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Patience among children*

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Abstract

Recent policy initiatives offer cash payments to children (and often their families) to induce better health and educational choices. These policies implicitly assume that children are especially impatient (i.e., have high discount rates); however, little is known about the nature of children's patience, how it varies across children, and whether children can even make rational inter-temporal choices. This paper examines the inter-temporal choices of five to sixteen year old children in an artefactual field experiment. We examine their choices between varying levels of compensation received in two or four months in the future and in zero or two months in the future. We find that children's choices are consistent with hyperbolic discounting, boys are less patient than girls, older children are more patient and that mathematical achievement test scores, private schooling and parent's patience are not correlated with children's patience. We also find that although more than 25 percent of children do not make rational inter-temporal choices within a single two-period time frame, we cannot find variables that explain this behavior other than age and standardized mathematical achievement test scores.

Keywords: Experimental Economics, Children, Inter-temporal Choice

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I. Introduction

In recent years, academics and policymakers around the world have become increasingly interested in educational policies that change the incentives that primary and secondary school students face. For example, programs in Kenya, Israel, New York City, and Ohio provide cash payments to children who perform well on standardized exams. The premise of such programs is that children may be more motivated by short-run rewards than by the long-run benefits of education; it may be that children's discount rates are sufficiently high (children are sufficiently myopic) such that short-run benefits outweigh long-run rewards.[1] It could also be that children do not understand or know how important education can be to their future earnings. Regardless of the reason, these programs contend that more tangible shorter run rewards will motivate children. Thus, the programs use immediate cash payments to motivate positive educational choices.

Unfortunately, little economics research exists to document the magnitude of students' discount rates and the factors that affect them.[2] Indeed, there is very little economic research that examines whether younger children are even capable of making rational inter-temporal choices.[3] To fill this gap, this paper investigates whether children make rational inter-temporal choices, the factors that determine this rationality, and the factors that affect discount rates. Using experimental procedures specifically developed to work with children, we measure the time preferences of low-income, primary school age children. Using data for both children and parents, we document how individual

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[1] This argument assumes markets do not exist for students to borrow against future earnings. For younger children (five to sixteen year olds) we work with this assumption seems reasonable. For older students this assumption may be inappropriate.

[2] Working papers by Harbaugh and Krause (1998) and Bowdoin (2002) have also begun to explore discount rates among children. Harbaugh and Krause propose a method to study very young children in a "tooth-fairy" game in which children can receive compensation for waiting an extra day to get money from the tooth-fairy. However, they do not examine consistent preferences over time and their study only pertains to a narrow range of young ages. Bowdoin's (dissertation) study is more similar to ours, but only examines older children (ages 11-18) and does not examine consistent preferences over time.

[3] Consider a choice between $X at time t and $$Y_i$ at time t+s ($t \geq 0$, $s>0$, $Y_i>X>0$) and let $z_i=(Y_i-X)/X$. Choosing $X reveals a discount rate between t and t+s $d_{t,t+s} \geq z_i$ and choosing Y reveals $d_{t,t+s} \leq z$. A set of choices between X at time t and varying amounts Y_i at time t+s is rational if there exists a discount rate $d_{t,t+s}$ that can be inferred from all choices; a set of choices is not rational if there exists a z such that one choice reveals $d_{t,t+s} > z$ while another choice reveals $d_{t,t+s} < z$. This revealed preference definition of rationality does not imply a constant discount rate across time (e.g., it does not require $d_{t,t+s} = d_{t+r,t+s+r}$, r>0). The revealed preference argument is made formal below and is consistent with exponential discounting (that assumes $d_{t,t+s} = d_{t+r,t+s+r}$ for all r>0) and hyperbolic discounting (that assumes $d_{t,t+s} > d_{t+r,t+s+r}$).

characteristics (such as race, gender, age, and schooling) and family characteristics (such as income, family size, parental education and even the time preferences of parents) affect the development of rational inter-temporal choice and children's preferences over time.

Discount rates and inter-temporal choice have received a great deal of attention from economists for many years. For example, Samuelson (1937) introduced the use of a single discount rate to summarize inter-temporal choice reflecting the underlying psychological assumptions of patience (i.e., the tradeoffs of choice over time). Other economists have linked patience to important outcomes such as consumption, savings, interest rates, income, and employment (e.g., Becker and Mulligan 1997; Bowles, Gintis and Osborne, 2001a and 2001b; see Frederick, Lowenstein and O'Donoghue, 2002 for a review). Psychologists and educational researchers have also investigated the role of inter-temporal choice and specifically impulse control in child development and eventual educational outcomes including pre-school test scores (Flynn 1985), academic performance (Mischel, Shoda, and Rodriguez 1989; Shoda, Mischel, and Peake 1990), and even college GPA (Kirby, Winston, and Santiesteban 2005). Further, functional magnetic resonance imaging (McClure et al. 2004) shows that inter-temporal choice activates specific areas of the brain, suggesting inter-temporal preferences may develop early in life.

We study patience in children for several reasons. First, as mentioned above, recent policies in health and education implicitly assume that children are sufficiently impatient such that they may be more responsive to small cash payments in the present or immediate future than to distant future returns. We discuss many of these programs in the interpretation of our findings.[4] Second, researchers in education and psychology suggest that the development of time preference occurs in childhood and varies by both child and family characteristics (e.g. Chelonis, Flake, Baldwin, Blake

[4] Israel's high school completion program is discussed in Angrist and Lavy (2002). Kenya's program focused on female school attendance and performance is discussed in Kremer, Miguel, and Thornton (2005). Other programs are currently being evaluated in New York City (Fryer 2006), Ohio (Bettinger 2006), and Canada (Oreopolous 2006). There are a number of other programs offering cash incentives for individual actions. For example, Progresa in Mexico provides cash payments to families whose children get regular check-ups and attend school. Evidence on Progresa is discussed in Behrman, Sengupta and Todd (2001) and Bobonis and Finan (2005).

and Paule 2004). Finally, a sample of school principals of the children in our sample indicated that they were attempting to teach children how to give up current rewards for future benefits. Thus, children's patience is interesting from both a policy and developmental perspective.

Measuring patience among children, especially young ones, is not trivial, however, since typical evidence on inter-temporal preferences (such as consumption and investment decisions) is not observable. To overcome this difficulty, we use economic decision-making experiments. Such experiments have recently been used to observe economic behaviors on otherwise hard to observe outcomes. For instance, experimental methods have recently been used to study discrimination (Fershtman and Gneezy 2001; List 2004), social capital (Karlan 2003) and charitable giving (Bettinger and Slonim 2005). Further, experiments are increasingly used to study discount rates among adults (e.g., Harrison, Lau, and Williams 2002; Eckel, Johnson and Montmarquette 2003).

Our research also builds upon economists' growing interest in documenting the development of children's economic behaviors and preferences. For example, Harbaugh, Krause and Berry (2001) and List and Millimet (2005) document rational choice behavior over consumption goods among children; Harbaugh, Krause and Liday (2002) shows factors affecting bargaining among children; and Harbaugh and Krause (2000) and Bettinger and Slonim (2005) examine altruism among children. To measure these phenomena in children, these researchers have developed experimental procedures designed especially to address the needs for examining children's behavior (e.g., children's more limited cognitive ability and attention span). Harrison and List (2004) categorize these and the current experiment as artefactual field experiments since they use nonstandard (i.e., non-university student) populations but otherwise use standard laboratory procedures.

