply done and could be built into the software that codes the meal cards. Restricting the use of debit cards to healthier items is a default change that could be made with all cards at the beginning of the year. Any parent wishing to change the card to an unrestricted card could do so on-line.

At that point, a school district wellness board, a school dietitian, or the cafeteria management would need to designate which foods would be considered the healthier options and mark them accordingly. The simple use of green colored dots was effective in this study, but the use of labels, icons, locations, or some other means might also be effective.

Every school district that participates in the National School Lunch program is required to have a local school wellness policy – this is a tool that can be used to promote healthier eating and physical activity through changes in school environments. These nascent wellness policies are to be determined by, monitored by, and altered by a school district wellness board comprised of local citizens. Many of these boards are uncertain of the steps they can take to make a positive difference in their schools. Being able to champion a restricted debit card system would be an easy, high visibility initiative for a wellness board. The results from this initial study suggest there could be a number of benefits from such a system:

1. Restricted debit cards may encourage students to eat healthier. In this single occasion study, they ate a lower number of total calories, and a higher percentage of these calories come from healthier foods.

2. Restricted debit cards may lead students to value unhealthy foods less and healthier (target) foods more.
3. Restricted debit cards may be the easy default option to an existing payment system.
4. Restricted debit cards may result in no loss of revenue for the school cafeteria.
5. Restricted debit cards may represent a tangible contribution for a local wellness board to champion.

For some wellness boards, the next step might be a cautious one that would require results from controlled random-trial studies at a wide range of schools in their district. Yet such expense and caution may not be necessary. Given the strength of the effect reported here during one occasion, the ease (and low-cost) of implementation, and the immediacy of the results, there are wellness boards who may simply what to implement a trial version of a restricted debit card system and gauge its acceptance by students, parents, and lunch staff.

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Table 1 Predicting The Influence of Restricted Debit Cards

	Economic Predictions (Constrained Rationality)	Psychology Predictions (Constrained Volition)
How Do Debit Cards Influence the Purchase and Intake of Food?		
• Comparing Cash vs. Unrestricted Cards	People should buy more food with the unrestricted card than with cash	People should buy a greater proportion of hedonic (less healthy) food with the unrestricted card than with cash
• Comparing Unrestricted Cards vs. Restricted Cards	Restricted cards will encourage a greater incidence of purchase and intake of targeted (healthy) foods	Restricted cards will encourage a greater incidence of purchase and intake of targeted (healthy) foods
How Do Unrestricted and Restricted Debit Cards Alter Choice Perceptions?		
• Altering the Discount Value of Money	Cards will have no impact on discount values	Restricted cards will encourage higher discount values
• Altering the Taste Ratings of Food	Cards will have no impact on taste evaluations	Restricted cards will encourage higher taste evaluations of target (healthy) foods and lower taste evaluations of nontarget (less healthy) foods
How Do Unrestricted and Restricted Debit Cards Influence Perceived Monetary Influence?		
• Perceived Impact of the Card on Behavior	Those with restricted cards will claim the card influenced their behavior	Those with restricted cards are less likely to claim that the card influenced their behavior
• Perceived Role of Food Prices	Those with restricted cards will claim price had a role in their selection	Those with restricted cards will less strongly claim price had a role in their selection
• Perceived Selection of Less Favorite Foods	Those with restricted cards will claim they took less favorite foods	Those with restricted cards are less likely to claim to have taken less favorite foods

Table 2 The Impact of Payment Systems On Food Purchased, Calories Consumed, and Cafeteria Profit

