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Gender, Affect and Intertemporal Consistency: An Experimental Approach

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ABSTRACT

Gender, Affect and Intertemporal Consistency: An Experimental Approach*

We conduct experiments in which participants made multiple intertemporal decisions throughout a seven week period. In addition to exploring dynamic consistency and the stability of single period discount rates, our experiments introduce a manipulation to identify the role of positive and negative mood/affect in intertemporal choice. Our results demonstrate that, while individuals' single period discount rates are stable over time, there is evidence of dynamic inconsistency. While we find no differences in the discount rates of men and women, we find gender differences in the character of hyperbolic discounting in which women display greater patience in their "present bias." We also identify a gender-mood interaction: Negative mood in women yields increased impulsiveness while inducing positive affect in women or affect (positive or negative) in men yields little change.

JEL Classification: C91, D91, J16

Keywords: intertemporal, choice, experiments, gender, affect

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1 Introduction

There are those who plan, save, and invest for the future, and there are those who do not. Those in the latter category may jeopardize their well-being through welfare-reducing choices in areas such as health, education and retirement planning. Anywhere that an individual makes a decision involving tradeoffs between current costs and future benefits, inappropriate intertemporal discounting has the potential to lead the individual to sub-optimal outcomes. For example, in a tradeoff between consumption today and saving for retirement, impulsiveness or a heightened focus on one's current situation may lead to excessive discounting of future needs and sway the individual towards reduced retirement planning (e.g. savings). In areas such as health care and education, similar discounting can lead individuals to choose sub-optimal levels of preventative health measures (e.g. exercise, nutrition) or investments in human capital.

While the modus operandi of the analyses of intertemporal decision making lies in the work of Samuelson (1937), there is substantial evidence that individual discounting of future costs and benefits is not consistent in the way characterized by this standard model.[1] As such, numerous models have been proposed to account for the behavioral aspects of intertemporal choice (e.g. hyperbolic discounting) while maintaining the tractability and logic of the traditional model (Strotz, 1956; Laibson, 1997; O'Donoghue and Rabin, 1999, 2001). As opposed to the model of Samuelson (1937), these latter developments focus on the causes of (and the mechanisms available to mitigate) dynamic inconsistency. In terms of policy, research has demonstrated how hyperbolic discounting affects environmental policy (e.g. Cropper and Laibson, 1999; Karp, 2005), consumer behavior

[1] See Frederick et al. (2003) for a thorough review of this evidence.

and savings (e.g. Harris and Laibson, 2001; Laibson, 1997), and welfare programs (e.g. Shapiro, 2005).

In this paper, we explore intertemporal decision making through a series of experiments. In our experiments, individuals participated in four experimental sessions (each two weeks apart) in which discount rates were elicited. We elicited not only discount rates pertaining to a fixed time period, but also discount rates with regard to rewards approaching in time. That is, discount rates were repeatedly elicited for the same choice when the choice was between 6 and 11 weeks into the future, 4 and 9 weeks into the future, 2 and 7 weeks into the future and finally, the present day and 5 weeks into the future. This enables us to distinguish between the patterns of time preference inherent in traditional models of decision making (e.g. Samuelson, 1937) and models of hyperbolic or quasi-hyperbolic discounting (e.g. Laibson, 1997; O'Donoghue and Rabin, 1999). To our knowledge, this is the first laboratory experiment to address time inconsistency by eliciting discount rates from the same individuals at different times (i.e. through a within subject design). We are thus able to explore multiple aspects of intertemporal decision making within a unified design.

In the same spirit, Harrison et al. (2005a) conduct a field experiment in which participants were visited twice to make intertemporal decisions, but consider only choice alternatives beyond a one month time horizon. **Would you mind looking at the following sentence (I think maybe "less" should be switched to "greater", but I'm not sure):** Such a design only permits the identification of dynamic inconsistency if the "present bias" described in models of quasi-hyperbolic discounting is less than one month. Our experiments complement these by considering present biases ranging from the present to twelve weeks in the future, allowing us to identify whether a present-bias may

exist anywhere between the present and twelve weeks into the future. Further, we provide a richer test of consistency through a deeper within subject design (i.e. four versus two observations per participant). This increases the probability that we may detect hyperbolic discounting, where it exists, because an individual's present-bias may not be detected if too much time has elapsed between consecutive observations.