In this paper, we examine sequences of binary choices that children make over receiving compensation in either zero or two months in the future (the no front-end delay choice set) and between either two or four months in the future (the two month front-end delay choice set). To understand the determinants of children's patience, we also collect a variety of family and other background data including income and household size, demographics and children's schooling. In addition, we use similar economic experiments to measure the patience of parents.

We find that more than 25 percent of children make choices inconsistent with rational behavior; these children make sequences of choices within a single choice set that cannot be explained by any model of rational discounting behavior including exponential, hyperbolic or quasi-hyperbolic discounting. Further, we do not find any demographic or other variables that explain whether children make rational decisions other than standardized math achievement test scores, race and age. With regard to patience, we find that children's behavior is heterogeneous. Across all children, we find that boys are less patient than girls, children are less patient if there is no front-end delay, and that mathematical achievement test scores, private schooling and parent's patience have insignificant relationships with children's patience. Among the children who make rational inter-temporal choices within each choice set, 43.4 percent make choices with higher implied discount rates when there is no front-end delay (consistent with hyperbolic discounting) and 39.6 percent make choices with the same implied discount rate with and without front-end delay (consistent with exponential discounting).

II. Subjects and Experimental Design

Subjects

We recruited subjects from the Children's Scholarship Fund (CSF) of Toledo, Ohio. CSF let us run experiments as part of an evaluation of their scholarship program.[5] To be eligible for a CSF Scholarship, children must qualify for federal reduced/free lunch programs. In the fall of 1997 and spring of 1998, 2,424 families applied for CSF scholarships. Using this population, during 2001 and 2002 we attempted to contact via mail, phone, and even home visits a random sample of 438 families including nearly 900 children. We surveyed 260 of these families gathering information on both

[5] This paper is one of three papers that are based on data collection by the authors in Toledo, Ohio during 2001 and 2002. The two other papers examine the effects of a voucher program on altruism (Bettinger and Slonim 2005) and on confidence (Slonim and Bettinger 2005) among children.

parents and children. From this group, we recruited both parents and children to attend "evaluation events" where we conducted our experiments. Over 200 children and 100 families attended our sessions. Each child who participated came with at least one parent who also participated in the experimental exercises.[6]

Table 1 describes the children who participated in the patience experiments.[7] The mean family income of these children was $22,100 and the mean household had just over two children living at home. About 50 percent of the participants were African-American and male and the mean age was just under 10 years old. Almost one-third of the participants attended private school at the time of the sessions. During the sessions, children completed two grade-dependent twenty-question standardized mathematics exams lasting eighteen minutes each. On average, children answered just over 50 percent of the questions (10.5 out of 20) correctly: the normal curve equivalent was in the 49th percentile of the national average.[8] Table 1 also shows the means by age groups. While we control for all of the covariates in Table 1 in the regressions presented below, note the youngest children's families had higher income than the older children's families, fewer of the oldest children were in private school and a higher percent of the older children were male.

Experimental Protocols to Measure Patience

To measure patience, we had children make a sequence of 12 binary choices in two decision sets.[9] All decisions in Set 1 had a two-month front-end delay; children chose between receiving $10 (of Toys-R-Us gift certificates) in two months and receiving $X in gift certificates in four months. The amount $X that children could receive in four months increased with each decision from $9, to $10, $11, $12, $13, $14, $15, $16, $18, $20, $22, and $25. For each decision, the experimenter

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[6] Bettinger and Slonim (2005) provide details and show participants and non-participants don't differ in any meaningful manner.
[7] We ran several other decision-making exercises besides patience at each session resulting in a few of the families who attended the events not participating in every exercise because of other commitments. Thus, of the sample of 203 children who attended the events, only 191 participated in the patience decision-making exercises.
[8] For the standardized exams, we administered the grade-appropriate, mathematics portions of the Iowa Test of Basic Skills.
[9] The complete protocols are available at http://wsomfaculty.cwru.edu/slonim/.

physically displayed each option; e.g., in the first choice the experimenter held ten $1 gift certificates in one hand and nine $1 gift certificates in the other, and said, "you need to choose between receiving $10 of gift certificates in two months from now or $9 of gift certificates in four months from now." In each subsequent choice the experimenter added gift certificates to the four month bundle and repeated the question. Set 2 was nearly identical to Set 1 except there was no front-end delay: children chose between receiving $10 at the end of the session and the alternative amounts in two months. Parents faced similar decision sets, except they chose between $50 in cash in the earlier period and twelve different amounts ranging from $45 to $80 in the later period. To avoid wealth effects and/or possible hedging behavior associated with making multiple decisions and to avoid subjects "gaming" their choices in any possible way, subjects were randomly and anonymously paid for at most one of the possible decisions across the two decision sets (the specific details for payment are described below).

We used these procedures for several reasons. First, we used binary choices, the identical $10 front-end amount, the visual display of compensation and the sequentially increased amount of compensation in the two-months later period to reduce the cognitive difficulty of the task. Coller and William (1999) present evidence indicating that several of these procedures, e.g., holding the front-end delay constant, will increase the reliability of the measures.

Second, we included many binary choices within each set to examine whether children can make rational inter-temporal choices *within each set*. Specifically, let $C_{i,j}$ be the set of all choices in set i in which child j chose to wait the extra two months to receive compensation. We say that each set of inter-temporal choices i for child j is rational if and only if one of the following three conditions is met:

a) $C_{i,j}$ is empty (i.e., the child was *always impatient* always choosing $10 rather than waiting the extra two months for compensation) or
b) $C_{i,j}$ contains all 12 choices (i.e., the child was *always patient* always choosing to wait the extra two months) or

c) for all choices in $C_{i,j}$ in which the child chose to wait the extra two months to receive compensation \$Y, *all* \$X > \$Y are also in $C_{i,j}$. (i.e., the child chose to be impatient up to a certain amount, but above this amount the child always chose to be patient).

For instance, if a child chose to receive \$14 in four months rather than \$10 in two months, then the discount rates consistent with this inter-temporal choice imply the child will prefer any amount Z > \$14 in four months rather than \$10 in two months. Rationality does not imply children have the same discount rate for both choice sets; for instance, children may have a higher discount rate when there is no front end delay (Set 2) than when there is front end delay (Set 1), consistent with hyperbolic discounting.

The third motivation for our design, as discussed in Coller, Harrison and Rutstrom (2003), is to measure patience with and without front-end delay to examine whether subjects' preferences are better described by hyperbolic or quasi-hyperbolic rather than by exponential discounting. Exponential discounting implies the use of a constant discount factor regardless of the front-end delay while hyperbolic and quasi-hyperbolic discounting imply a higher discount rate when there is no front-end delay than when there is positive front-end delay. Hyperbolic discounting further implies a continuously increasing discount rate the smaller the front-end delay whereas quasi-hyperbolic discounting implies a constant discount rate other than when there is no front-end delay. In this paper, since we only measure choices with no front-end delay and with a two-month front-end delay, we cannot distinguish between hyperbolic and quasi-hyperbolic discounting. Laibson (1997, 1998) offers empirical evidence of behavior that cannot be described by exponential discounting but that can be understood with hyperbolic discounting. Examining whether children exhibit similar behavior to adults is important since differentiating hyperbolic from exponential discounting may explain many adverse economic phenomena.