	Cash (n = 49)	Unrestricted Debit Card (n = 52)	Restricted Debit Card (n = 55)	F (2, 151)
Food Purchased (\$)				
Healthier (target) Foods	3.56 (2.49)	3.03 (3.05)	5.23 (3.10)	8.35 (<.001)
Less Healthy (nontarget) Foods	3.27 (2.78)	3.36 (2.89)	1.40 (2.25)	9.36 (<.001)
Total Spent	6.83 (2.22)	6.39 (2.17)	6.63 (2.45)	.452 (.637)
Calories Consumed				
Healthier Calories Consumed	239.46 (188.01)	201.12 (228.90)	337.47 (242.76)	5.19 (<.01)
Less Healthy Calories Consumed	386.84 (326.14)	408.42 (338.51)	156.93 (267.55)	10.46 (<.01)
Total Calories Consumed	626.31 (287.88)	609.55 (254.45)	494.40 (268.87)	3.86 (<.05)
Cafeteria Profit (\$)				
Average Revenue (per person)	6.83 (2.22)	6.39 (2.17)	6.63 (2.45)	.452 (.637)
Average Profit (per person)	5.20 (1.74)	4.80 (1.67)	4.99 (1.84)	.521 (.595)
Profit Margin	74.9% (4.59)	75.1% (4.0)	75.31% (3.01)	.144 (.866)

Note.-- Standard deviations noted in parentheses

Table 3.
Purchase Incidence Across Foods and Payment Conditions

	Cash Only (n=47)	Unrestricted Debit Card (n=51)	Restricted Debit Card (n=53)	X²-Test (P Value)
Healthier (target) Foods				
Baked Potato Chips (Side-\$1.00)	0.106 (0.312)	0.137 (0.348)	0.434 (0.500)	18.87** (0.000)
Peaches (Dessert-\$1.00)	0.128 (0.337)	0.157 (0.367)	0.340 (0.478)	8.09** (0.017)
Water (Drink-\$1.50)	0.298 (0.462)	0.333 (0.476)	0.585 (0.497)	10.38** (0.006)
Chicken Sandwich (Entrée-\$5.00)	0.340 (0.479)	0.196 (0.401)	0.453 (0.503)	7.76* (0.021)
Salad (Side-\$2.00)	0.085 (0.282)	0.118 (0.325)	0.226 (0.423)	4.48 (0.106)
Skim Milk (Drink-\$1.00)	0.170 (0.380)	0.078 (0.272)	0.132 (0.342)	1.90 (0.386)
Turkey Sandwich (Entrée-\$4.50)	0.213 (0.414)	0.196 (0.448)	0.189 (0.395)	2.41 (0.659)
Less Healthy (nontarget) Foods				
Soft Drink (Drink-\$1.00)	0.191 (0.398)	0.353 (0.483)	0.132 (0.342)	7.71* (0.021)
Chicken Fingers (Entrée-\$4.00)	0.277 (0.452)	0.216 (0.415)	0.075 (0.267)	7.13* (0.028)
Bacon Cheeseburger (Entrée-\$5.00)	0.170 (0.380)	0.255 (0.440)	0.075 (0.267)	6.06* (0.048)
French Fries (Side-\$1.00)	0.298 (0.462)	0.314 (0.469)	0.151 (0.361)	4.43 (0.109)
Brownie (Dessert-\$1.50)	0 (-)	0.039 (0.196)	0.019 (0.137)	1.93 (0.380)
Macaroni and Cheese (Side-\$2.50)	0.213 (0.414)	0.137 (0.348)	0.113 (0.320)	2.04 (0.359)

Note.--Standard deviations noted in parentheses underneath mean values. *p <.05 **p <.01