Our results suggest that while discount rates are consistent over time, individuals display dynamic inconsistency as described by models of hyperbolic and and quasi-hyperbolic discounting. Further we find that these characteristics of intertemporal preferences differ across genders. Specifically, while we find no difference in single period discount rates across genders, we find that dynamic inconsistency among women is characterized by a present bias occurring later relative to men. Thus, while theories of evolutionary psychology and evolutionary biology argue that women have lower discount rates than men (Campbell, 2002; Barkow et al., 1992) and experiments have found gender differences in impatience (Coller and Williams, 1999), our results suggest that differences in discount rates may be an artefact of differences in the pattern of quasi-hyperbolic discounting across genders.

In addition to addressing the stability of discount rates and dynamic consistency, we also consider the role of emotions (i.e. affect or mood) in intertemporal choice by using a simple mood induction procedure: To discern the relationship between emotions and time preference, we used information on the outcome of an initial bargaining game to motivate an affective state. That is, some participants learned the outcome of a bargaining game in which they had participated prior to the elicitation of discount rates. By presenting this outcome prior to the elicitation of discount rates, feedback regarding the game's outcome created an

emotional state which was proximate to the elicitation of discount rates, thereby allowing us to explore the effect of these outcomes (or more precisely, the emotions or moods relating to these outcomes) on intertemporal choices.

Our results suggest that individuals' rates of impatience are affected by the experience of positive and negative mood, with these effects being particularly strong for women. Thus our research provides experimental support for evidence on the relationship between emotional state and intertemporal decision making. For example, Loewenstein (1996) and Loewenstein and O'Donoghue (2004) discuss how the presence of cravings and moods can cause individuals to act in manners which are "contrary to their own long-term self-interest, often with full awareness that they are doing so." Moreover, there is neurological evidence that brain function (particularly, in the prefrontal cortex) and neurotransmitters associated with emotions (notably serotonin) are linked to intertemporal decision making (see Manuck et al., 2003; Patton et al., 1995).

The tie between emotion and intertemporal choice can have important implications for economic analysis and policy making. For example, Elster (1998, 1999) and Herman and Polivy (2003) discuss how emotional distress can trigger dynamic inconsistency in addicts and dieters. Emotional distress (and even positive emotions) in these environments can lead to a "motivational shift" in which immediate satisfaction surpasses long-term goals in an individual's decision making.[2] Indeed, Wilson and Daly (2003) find that men's discount rates are affected by the evocation of feelings of arousal.[3] The effects of these emotional states (through their corresponding effects on intertemporal preferences)

[2]With respect to altruism and bargaining behavior, Capra (2004) finds that individuals experiencing good mood are more altruistic and helpful in experimental games.

[3]Wilson and Daly (2003) study how viewing attractive members of the opposite sex affect elicited discount rates. They find that men's discount rates rise after viewing images of "pretty girls."

can have significant effects in economic environments. For example, it is argued that depressed mood accompanies living in poverty (Kelso, 1994; Oxoby, 2004). Correspondingly, Shapiro (2005) finds powerful evidence of hyperbolic discounting in the behavior of food stamp recipients, behavior which results in a 10 to 15% reduction in caloric intake over the 30-day period following the receipt of food stamps. In financial markets, Kliger and Levy (2003) and Mehra and Sah (2002) address how mood can affect risk and time preferences and, hence, equity prices. This research indicates that positive (negative) mood can induce less (more) risk aversion and that small changes in mood (which alter discount factors by 0.1%) can induce a 4% deviation in equity prices.

Recent research has tried to delineate the manners in which emotion and rational decision making interact. Loewenstein and O'Donoghue (2004) develop a two-system model of decision making consisting of an affective (emotional) system and a deliberative (cognitive system).[4] In this model, the "hot emotional" system and the "cool cognitive" system (cf. Metcalfe and Mischel, 1999) are imperfectly in control of their objectives and can influence one another's choices. For example, one can exert greater cognitive effort (willpower) to try and control one's immediate emotional desires in favor of satisfying longer-term objectives. On the other hand, the proximity of affective stimuli (e.g. the vividness or saliency of a prior event or outcome) can give the emotional system greater influence over the deliberative system, resulting in an individual "acting out" and exhibiting behavior which, on the surface, appears contrary to one's long-term interests. Most germane to our analysis are the implications of this model for time preferences and the prediction that "the proximity of immediate outcomes

[4]This approach is similar to planner-doer models (e.g. Thaler and Shefrin, 1981) and cue-conditioned models (e.g. Bernheim and Rangel, 2002).

should play a large role in elicited discount rates" and that discounting may be stimulus-specific.