We did not vary the order of decision sets: all children first completed Set 1 with two months front-end delay and then completed Set 2 with no front-end delay. Our reasons for not varying order are twofold. First, within each session, we chose to conduct the tasks verbally (reading the decisions aloud) and with props (showing the children the amounts) to facilitate children understanding the task, thus we could not vary the order within each session. Second, we could (should) have varied the order across sessions; however, this variance of order would have been confounded with fixed session effects. Thus, we would not have been able to easily separate session from order effects.

To examine whether there was an order effect, we ran a second study among university students. We gave 50 university students (recruited from a medium sized Midwestern university) nearly identical protocols to the children's protocols for the patience task, offering either $10 (payable by check) in the early period or increasing amounts two months later (also payable by check), with either no or two months front-end delay. Instead of reading the tasks verbally, we had the students read the instructions and complete the decisions privately, thus we could vary the order of these decision sets within and across sessions. In this study, half the subjects completed the no front-end delay set first followed by the two month front-end delay set while half the subjects completed the sets in the reverse order. After each subject completed the decision sets and a short survey, one choice from one of the decision sets was chosen to determine compensation. Using similar regressions to those presented below, we find that order had no significant effect ($p>.70$). Thus, unless order has a distinct effect on younger children than on university students, order is likely to have had minimal impact on behavior with the children. Nonetheless, by not varying the order, we must be cautious in interpreting results regarding hyperbolic versus exponential discounting.

Another concern measuring patience in an experiment is the possibility of arbitrage. If we assume subjects maximize the present value of wealth and can borrow and lend at a fixed rate without transactions costs, then offering fungible payoffs between two time periods will be uninformative about underlying inter-temporal preferences (exponential, hyperbolic or quasi-hyperbolic or any other preference); regardless of inter-temporal preferences, wealth maximization requires all subjects to take the option with the highest present value. Thus, even if subjects prefer short-term payoffs they will take future rewards if they can borrow money without transactions costs.

For example, a subject with hyperbolic preferences will prefer $10 now to $20 later if he cannot borrow money. Nonetheless the subject will choose the $20 later option if he can arbitrage by borrowing $10 (or more) now and transferring the $20 to the lender once the later payment comes.

While we cannot reject the possibility that such arbitrage (i.e., access to credit markets) could exist, experiments can take several steps to minimize this concern. In the current setting we think arbitrage is less plausible for several reasons. First, the children participating in our experiment were from low-income families which all qualified for the federal free/reduced lunch program, thus parents and children could have faced liquidity constraints. Second, we compensated children in the form of Toys-R-Us gift certificates, so any attempt to arbitrage would have to be done in Toys-R-Us gift certificates. If parents (or another creditor) were to lend money to children, parents would have had to value Toys-R-Us gift certificates. The parent's low income status and use of gift certificates suggests transactions costs to arbitrate are likely to be very high. Third, the children did not know before the event the nature of our questions or the experiment, and when children did learn about our experiment, they learned about it and had to make decisions in the absence of their parents or anyone else they could talk with regarding borrowing money. Finally, arbitrage may be difficult for children to comprehend and use during the experiment.

Additional Design Features

Almost all data were collected at Central Catholic High School in Toledo, Ohio. Since most sessions lasted more than two hours, we provided soft drinks throughout the event and snacks at the beginning and pizza at the end of each session. Each family received $15 in cash paid to the parents and $5 in Toys-R-Us gift certificate paid to each child.[10]

We paid children with Toys-R-Us gift certificates since researchers who conduct economic experiments with children find that money may not hold children's attention as effectively as being

[10] A few families received $50 instead of $15. We control for this difference in the regressions and find that the show-up fee has no effect on behavior in the experiments.

compensated with toys.[11] Some children, especially young ones, may not fully comprehend the value of money and may also fear that their parents will confiscate their earnings or at least partially influence how the money will be spent. To further make the compensation salient for the children, at the outset of every session we asked them if they had ever been to a Toys-R-Us store and to think of things they would like to buy from the store. Virtually every child indicated that they had been to a Toys-R-Us store. We also observed that the children became very animated when asked to think about the toys and games available at Toys-R-Us.[12]

Since we examined several measures during the experimental sessions, we reduced possible wealth effects by using a random selection payment mechanism across most of the measures, including patience. Specifically, at the end of each session we randomly and anonymously chose approximately one out of every five participants to receive compensation for each decision set. For each subject randomly selected, we randomly chose one of the binary choices and paid the subject according to the choice he or she had made. If subjects selected to be paid in the future, we inserted the compensation (a check for parents, Toys-R-Us certificates for children) into envelopes that, with the subjects present, we sealed, addressed and dated. All procedures were explained to the subjects (and the envelopes were shown) prior to them making any decisions. To reduce the complexity of the design, we collected all outcomes single anonymous (subjects are unaware of what choices other subjects make) and single blind (subjects are unaware of the objective of the experiment). We also reduced the complexity of the design by running all tasks with paper and pencil to simulate a classroom environment that these children would typically experience.

These procedures introduce a potential additional explanation for different behavior between decision Set 1 and 2 besides hyperbolic and exponential discounting: subjects may be risk averse and

[11] We thank William Harbaugh and Kate Krause for helpful discussions on this issue.

[12] Using Toys-R-Us gift certificates should mitigate, but may not completely eliminate, children's concern that their parents will ultimately decide what things they can purchase. We did not collect the children's response to the questions regarding their knowledge of Toys-R-Us. We sacrificed some control to keep children attentive and reduce time they needed to pay attention.

perceive greater risk to future compensation than being compensated at the end of the session. For instance, if children question whether the experimenters will send the gift certificates, have doubts the mail will get to them, or perceive any other risks related to future rather than immediate compensation, we'd expect to see higher discount rates when there is no front-end delay (Set 1). Thus, the zero versus two month choices may involve other concerns besides the time value of money whereas the two versus four month choices holds constant the risks of future compensation, so it isolates the time value of inter-temporal choice.

To explore the risk explanation for greater impatience when there is no front-end delay, we experimentally measured risk attitudes.[13] We had subjects choose one lottery from a set of eleven possible lotteries that paid $2.50*x with probability 1.1-x, where x = 0.1, 0.2, …, 1.1: a greater choice of x implies less risk aversion.[14] We will use each subject's lottery choice as a control for risk attitudes.[15]

We also administered a survey to parents while they waited for their children to finish. The survey included several manipulation checks. Each check involved a statement that they could respond from 1 (strongly disagree) to 5 (strongly agree). The subjects' responses indicate that they believed they understood the tasks and believed we would follow our stated procedures. For instance, the average responses to the statements "The instructions for the games were clear and easy to follow" and "The procedures followed for all games we played today preserved my anonymity (no other participants knew your choices)" was 4.78 and 4.63, respectively

[13] Harrison et al. (2004) also measure discount rates and risk aversion within a single experiment with adult subjects.
[14] Similar to the patience tasks, we randomly chose approximately one in five subjects to pay for this risk measurement task. To conduct the lottery task, we provided a decision sheet that indicated 10 possible payoffs for teach of the eleven possible lotteries the subjects had to choose from. The lottery was conducted by rolling a 10-sided die, with each of the possible die rolls corresponding to the payoff the subject would receive.
[15] For this risk measure to control for the risk of receiving future compensation, we assume that greater risk aversion regarding these lotteries reflects greater risk aversion regarding receiving gift certificates in the future. To the extent that risk aversion is context free, this assumption is reasonable.