Figure 1.
Restricted Debit Cards Alter Spending Behavior

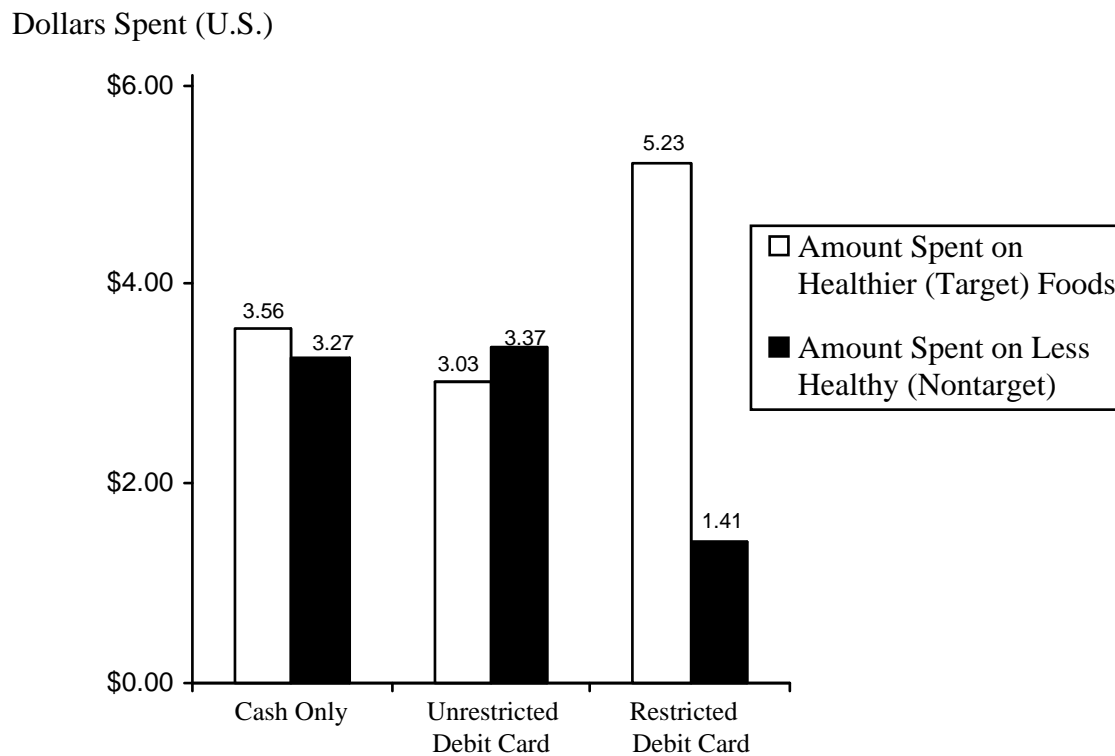


Figure 2
Calorie Intake Differs Widely Across Payment Conditions

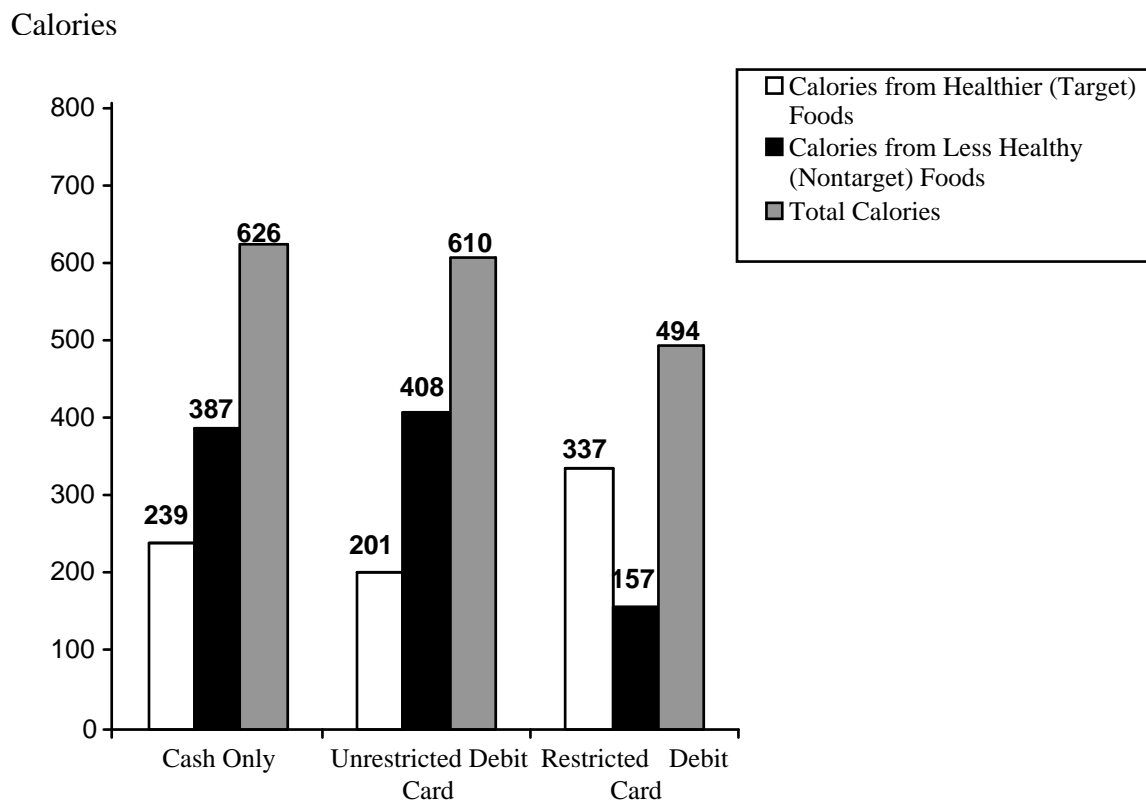