Similarly, there is evidence that gender and affect are closely tied in intertemporal decision making. For example, evolutionary psychology suggests that emotional states may generate different behavioral responses in men and women (aggressive versus defensive, rational versus reactive; Barkow et al., 1992; Campbell, 2002). Elsewhere, researchers have found that women have more emotional ties to smoking and tend to have a more difficult time quitting (Gritz, 1980; Mazure et al., 2002). With regards to alcoholism, there is evidence that the menstrual cycles of alcoholic women (specifically, the mood changes resulting from such cycles) are correlated with alcohol consumption (Mello, 1980).

This gender-affect relationship in intertemporal decision making may characterize behavior regarding drug and alcohol abuse. For example, while males typically outnumber females in substance dependency, female addicts are more likely to have mood disorders than male addicts, with rates in excess of those found in the general female population (Boothroyd, 1980; Grunberg et al., 1991; Mazure et al., 2002; Sinha and Rounsaville, 2002; Wallen, 1992): Weiss et al. (2003) reports that among substance abusers, 32.7% of males and 55.3% of females report having an affective disorder. Beyond issues of substance dependency, gender differences in intertemporal preferences and the influence of mood or affect on these preferences may underlie the ways in which different genders make financial decisions. For example, Turner (2003) finds evidence of differences in the way men and women invest in housing (beyond those explained by mobility and employment issues) and Woolley (2004) finds differences in the way men and women allocate resources received through child benefits.

Broadly speaking, our experiment identifies three key results. First, we

find that individuals' single-period discount rates are consistent over elicitation rounds and do not differ across genders. Secondly, we find evidence of dynamic inconsistency according with models of hyperbolic and quasi-hyperbolic discounting. Our results indicate that, while individuals' discount rates for fixed periods of time are consistent across experimental sessions, there is strong evidence of quasi-hyperbolic discounting in which rewards in the near future are discounted disproportionately less than rewards farther in the future. Interestingly, the character of this inconsistency differs across genders: Our results suggest that the "present bias" characterizing models of quasi-hyperbolic discounting (e.g. the parameter β in the models of O'Donoghue and Rabin, 1999, 2001) occurs sooner for men than for women. In other words, while men and women do not differ with respect to discounting over the longer term, they differ with respect to the time periods in which immediate rewards receive a disproportionate weight or become more salient in decision making (relative to more distant future rewards). Thus, women are "more patient" in our environment only to the extent that "the present looms larger" for women later than it does for men. Finally, we identify a gender-mood interaction: Women's discount rates rise when they experience negative mood. More generally, our results are suggestive that the experience of any affective state raises discount rates in women while lowering discount rates in men.

This gender asymmetry regarding the susceptibility of discounting to mood or emotions may have important implications for the ways in which individuals manage intertemporal decisions. For example, our results can shed light on the gender differences in substance abuse noted above. Addiction is a problem involving impulsivity: Immediate satisfaction is weighted more highly than longer-term goals (e.g. freedom from addiction). Men, having on average a more

immediate present bias, would seem to be at higher risk for addiction. Further, women primed with negative affect show significantly higher impulsivity than women in neutral moods. This correlates with the finding that women with substance dependency are predominantly those with mood disorders. Moreover, the heightened sensitivity to mood among women may be at play in the way in which women allocate welfare receipts (Shapiro, 2005; Woolley, 2004).

The remainder of the paper is organized as follows: Section 2 presents our experiment and hypotheses. Section 3 presents our results. While we find consistency in single-period discount rates, we identify dynamic inconsistency with differences in the character of this inconsistency across genders. We also identify an effect of emotions in intertemporal discounting in which women display greater impatience when primed with negative mood. Section 4 concludes.

2 Experiment and Hypotheses

We designed our experiments to test (i) the consistency of discount rates over a single, fixed period and (ii) for the presence of dynamic inconsistency as predicted by hyperbolic and quasi-hyperbolic discounting. Moreover, our experiments included a manipulation designed to address the interplay between the proximity of affective stimuli and discounting.