III. Results

Rational inter-temporal behavior within each decision set

We first examine the frequency and determinants of rational inter-temporal behavior and then examine the determinants of patience. Let c_{jk} equal 1 if subject j's choices in set k are rational (i.e., consistent with a single discount rate) in set k and 0 otherwise. Recall, a set of choices is rational, i.e. $c_{jk} = 1$, if a subject (a) is always impatient (i.e., never chooses to wait the extra two months) (b) is always patient (i.e., always chooses to wait the extra two months or (c) chooses to be impatient up to a certain amount and chooses to be patient beyond this amount.[16]

Table 2 shows the percent of subjects whose choices are (1) rational, (2) always impatient, (3) always patient and (4) rational but neither always impatient nor always patient. A child who is always impatient implies a discount rate greater than 150 percent over two months since the child chose $10 over receiving $25 two months later. A child who is always patient possibly suggests irrational behavior since this behavior includes choosing to receive $9 two months later than receiving $10. However, this behavior may not be irrational if, for instance, an individual wants to commit to savings as a means of self-control (e.g., Laibson (1997) discusses costly commitment devices such as tax over-withholdings and defined contribution plans). In a pilot session one 7-year old boy explained that he preferred to receive gift certificates in two months at the time of his birthday rather than at the time of our experiment. Although almost 10 percent of the children chose the $9 in two-months to $10 immediately, among the children making rational choices only 8 percent (2/25) of the 5 to 7 year olds and less than 3 percent (3/107) of the older children displayed this behavior.

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[16] Another explanation for the inconsistent behavior we observed may be that students did not adequately understand the nature of the exercise, and our results suggest that students with lower test scores were less likely to exhibit consistent preferences. In retrospect, we should have provided a test of understanding to verify that students understood the exercise. To improve students' comprehension in the exact realization of our experiment, we guided students through the decisions one-by-one. We physically demonstrated each task holding $10 in Toys-R-Us gift certificates in one hand and $X of gift certificates in the other hand (with X corresponding to the alternative choice).

Table 2 shows consistent behavior by 5-7, 8-10 and 11-16 year olds. We expect that older children are more likely to make rational choices if rationality develops with age rather than is endowed or fully developed by the age of five. There is some evidence that rationality develops with age in one other context: Harbaugh et al. (2001) show that older children's choices over consumption goods become increasingly consistent with the general axioms of revealed preference, implying that at least over these choices rationality develops with age.

Panel A of Table 2 shows that the percent of rational choices increases with age. With two-month front-end delay (Set 1), 53 percent of the youngest children (ages 5-7) made rational choices while 66 and 73 percent of 8-10 and 11-16 year olds made rational choices. We see a similar pattern if we exclude children who made either always impatient or always patient decisions. With no front-end delay (Set 2), we surprisingly observe that the youngest children make the highest percent of rational choices: 74 percent of 5-7 year olds made rational choices whereas only 64 and 73 percent of 6-10 and 11-16 year olds made rational choices. However, the reason for this unexpected pattern is that more of the youngest children are always impatient (35 percent) compared to the older children (under 15 percent). Excluding always impatient and always patient behavior in Set 2, Table 2 shows that older children made more rational choices similar to the pattern observed in Set 1. Table 2 also shows that the percent of rational choices among parents and 11-16 year olds are similar, suggesting that rational behavior for inter-temporal choices has mostly developed by the ages of 11 to 16.

Panel B of Table 2 suggests that gender has mixed effects on making rational choices. For instance, more boys than girls make rational choices among 8-10 year olds, yet more girls than boys make rational choices among 11-16 year olds. With adults, men and women are almost identically likely to make rational choices.

To statistically examine the determinants of rational behavior, we estimate the following binary choice Model 1:

$$c_{jk} = \alpha + \beta * X + \gamma * E + \delta * P + \varepsilon_u \qquad (1)$$

where c_{jk} equals 1 if subject j's choice are consistent with a single discount rate in set k and 0 otherwise. *X* includes controls for family background (household income, number of children living at home) and demographics (race, gender, age, age-squared). *E* represents variables related to a child's education (whether the child currently attends private school and the mathematics achievement test score) and *P* represents parent's patience behavior (on the same set k and choice). We estimate Model 1 for Set 1 and Set 2 separately including all children and including only children whose choices are neither always impatient nor always patient. We also stack the regressions for both sets and re-estimate Model 1 with an additional indicator variable for which set the data come from. We include fixed session effects and report clustered standard errors throughout the paper that control for both correlation across an individual's observations and the correlation between siblings.

Table 3 reports the results. We show estimates using all children (Columns 1, 3 and 5) and using only children who are neither always patient nor always impatient (Columns 2, 4 and 6). We present estimates when there is two-month front-end delay (Columns 1 and 2), when there is no front-end delay (Column 3 and 4) and when we pool the data (Column 5 and 6). Estimates of parents' behavior using pooled data across both decision sets are shown in the last two columns.

Table 3 shows that older children are significantly more likely to make rational choices (i.e., choices consistent with a single discount rate within each set) when there is a two-month front-end delay (Set 1, Age: $p < .01$), but at a significantly decreasing rate (Set 1, Age-squared: $p < .01$). The effect of age is directionally the same when there is no front-end delay (Set 2), but not significant. When we combine the two decision sets, the effect of age is marginally significant ($p < .10$) among all children and significant when we exclude children who are either always impatient or always patient ($p < .05$). Combining the estimates on age and age-squared, in all regressions age has a positive effect throughout the age range of the children we observed (five to sixteen year olds). In sum, consistent with Harbaugh et al (2001) who find that rationality develops with age over consumption goods choices, we find that rationality develops with age over inter-temporal choices.[17]

Table 3 shows that only two other factors besides age have any significant effect on children making rational choices in any of the regressions: African-American and test scores. Being African-American and scoring higher on the achievement tests have positive effects on children being more likely to make rational choices across all of the regressions, but the effect is significant ($p < .05$) in only a subset of the regressions. African-American children made significantly more rational choices than non African-Americans when there is two-month front-end delay ($p < .05$), and higher test scores also predict significantly more rational choices when there is two-month front-end delay. Higher test scores also predict significantly more rational choices when we stack the data and exclude children who are either always impatient or always patient. The point estimates in these regressions predict that as a child moves one percent higher in the test score distribution, on average the likelihood of a child making rational choices increases by approximately 0.40 percent. Given one standard deviation in test scores is 22.5 percent, the regression results suggest that a one standard deviation improvement in test scores predicts a nine percentage point increase in the likelihood of a child making rational choices.

The regressions also show that private school attendance has no significant effect on rational choices. One hypothesis for this lack of a relationship is that test scores capture the effect of schooling. However, if we exclude test scores from the regressions shown in Table 3, the effect of private schooling remains insignificant ($p > .20$). The stacked regressions also show that front-end delay has no direct effect on children making rational choices.[18] Finally, these regressions also show

[17] List and Millimet (2005) examine violations of GARP before and after a manipulation to induce market experience. Although they do not report the effect of age, they find that market experience decreases the percent of GARP violations, indicating that market experience increases rationality. Since age may be correlated with market experience, our finding that inter-temporal rational choices develop with age may reflect some unobserved experience correlated with age.