Figure 3
Restricted Debit Cards are Less Steeply Discounted

Cumulative Distribution Function

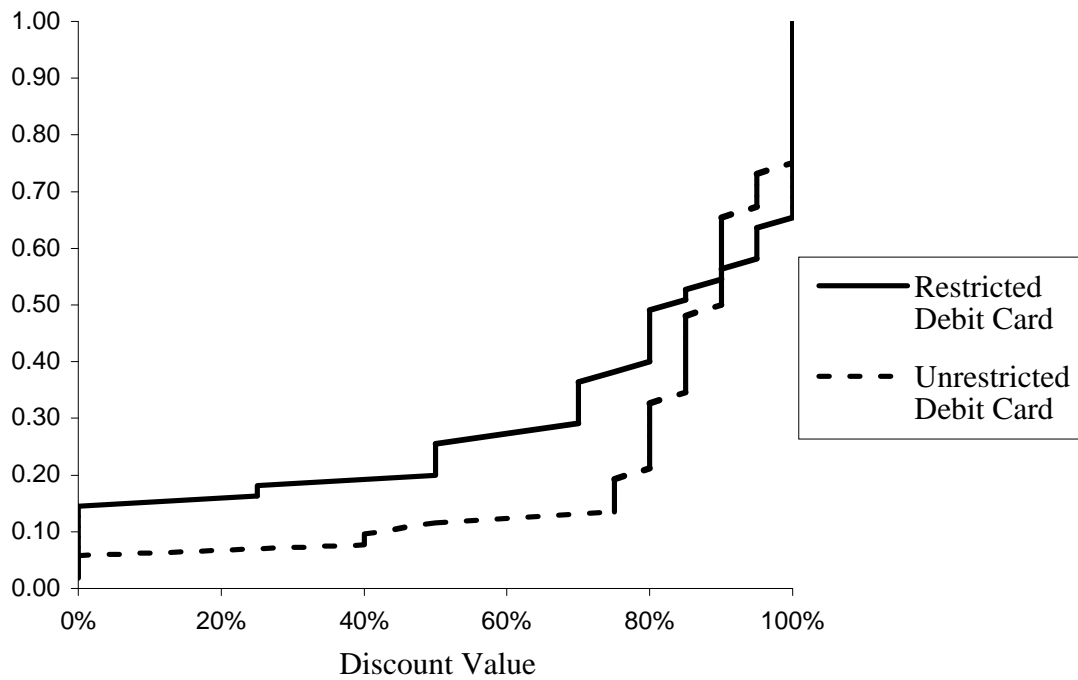
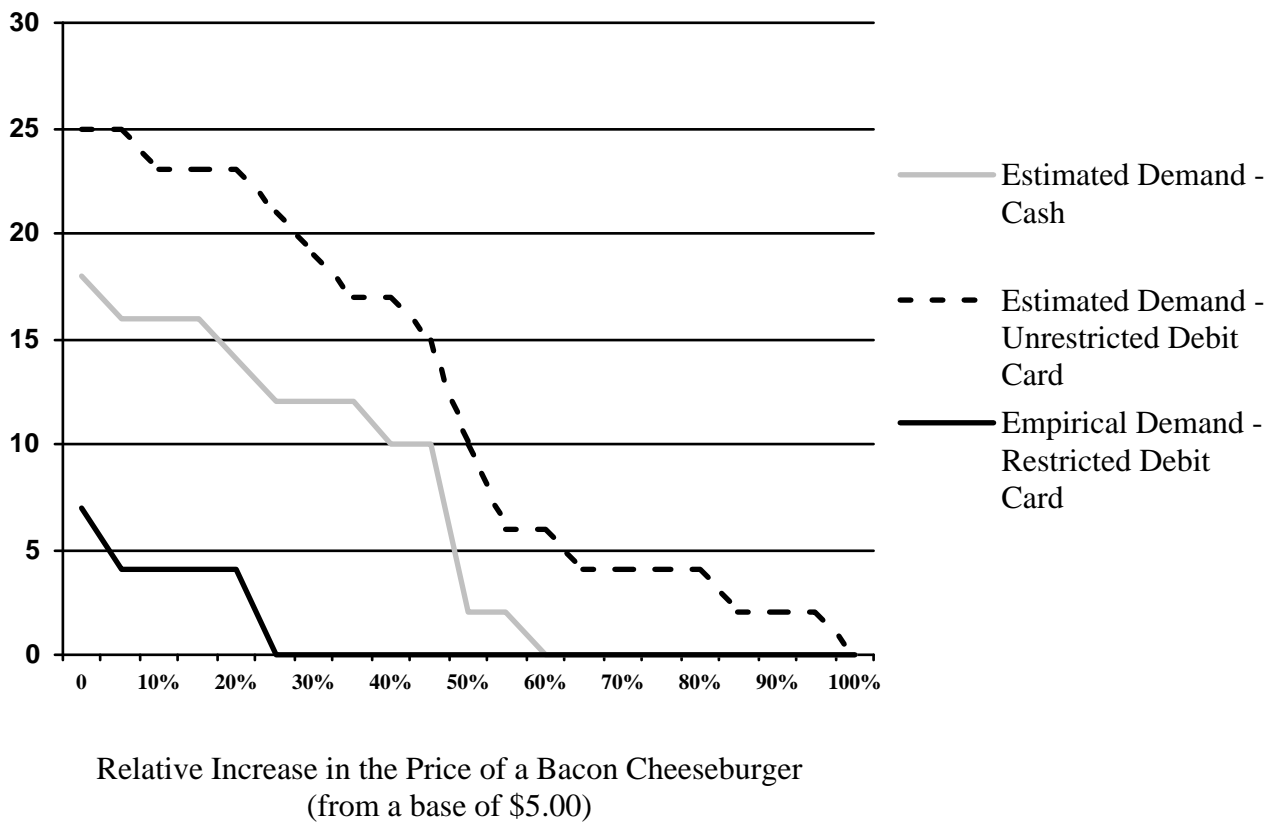