We elicited individuals' discount rates over a seven week period during which participants returned every two weeks to answer the same set of discount rate questions. Thus, a maximum of four observations were available for each participant (cf. Harrison et al., 2005a), permitting us to address the consistency of individuals' discounting over time and control for unobserved heterogeneity in individual responses.

Each experimental session consisted of three parts: a bargaining game, the elicitation of discount rates between two and five weeks from the date of the session, and the elicitation of discount rates between the last day of the experiment and five weeks thereafter.[5] At the start of each session, subjects participated in a simple bargaining game. These one-shot bargaining games followed variations of ultimatum and dictator games with random matching. Participants' payoffs could vary between zero and ten dollars.

After playing the bargaining game, participants were presented with Figure 1 to elicit individual discount rates. As in Coller and Williams (1999), Harrison et al. (2002), Harrison et al. (2005b), and other studies, Figure 1 allowed individuals to indicate their preferences among a series of choices between a smaller sum of money in two weeks and a larger sum in five weeks. Implied three-week discount rates ranged between 2.5% to 30% in increments of 2.5% (excepting the first two choices, which differ by 3%). We refer to the elicited discount rates from Figure 1 as *ARate*. The size of these interest rates were chosen in order to motivate robust differences in waiting for three weeks. Our concern was that using annual rates ranging from, say, 2.5% to 10% would result in negligible differences between payoff amounts and thus less attentive decision making by participants.

Figure 1 about here

After completing Figure 1, participants were asked to complete Figure 2 which asked individuals their preferences between a smaller sum of money on March 23nd (six weeks from the start of the experiment) and a larger sum of

[5]Instructions are provided in Appendix A and the bargaining games are described in Appendix B. Participants also completed pre- and post-experiment questionnaires to elicit personal information (notably, gender).

money on April 27th (eleven weeks from the start of the experiment). This gave us another measure of individual discount rates and again the alternatives ranged from implied three-week discount rates of 2.5% to 30%. Our purpose in asking this question was to identify dynamic inconsistency as characterized by hyperbolic discounting (e.g. Laibson, 1997; O'Donoghue and Rabin, 1999) in which individuals weigh events differently as they approach in time.[6] This design permits the identification of hyperbolic behavior since in each session the dates of interest (March 23 and April 27) were two weeks closer to the time discount rates were elicited. Thus, by having participants complete Figure 2 each session we are able to collect evidence on how decision making changes as the time period of interest approaches. We refer to the discount rate elicited from Figure 2 as $BRate$.

Figure 2 about here

To insure incentive compatibility in elicited discount rates in each session, participants faced a 10% probability that their choices from Figures 1 and 2 would be implemented. These random draws were made at the end of each session. Successful participants were notified at the end of the subsequent session or, in the case of the last session, by email.

Our primary treatment variable was affective stimuli related to the initial bargaining game. In our *control* treatment, participants were not told the outcome of the bargaining game prior to the elicitation of discount rates (i.e. prior to completing the tables in Figure 1). In our *affect* treatment, individuals were informed of the bargaining game's result prior to the elicitation of discount rates.

[6] Another possible explanation for any observed inconsistency is the presence of projection bias in which individuals mis-judge future preferences over monetary amounts (Loewenstein et al., 2003). However, as argued by Mulligan (1996), we should not observe inconsistency in these circumstances given the fungibility of money received in different time periods.

That is, individuals in the affect treatment knew the outcome of the bargaining game (i.e. the amount of money allocated based on the game and how they had been treated by another participant) and this information was salient in their minds prior to being presented with Figure 1.

Our hope was that this would motivate either positive or negative mood, the effect of which would be observed in elicited discount rates. We chose simple bargaining games to motivate affective stimuli given the strong evidence on the prevalence negative reciprocity and altruism, their prevalent use in economic experiments, and that these games represent some of the most economically relevant decision making environments. Moreover, our belief is that these games are more economically relevant for mood induction than are other techniques often used in psychology (e.g. the recall of pleasurable of painful memories).[7]

The games used in the experiment can each be interpreted as a combination of three types of mood induction procedures (MIPs) used in the psychology literature: feedback (a.k.a. success/failure) MIP, social interaction MIP, and gift MIP. Further, the effectiveness of these MIPs (as measured through manipulation checks) have been well-documented: Westermann et al. (1996) show that social interaction and feedback MIPs are effective at inducing mood (particularly negative mood), while Gerrards-Hesse et al. (1994) show that the feedback or gift MIPs are effective at inducing elation while the feedback or social interaction MIPs are effective at inducing depression in subjects.