[18] The result that front-end delay has no significant effect on making rational inter-temporal choices is interesting since it could have also measured an order effect since Set 2 always followed set 1 in the procedures. Specifically, subjects could have learned

that whether parents make rational choices has no significant effect on predicting whether children make rational choices. This result may be due to the relatively high percent of parents (80 percent) who make rational choices.

For parents, we estimate a model that excludes schooling, test scores, age and their parents' behavior since we did not collect this data for the parents. Table 3 shows that for the adults, like their children, the likelihood of making rational choices is not influenced by the number of children living at home, gender or front-end delay. In contrast to their children, greater family income significantly ($p < .05$) increases the percent of adults who make rational choices. This result suggests that income may be correlated with the parents' education or other labor market skills that are correlated with rationality.

In sum, children are more likely to make inter-temporal rational choices the older they are, and in some specifications if they are African-American and the greater their test scores are, but inter-temporal rationality cannot be explained by public/private schooling, family income, gender, number of children living at home or their parents' rationality.

Patience

Figures 1-3 show the percent of children who were patient (chose compensation after waiting an extra two months) by front-end delay and the amount received if they wait the extra two months. The figures show that the percent of children choosing to wait increases, usually monotonically, the greater the future amount. For instance, Figure 1 shows that with a two-month front-end delay the percent of children who wait increases from 11 to 18 to 56 percent when the future amount increases from $9 to $10 to $11, respectively, and continues to increase to 70 percent when there is a $16 delayed payoff and to 87 percent when there is a $25 delayed payoff. The figures also show that children are less patient for the future amount when there is zero rather than a two-month front-end

to make rational inter-temporal choices from the experience they had in Set 1. However, the point estimates are insignificant, suggesting this learning (to make rational choices) did not occur across the two sets.

delay. For instance, Figure 1 shows that this gap ranges from 2 to almost 20 percent depending on the future amount.

Figure 2 shows the effect of age on patience: older children are more patient if the future payoff is more than $12. For instance, when there is no front-end delay (Figure 2b) and the children chose between receiving $10 at the end of the session or $22 in two months, 48, 69 and 82 percent of 5-7, 8-10 and 11-16 year olds, respectively, were patient. Figure 3 shows patience by gender and front-end delay. This figure shows that boys are less patient than girls when there is no front-end delay or there is two-month front-end delay for virtually all future amounts. The figure also shows that both boys and girls are less patient if there is no front-end delay.

To statistically examine the determinants of patience, we estimate the following Probit models:

$$w_{jk} = \alpha + \gamma X_j + \lambda Risk + \beta NoFrontDeay + \delta_1 Fut\mathrm{Re}t + \delta_2 Fut\mathrm{Re}t^2 + \varepsilon_j \quad (2)$$

$$w_{jk} = \alpha + \gamma X_j + \lambda Risk + \beta NoFrontDelay + \sum_{i=1}^{11} \delta_i Fut\mathrm{Re}t_i + \varepsilon_j \quad (3)$$

where w_{jk} is 1 if subject j chose to wait for the future payoff, X_j includes the control variables discussed above and NoFrontDelay is equal to 1 if there is no front-end delay (Set 2) and 0 otherwise. We also include the experimental measure of risk aversion, Risk, with greater values of Risk indicating less risk aversion. We further include controls for the future return (FutRet = [Future Amount-$10]/$10). Model 2, includes controls for future return linearly (to estimate the effect of the increased amounts children get if they wait) and quadratically (to estimate the future return's decreasing influence as the returns get larger - see Figures 1-3). Model 3 includes dummy variables for the effect of each possible level of future return (where $FutureReturn_i$ = 1 for the future amount in choice i, and 0 otherwise).[19] Both models also estimate fixed session effects. We discuss results from both models although Model 3 provides a significantly better fit than Model 2 (chi-square < .001).[20]

[19] The omitted future return category in Model 3 is for the choice to receive $9 in the future.
[20] Some authors examine the inferred discount rate implied by the binary choices. We examine the choices themselves for a few reasons. First, we cannot infer a discount rate for subjects who did not make rational choices. Second, the binary choices give us more power to detect significant comparative static effects (such as age and education) since we do not have to throw out or

Table 4 presents the results. Given the panel structure of the data, we report parameter estimates and clustered standard errors that again control for correlation across an individual's observations and correlation between siblings. Column 1 and 2 present estimates using Models 2 and 3, respectively, using all the children across both decision sets.[21] Column 3 presents estimates for the parents using Model 3 and data from both decision sets for all parents.

Column 1 shows children are significantly more likely to choose the compensation after the extra two months the greater the future return (δ_1=2.50, p<.001), but at a decreasing rate (δ_2=-1.07, p<.001). We also find that children and parents are significantly more likely to choose the compensation after an extra two months for all future returns (δ_i>0, p<.01) and that the size of the effect of these returns (weakly) monotonically get larger as the returns get larger. Point estimates (not shown) for the dummy variables for future amounts in Model 3 indicate that the children were approximately 25 percent more likely to be patient if they could get a 10 percent than 0 percent return by waiting the extra two months and that they were approximately one to three percent more likely to be patient for each additional ten percent increase in return for waiting.

Table 4 also shows that boys are significantly less patient than girls (p < .05). The point estimates predict that boys are approximately 10 percent less likely than girls to defer the $10 for the two-month delayed future rewards. Boys' greater impatience is interesting given the lack of a gender effect among parents in our data (Column 3) and since there is mixed evidence in other literature of gender effects among adults. For instance, some studies find men more patient (e.g., Coller, Harrison and Rutstrom 2003 with front-end delay) and some studies find men less patient (e.g., Warner and Pleeter 2001 among enlisted personnel), but most studies find no significant gender effect on discount rates (e.g., Andersen, Harrison, Lau and Rutstrom 2004**,** Coller et al 2003, Harrison, Lau,

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censor the data. Last, discount rates are sensitive to elicitation methods. For instance, if we ask a subject to choose between 30 cents now or 40 cents tomorrow (see Harbaugh and Krause (1998) for a similar question), then choosing 30 cents implies a daily discount rate of at least 33% and an annual rate over 10^{44}%. We find discount rates in the range of past studies. For instance, when there is a two month front-end delay, we find a 5% median discount rate for children on a 2 month basis (34% annualized); the rate for 11-16 year olds is also 5% and the discount rate is 15% (131% annualized) for 5-7 year olds.

[21] We examined the entire sample since policies are, and are likely to remain, targeted towards all children.

Rutstrom and Sullivan 2004, Harrison, Lau and Williams 2002, and Warner and Pleeter 2001). This gender difference suggests that policies targeted towards increasing immediate returns to children may have a greater impact on boys than girls. It also suggests that policies which provide incentives over longer periods of time may be more effective with girls than with boys. This resonates with recent evidence from a pay-for-performance program in Israeli high schools. Angrist and Lavy (2002) find that the year-long program generated gains among women but not men. Specifically, they find that high school boys did not respond to the cash incentives available for success on the college entrance exams, and one possible explanation for this lack of response could be that men had less patience than women and were thus less willing to wait for the future cash incentives.