Figure 4
Restricted Card Holders are More Sensitive To Price Increases of Less Healthy
(Non Targeted) Foods

Percent Purchasing



APPENDIX

Those who use a reclaimable debit card that can only be used on a restricted set of foods must trade off future unrestricted purchases with current restricted purchases,

$$\max_{x, x_{future}} U(x) + \delta U(x_{future})$$

subject to $p \cdot Rx \leq w(1 - \theta)$ and $p \cdot x_{future} \leq w - p \cdot x$, where $x \in \mathbf{R}_+^n$ is a vector

representing food purchases that are made with either the debit card or cash before the

redemption period of the card; $x_{future} \in \mathbf{R}_+^n$ is purchases on any item (food or nonfood)

after the card is redeemed; $p \in \mathbf{R}_+^n$ is the vector of prices for the various items; U

represents the single period utility of purchase; and δ the discount applied to purchases

after the redemption period of the debit card. Furthermore, in this economic framework

of debit card spending, R is an $n \times n$ matrix of ones and zeroes representing the

purchasing restrictions placed on the debt card (a one appearing in the position of each

food that cannot be purchased with the debit card); and $\theta \in [0, 1]$ is the proportion of

available money contained in the debit card account. If all constraints bind, one's

behavior will be explained by

$$U_i(x) + \lambda_1(w, p, \delta) R_{ii} p_i = \delta U_i(x_{future})$$

where R_{ii} is the derivative of the restrictions imposed by the debit card, and

$\lambda_1(w, p, \delta) > 0$ is the LaGrangian multiplier required under constrained optimization.

The model predicts if individuals have a debit card that can only purchase a restricted set

of goods: i) individuals will spend more money on items that can be purchased with the

debit card in the near term, and ii) individuals will spend less money on items that cannot

be purchased with the debit card in the near term.