Note the outcome of the bargaining game is sunk at the time participants are asked their intertemporal preferences. Moreover, we implemented a (minimum) two-week "front-end gap" between the elicitation of discount rates and

[7]Similar procedures have been used in Charness and Levin (2005) and Westermann et al. (1996).

the receipt of payment. Thus, given the relatively small sums of money involved, it is unlikely that an income effect related to the games' payoffs played a role in revealed discount rates. As such, standard theory predicts that information regarding the outcome of the initial bargaining game should have no effect on intertemporal preferences. However, theories of visceral factors (Loewenstein, 1996) or "two system" decision making (Loewenstein and O'Donoghue, 2004; Metcalfe and Mischel, 1999) suggest that the proximity of information regarding the results of the bargaining game will influence the ways in which individuals discount the future.

Participants were randomly assigned to the control or affect treatment in each session. Given that participants returned every two weeks, individuals' decisions were potentially elicited under each treatment, providing a "partial" within subject design.

2.1 Hypotheses

Our hypotheses fall into three broad categories: intertemporal discounting, demographic characteristics, and the effect of mood or emotion.

2.1.1 Intertemporal Discounting

Hypothesis 1 *Discounting over identical scenarios is consistent over time.*

Consistent discounting over identical scenarios implies that a choice made today between payoffs t periods apart should be the same as that made at time τ between identical payoffs t periods apart. That is, individuals' discount rates should be stable over time. This hypothesis is predicted by both dynamically consistent (e.g. Samuelson, 1937) and dynamically inconsistent (e.g. O'Donoghue

and Rabin, 1999) models of intertemporal choice and has been supported in previous experiments (Coller et al., 2005; Harrison et al., 2002).

Hypothesis 2 *Discounting is dynamically consistent.*

That is, when individuals are presented with choices over a time period that is approaching, their discount rate should remain constant as the time period approaches. This is consistent with traditional models of intertemporal choice (e.g. Samuelson, 1937). In contrast, models of hyperbolic and quasi-hyperbolic discounting predict an increase in the discount rate as the time period approaches (e.g. Strotz, 1956; Laibson, 1997). Experimentally, Harrison et al. (2005a) find evidence of dynamic consistency in a field experiment with a one-month front end delay.

2.1.2 Demographic Differences

Hypothesis 3 *Women will exhibit lower discount rates than men.*

Support for this hypothesis can be found in previous research (e.g. Coller and Williams, 1999). Wilson and Daly (2003) point to evidence from evolutionary psychology (specifically with regards to mating and reproductive behavior) implying higher discount rates among males. However, Harrison et al. (2002) and Patton et al. (1995) find no significant differences between genders.

2.1.3 Mood and Intertemporal Discounting

Models acknowledging a role of affect or mood in decision making often focus on intertemporal discounting as an area prone to emotional changes (Frijda, 2003; Loewenstein, 1996). Our affect treatment primes participants with information

which may generate an affective state or mood, motivating "hot" versus "cold" decision modes in discounting (Loewenstein and O'Donoghue, 2004; Metcalfe and Mischel, 1999).

We have the following two hypotheses regarding the role of affect:

Hypothesis 4 *Negative affect will induce higher discount rates. Positive affect will induce lower discount rates.*

This follows research in neuropsychology drawing links between emotion, serotonin, and intertemporal choice (Manuck et al., 2003; Patton et al., 1995).

Hypothesis 5 *There will be an affect-sensitivity difference between genders.*

This hypothesis follows, in part, from research on general gender differences in decision making (Eckel and Grossman, forthcoming) and research demonstrating how visceral factors differentially affect different genders (Gritz, 1980; Mello, 1980; Wilson and Daly, 2003). Moreover, research in evolutionary psychology suggest that emotional states may yield different behavioral patterns in men and women. As such, men (women) may become more aggressive (defensive) or rational (reactive) when faced with emotional stimuli (Campbell, 2002). This may result in a greater or lesser discounting of the future.

3 Results and Analysis

The experiment was conducted with 86 participants recruited from the undergraduate student body at our university. Participants were split over three groups who each participated in four experimental sessions (one every two weeks). The three groups participated in each experimental session within 24 hours of one

another. With attrition over the seven week period, we have a total of 259 observations.[8] The experimental sessions were conducted in the experimental economics laboratory over a closed computer network and programmed in z-Tree (Fischbacher, 1999). The average age of participants was approximately 20 and forty percent of participants were female.