We also examine the effects of age on patience in Table 4. Columns 1 and 2 show that older children exhibit significantly more patience. The point estimates predict that an additional year of age increases patience by 1.8 percent. For our sample, this point estimate implies an approximately 20 percent increase in patience from our five to sixteen year olds. This result is consistent with neuroscience evidence that finds the frontal cortex system still developing during these ages (which may moderate impulsive behavior) whereas the limbic system that drives impulsive behavior has developed at a much younger age (Gied et al 1999, Price and Wilshaw 2000, and see Camerer et al 2005 for a further review on economics and neuroscience). This result suggests that policies aimed at improving performance among young children may be more effective if they provide immediate rewards rather than require some delay before rewards are realized. In particular, programs which provide rewards after short-term assessments may be more effective in young children than programs that reward children for progress after a full-year. Additionally, since patience develops with age, the amount of time students must wait before receiving rewards could increase with age.

Table 4 further shows that children are significantly more impatient when there is no front-end delay (NoFrontDelay dummy: $p < .001$). The point estimates from these regressions predict that the children are approximately 16 percent less likely to wait for the delayed reward if there is no front-end delay than when there is two months front-end delay. These estimates represent the mean effect across all subjects. At a disaggregated level, we can also calculate the percent of children who were more, less or equally patient when there is no front-end delay than when there is front-end delay. Among the children who make rational choices (who we can infer discount rates for when there is and is not front-end delay), 39.6 percent (42/106) exhibit preferences consistent with using the same discount rate for both decision sets (consistent with exponential discounting), 43.4 percent (46/106) exhibit preferences consistent with using a higher discount rate when there is front-end delay (consistent with hyperbolic and quasi-hyperbolic discounting) and only 17.0 percent (18/106) exhibit preferences consistent with using a lower discount rate when there is no front-end delay (inconsistent with exponential, hyperbolic and quasi-hyperbolic discounting).

The greater impatience among children when there is no front-end delay than when there is positive front-end delay is consistent with their parent's behavior and most other empirical and experimental studies with adults (e.g., Laibson 1997, 1998; Harrison et al 2002, 2004). Coller et al (2003) attributes this behavior to quasi-hyperbolic discounting. That children exhibit hyperbolic discounting suggests that whatever the causes may be, this behavior develops at a young age.

Children's hyperbolic discounting behavior suggests that policies with no front-end delay may be more effective than policies with front-end delay in changing children's behavior. For instance, if policy-makers wish to pay children for health or educational performance, the policies may be most effective if the rewards have less front-end delay. Inevitably, these programs must have some front-end delay – children and parents need some time to make decisions in terms of health and education; however, especially in young children, our results suggest that less front-end delay is better. In an ongoing study (headed by Roland Fryer), several schools in New York City are providing incentives for test performance every three weeks. While there is front-end delay in this intervention, students' decisions were rewarded after a short period of time (3 weeks) relative to other programs which reward students after one year.

While we have attributed differences in behavior between Sets 1 and 2 to the difference in front-end delay, recall that the experimental design introduced other differences that may offer alternative explanations for this behavior. While there could be an order effect, we did not detect an order effect ($p>.70$) when we ran a similar study with college students. Alternatively, subjects may have perceived additional risks to delaying compensation in the no front-end delay decision set.[22] Thus, we measured risk preferences over a risky lottery choice. While this measure may not capture the same perceived risk associated with waiting for future compensation, policies that introduce delayed payment for compensation may, similar to the current decisions without front-end delay, introduce additional risks that also reduce the value of future payments.[23] Thus, policies providing rewards immediately may be optimal not only if children have hyperbolic or quasi-hyperbolic discounting functions, but also if they are risk averse regarding delayed payments.

The other variables included in our model do not have a statistically significant effect on children's patience. Some of these "no effects" are interesting. First, we find that income has no significant effect on children's patience, though we might expect lower income to decrease patience if lower income causes a liquidity constraint. While the lack of an income effect on patience may be due to children being at least partially sheltered from or unaware of their family income, we also find that parents' patience is also not significantly affected by income.

Second, we find that risk does not significantly affect patience ($p > .15$). However, since we only expect risk to affect choices when there is no front-end delay (since there may be greater perceived risk to delay than getting it at the end of the session), regressions shown in Columns 1 and

[22] Added risk from delayed payments (either the timing or actually receiving the cards) offers a rational reason for hyperbolic discounting; for instance Dasgupta and Maskin (2005) show that greater uncertainty regarding the timing of rewards the greater the delay can lead to rational discounting behavior that is hyperbolic. Thus, providing the identical risk across all time periods has the advantage of control for examining the effect of delay in isolation, controlling for risk may remove a central reason why people exhibit hyperbolic discounting behavior.

[23] For instance, the educational studies providing incentives for performance (e.g., Angrist and Levy (2002), and the ongoing studies in Canada, Ohio and New York City), there is not only delay before payments are made, but also risk that the payments may not be made. Angrist and Levy, for instance, presented incentives for performance up to three years in the future, yet needed to terminate the study after the first year and thus could not pay for performance after the first year. It is not clear whether our study introduces greater, similar or lower perceived risk.

2 combining both decision sets may inappropriately test the effect of risk. We thus re-estimated the regressions in Columns 1 and 2 for each decision set alone. These regressions (not reported) show that risk still has an insignificant effect ($p > .15$) on patience regardless of whether there is or is not front-end delay.

Third, Columns 1 and 2 show parents' patience positively predicts children's patience, yet not significantly ($t=1.47$ and $t=1.28$, respectively). Although insignificant, the point estimates predict that if a parent was patient on a decision, then the child was approximately 6 percentage points more likely to be patient. There is little experimental or other data to compare this result to, yet we included parents' behavior because we suspected that more patient parents might influence their children to be more patient. Although our results do not statistically support this hypothesis, directionally the evidence is positive.

Last, we find that both private schooling and test scores do not significantly affect patience, and the parameter estimates for these factors imply marginal effects close to zero.[24] We examined education since some researchers suggest that education may affect children's discount rates. For instance, Becker and Mulligan (1997) argue that, in contrast to the classical treatment of inter-temporal choice, the discount rate may be *endogenously* determined by a variety of factors including education. They argue that patience reflects an individual's "imperfect ability to imagine the future," and "while forming a mental picture of one's future pleasures may not be incredibly difficult, the process of anticipation is not merely one of image formation but also one of simulation." They further speculate that schooling can help with this image simulation:

> "…schooling focuses students' attention on the future. Schooling can communicate images of the situations and difficulties of adult life, which are the future of childhood and adolescence. In addition, through repeated practice at problem-solving, schooling helps children learn the art of scenario simulation. Thus, educated people should be more productive at reducing the remoteness of future pleasures," (pp. 735-736).

[24] Since private schooling and test scores may be correlated, we re-estimated the models including each of these items alone. The results indicate that neither measure has a significant effect on patience.

If private schooling enhances these experiences, then we should observe more patience (i.e. lower discount rates) among children in private schools. Yet we cannot find any significant relationship between private schooling and patience. Moreover, in our study, students were randomly chosen to receive educational vouchers. Educational vouchers could have facilitated private school attendance, raised a family's income (among those already planning to attend private school), or affected the child's confidence.[25] However, although we do not report them in the tables, we fail to find any significant causal effect of winning a voucher on patience. Perhaps the type of schooling is not important, but that any form of schooling (i.e., the progression of schooling from elementary through middle and high school) helps children gain the ability to look to the future. In this case, age may indeed be capturing this schooling hypothesis.