The variable *ARate* (the discount rate proxied by the choices in Figure 1) was chosen for much of the analysis. This was because *BRate* (the discount rate proxied by the choices in Figure 2) was more complex (i.e. the relative time period of the choice changed each session) and the effect of mood on *ARate* was more salient (i.e. it was elicited immediately after mood was primed). Moreover, *ARate* and *BRate* are highly correlated.[9]

Given that *ARate* is a censored dependent variable, we use a Tobit analysis to account for censoring on both upper and lower bounds. While a common Tobit is based on a continuous dependent variable, we can draw conclusions about a dependent variable made up of intervals because the intervals are small and numerous enough to approximate a continuous variable.[10] Moreover, the data can be treated as a panel with up to four observations for each individual. We

[8] Two groups had sessions every other Wednesday; one group had sessions every other Tuesday afternoon. Participants remained in their groups over the course of the experiment (i.e. a participant could not attend a session different than that they had been assigned). Forty-nine of eighty-six participants attended all four sessions. Those attending fewer than four do not seem to differ from the others in any statistical or demographic way: We are unable to reject the hypothesis that average discount rates do not differ between those who attended all four sessions and those who did not. Of the 259 observations, 162 were in the affect treatment and 97 were in the control treatment.

[9] The correlation coefficient between *ARate* and *BRate* is 0.764. The Spearman rank correlation coefficient is 0.820 and we can reject the null hypothesis that the two measures are independent.

[10] *ARate* follows a censored normal distribution with censoring points at 1 and 13 in which each consecutive value represents 2.5%. Participants were restricted to choosing integer values between 1 and 13, despite the possibility that they may have preferred to choose a value outside of this interval (e.g. an *ARate* of 1 would identify anyone with a discount rate less than or equal to 2%).

are thus able to account for unobserved, individual specific fixed effects which, if ignored, would bias our results.[11]

We estimate the following model:

$$ARate = \beta_0 + \beta_1 negative + \beta_2 positive + \beta_3 gender * negative$$
$$+ \beta_4 gender * positive + \beta_5 session2 + \beta_6 session3 + \beta_7 session4 + v_i + u_{it} \quad (1)$$

where $gender \in \{0, 1\}$ is 1 if the participant is female. The variables $session2$, $session3$ and $session4$ represent the session in which the observation was obtained and account for the choices in Figure 2 in which the events approach in time.

To account for the effect of mood, we define a participant as experiencing negative (positive) mood if they were in the affect treatment and received a payoff strictly less than \$5 (strictly greater than \$5) in the bargaining game. To this end, $negative \in \{0, 1\}$ takes the value of 1 if the participant received a payoff strictly less than \$5 in the bargaining game; $positive \in \{0, 1\}$ takes the value of 1 if the participant received a payoff strictly greater than \$5 in the bargaining game.[12] Observations with values $negative = positive = 0$ represent participants in the control treatment and participants in the affect treatment with payoffs equal to \$5. The cross-effects $gender * negative$ and $gender * positive$ measure the affect-sensitivity difference between genders for both positive and negative affect. Finally, v_i represents individual fixed effects and u_{it} is the error term.

[11] Greene (2004) shows that the estimators of a fixed effects Tobit exhibit only a negligible amount of bias, especially if $T \geq 3$.

[12] Our results are qualitatively robust to different approaches in coding positive and negative affect. For example, coding a payoff less than \$4 as *negative* and a payoff greater than \$6 as *positive* does not change the direction of the results.

In coding affective stimuli in this way, we take the most basic approach to mood induction, basing mood solely on the economic outcome rather than interpreting mood based on intentions (e.g. suggesting that engaging in negative reciprocity creates a positive mood). As discussed below, we find the effect of this induction techniques to be symmetric for each gender, suggesting that this coding appropriately captures the effect of mood independent of the experienced affect (e.g. joy, sadness, anger, fear). Moreover, these outcomes are perhaps the weakest mechanisms to evoke affective states (e.g. monetary amounts are less than \$10, the experience is confined to a laboratory environment). As such, our results are the minimal test of affect since the events individuals experience in the regular course of their lives are likely to induce stronger, longer lasting emotional states. Thus, our coding based on outcomes is the least evasive manner to chart the effect of mood: That we find any effect of mood on discount rates (i.e. *ARate*) suggests that intertemporal preferences may be strongly affected by more pervasive emotional states.