We also examined the statistical correlations between our measure of patience and several behavioral and educational measures that parents reported in our household survey. In terms of academic measures, we compared students' patience levels to whether parents had indicated their children were attending classes for gifted students, parents' educational expectations, and whether students attended classes for students with educational disabilities. We find no relationship between taking gifted classes or parental expectations and the likelihood that students waited for future rewards. We also found that students who had been suspended or students whose peer group had worsened over the last year appeared to be less patient. Our study was not designed to identify whether these relationships are causal; it is not clear whether patience causes these outcomes or vice-a-versa. We hope that future research can identify additional information on the relationship between patience and these academic and behavioral outcomes.

In sum, we find that boys are less patient than girls; children (like adults) are less patient when there is no front-end delay; and older children are more patient. However, we do not find any

[25] Angrist, Bettinger, Bloom, Kremer, and King (2002) and Bettinger and Slonim (2005) discuss other mechanisms by which vouchers may have affected student outcomes. The random assignment of vouchers can facilitate identification of the causal effect of winning a voucher on patience.

significant influence of family income, education, risk attitudes or parent's behavior on children's patience, though some of these variables had the expected directional effect.

IV. Conclusion

We used experimental economic methods to characterize the determinants of both rational inter-temporal choice and patience among children. We find that as children become older, they become more patient, that boys are less patient than girls, and that children, like adults, are less patient when there is not front-end delay. We do not find that family income, education or parent's patience has a significant effect on children's patience. We also find that children who are older, African-American or have higher test scores are more likely to make rational inter-temporal choices. These results provide evidence that rational behavior develops with age.

Our results add to the economics literature on discounting behavior and the psychology literature on children's discounting behavior. Our results indicate that younger children have higher discount rates than adults, but that by the age of 16 discount rates are fairly similar, and that like adults, children exhibit hyperbolic discounting behavior. Unlike the extant psychology literature (e.g., Flynn 1985; Mischel, Shoda, and Rodgriguez 1989; Shoda, Mischel, and Peake 1990), we did not find a significant relationship between educational outcomes and patience. However, our procedures, similar to most economics decision making experiments, differ in many ways from the psychology literature. For instance, the psychology literature often examines impulse control problems providing non-monetary, sometimes food, rewards that may be consumed either immediately or almost immediately. We designed our measure with long delays in terms of months since many of the educational policies have these long delays.

Our results have several implications for public policy. In terms of patience, children were very myopic in our study, particularly the young children. Almost 1/3 of the children in our sample between the ages of 5 and 7 turned down a 150 percent return in two months in favor of immediately receiving compensation. Programs that provide short-term, almost immediate incentives for children at all ages, but especially at this young age, may thus be most likely to be successful. Even programs which offer incentives over a longer period of time (e.g. academic achievement after one year) may prove successful although students may not respond to the incentives until shortly before the rewards are realized. Likewise, policies that increase the immediate costs of activities may similarly affect children's behavior toward more health and educational activities. For instance, Babcock (2004) finds that when the penalty for truancy increases, graduation rates are higher. The current results also suggest that programs, which provide short-term or immediate incentives to perform, may have a larger effect on boys than girls. Boys appear more impatient and may thus have a greater response to more immediate incentives.

The experimental methods used in this paper allowed us to examine patience among children that could not have been observed easily in some other manner, especially among the youngest children. Studying patience among children is important since many pivotal decisions children make, such as the trade-offs between studying for future benefits versus receiving greater immediate benefits, will depend on children's patience. Our study, however, provides evidence for a partial solution if we believe there is too much impatience: require children to make decisions with greater front-end delay and/or provide larger immediate rewards if there is no front-end delay. Our results suggest that policies can take advantage of the implied high discount rates among children by increasing the immediate rewards to health and education decisions thus encouraging positive choices.

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Table 1. Population Statistics N=191 Children

	All Children	Age 5-7	Age 8-10	Age 11-16
Family Income	$22,110 ($12,398)	$25,074 ($11,118)	$21987 ($13,189)	$20,929 ($12,018)
Number Children Living At Home	2.18 (0.95)	2.03 (1.09)	2.15 (.887)	2.29 (.958)
Male	.492 (.501)	.382 (.493)	.513 (.503)	.519 (.503)
African American	.497 (.501)	.529 (.507)	.475 (.503)	.506 (.503)
Age	9.90 (2.46)	6.59 (.557)	9.02 (.810)	12.27 (1.71)
Currently in Private School	.304 (.461)	.324 (.475)	.413 (.495)	.182 (.388)
Test Score	47.07 (21.96)	48.58 (23.95)	47.35 (22.21)	46.07 (20.96)
Number of Subjects	191	34	80	77

Notes: N=191 Children. Data are from surveys completed by subjects in 1998. Test Score is a pooled measure of math and reading tests.

Table 2. Percent Rational Choices

Panel A	Age 5 – 7	Age 8 – 10	Age 11 - 16	Parents
Two Months Front-End Delay (Set 1: 2 vs. 4 Months)				
Percent Rational	53%	66%	73%	83%
Percent Always Impatient	9%	8%	0%	8%
Percent Always Patient	3%	4%	5%	4%
Percent Rational but Not Always Impatient or Patient	41%	44%	68%	71%
N (1 observation per subject)	34	80	77	112
No Front-End Delay (Set 2: 0 vs. 2 Months)				
Percent Rational	74%	64%	73%	78%
Percent Always Impatient	35%	14%	5%	11%
Percent Always Patient	6%	1%	3%	3%
Percent Rational but Not Always Impatient or Patient	33%	49%	65%	63%
N (1 observation per subject)	34	80	77	112

Panel B	Age 5 – 7	Age 8 - 10	Age 11 - 16	Parents
Male				
Percent Rational in Both Decision Sets	65%	73%	66%	82%
Percent Rational but Not Always Impatient or Patient	30%	61%	62%	64%
N (2 observations per subject)	26	82	80	34
Female				
Percent Rational in Both Decision Sets	62%	56%	80%	80%
Percent Rational but Not Always Impatient or Patient	40%	41%	70%	69%
N (2 observations per subject)	42	78	74	190

Table 3: Probit Estimates of the Determinants of Consistent Preferences

	Children						Parents	
	Set 1: (2 vs. 4 months)		Set 2: (0 vs. 2 months)		Sets 1 and 2		Sets 1 and 2	
	All	Excludes Always Patient & Impatient	All	Excludes Always Patient & Impatient	All	Excludes Always Patient & Impatient	All	Excludes Always Patient & Impatient
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Family Income (In thousands)	.011 (.010)	.010 (.011)	.011 (.009)	.008 (.011)	.009 (.008)	.007 (.009)	.028** (.011)	.025** (.013)
Numb. Children Living at Home	-.022 (.123)	-.022 (.128)	.087 (.128)	.047 (.149)	.039 (.093)	.007 (.110)	-.006 (.128)	-.078 (.149)
Male	.200 (.246)	.227 (.263)	-.249 (.240)	-.265 (.284)	-.010 (.200)	-.005 (.219)	-.363 (.365)	-.274 (.420)
African American	.578** (.266)	.661** (.281)	.013 (.261)	-.032 (.312)	.321 (.196)	.311 (.222)	-.371 (.256)	-.446* (.268)
Age	.952*** (.331)	1.03*** (.344)	.100 (.368)	.425 (.413)	.531* (.282)	.730** (.307)		
Age-Squared	-.041** (.016)	-.044*** (.016)	-.004 (.018)	-.018 (.019)	-.023* (.014)	-.031** (.015)		
Parents Consistent	-.111 (.323)	-.063 (.360)	.324 (.377)	.140 (.401)	.219 (.197)	.143 (.215)		
Currently in Private School	-.025 (.277)	-.032 (.296)	.179 (.263)	.128 (.314)	.096 (.199)	.068 (.221)		
Test Score	.011** (.005)	.014** (.006)	.004 (.007)	.006 (.007)	.007 (.005)	.010** (.005)		
No Front-End Delay (Set 2) Dummy					.085 (.114)	-.044 (.109)	-.238 (.196)	-.208 (.204)
N	178	164	178	149	356	313	224	198
Log-likelihood	-90.11	-83.17	-80.46	-70.96	-184.87	-166.67	-94.24	-87.84

Notes: Standard errors are in parentheses, session effects not reported. Heteroskedastic errors clustered on children and parents. (*, **, ***: p<.10, p< .05, p<.01, respectively.)

Table 4: Probit Estimates of the Determinants of Patience

	Children		Parents
	1	2	3
Future Return	2.50*** (.231)		
Future Return Squared	-1.07*** (.125)		
Dummy Variables For Future Amounts	Not Included	Included	Included
Family Income (In thousands)	.003 (.005)	.003 (.005)	-.009 (.007)
Num. Children Live at home	.023 (.065)	.026 (.066)	.163* (.085)
Male	-.262** (.106)	-.269** (.109)	-.098 (.213)
African American	.104 (.130)	.104 (.132)	.018 (.171)
Age	.046** (.022)	.046** (.023)	
Parents Patient	.144 (.098)	.123 (.096)	
Currently in Private School	-.036 (.141)	-.038 (.144)	
Test Score	.002 (.003)	.002 (.003)	
Risk	.046 (.035)	.044 (.036)	
No Front-End Delay (Set 2) Dummy	-.397*** (.076)	-.411*** (.078)	-.263*** (.075)
N	4272	4272	2640
Log-likelihood	-2369.97	-2305.12	-1273.69

Notes: Data are from both Sets 1 and 2. Standard errors are in parentheses, session effects not reported. Heteroskedastic errors clustered on children and parents. (*, **, ***: p<.10, p< .05, p<.01, respectively.)

Figure 1: Decision to Wait by Front-End Delay

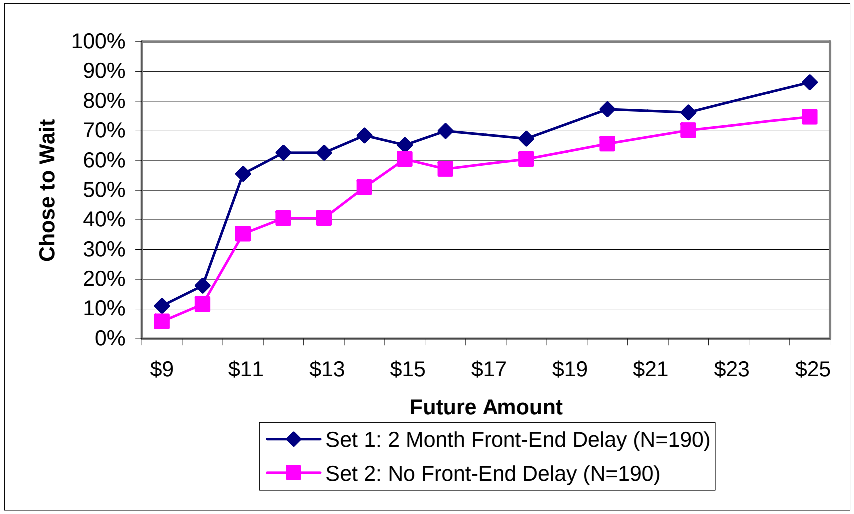

Figure 2b: Decision to Wait by Age Set 2: No Front-End Delay

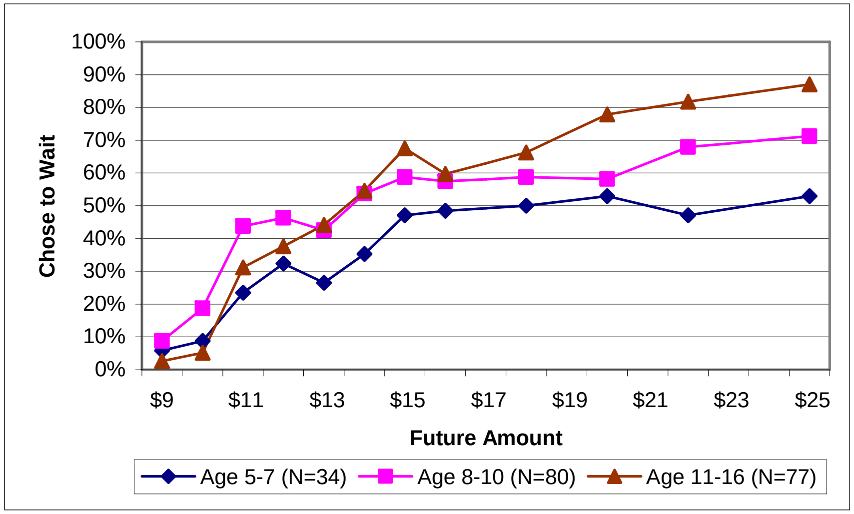

Figure 2a: Decision to Wait by Age Set 1: 2 Month Front-End Delay

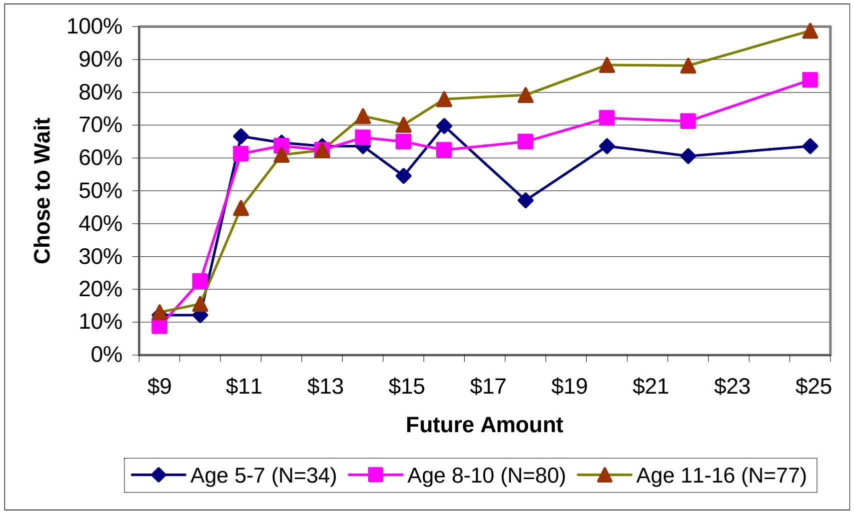

Figure 3: Decision to Wait by Gender and Front-End Delay