Table 1 here

Marginal effects (as calculated at the mean) are reported in Table 1.[13] The variable $gender * negative$ is significant, suggesting an interesting relationship between mood and *ARate*. In order to understand the effects of positive and negative mood and how these effects differ between genders, pseudo-coefficients are reported in the lower half of Table 1. Put simply, females' intertemporal decisions are significantly negative-mood sensitive, whereas males' decisions are not. That is, a poor result in the bargaining game contributed to higher discount rates

[13] As a check for the robustness of our results, we increased the "bin" size of the dependent variable (the dependent variable then consisted of 7 larger intervals rather than 13 smaller intervals). Under this specification, all estimated coefficients were of similar sign and scale.

in women with average three-week discount rates increasing by approximately 4% (ceteris paribus). This conforms with our hypothesis on the effect of negative mood (Hypothesis 4), but is qualified by our hypothesis on the gender-mood relationship (Hypothesis 5).

In economic terms these mood-induced changes in intertemporal preferences may be more important than they appear. First, note that the large discount rates we employed in Table 1 served to minimize the effect of mood by focusing attention on the larger monetary differences. Thus, when individuals are facing more realistic financial decisions (where annual discount rates, rather than three-week discount rates, vary form 2% to 10%) there may be a greater role for emotional responses in altering time preferences. Furthermore, our affect manipulation was innocuous: Individuals simply learned how much they had received in a prior bargaining game, which may have motivated emotions associated with success or having been treated unfairly. These are simple manipulations which are likely to only minimally affect one's emotional state relative to recalling emotional experiences or events (as in Morris, 1989; Capra, 2004) and the actual type of emotional experiences one has day-to-day. Coupled together, these two aspects of our experimental design imply that the effects of mood on intertemporal preferences are potentially understated relative to how these effects are manifest outside the laboratory.

Thus, although not statistically significant, it is interesting to note the economic significance of the effects implied by the pseudo-coefficients: Both positive and negative affect increase discount rates in females but decrease discount rates in males. This effect is illustrated in Figure 3. That the effects of mood are symmetric for each gender suggests that our coding of affective states (i.e. the variables *positive* and *negative*) does not bias our results: Any affective expe-

rience led to the same affect in men (lower discount rates) and women (higher discount rates). These results conform with the existing psychological research on the interaction of gender and emotion suggesting that women experience emotion more strongly than men, particularly negative emotions (see, for example, Fischer et al., 2004). Moreover, our results demonstrate that females' sensitivity and reactivity to negative emotional stimuli (Hillman et al., 2004; McManis et al., 2001) carries over into economic environments.

Figure 3 here

Table 1 also offers insight into the consistency of single-period discount rates (*ARate* choices) over the four sessions. That none of the session dummy variables is significant indicates that there was no systematic inconsistency among participants. Thus, we are unable to reject the hypothesis that $\beta_j = 0$, $j \in \{5, 6, 7\}$, and we are unable to reject Hypothesis 1: We find no systematic inconsistency of discount rates over fixed time intervals (cf. Harrison et al., 2002; Coller et al., 2005). Thus it appears that the three week discount rates elicited using Table 1 are consistent reflections of intertemporal preferences. Furthermore, the insignificance of β_j, $j \in \{5, 6, 7\}$, indicates that (in our data) the nature of the different bargaining games had no systematic effect on elicited discount rates.[14]

To estimate the role of gender in intertemporal choice we use a two-step process to identify gender differences. Using equation (1), fixed effects were estimated for all but one of the participants, identifying individuals' idiosyncratic tendencies when responding to Table 1 (e.g. the effects of gender and other unobserved variables). We then regress these fixed effects on *gender* to identify

[14]Note that the absence of systematic inconsistency does not equate to evidence in support of consistency: Participants may have displayed "random" inconsistency in their choices. However, we found no significant pattern of inconsistency in elicited *ARate*s over the four sessions. In the control treatment, the average within panel standard deviation of *ARate* is 1.32.

the effect of gender, the results of which are reported in Table 2. The fact that the coefficient on *gender* is insignificant indicates that, in this environment, females' discount rates do not systematically differ from those of males'. Thus, we do not identify any gender differences in intertemporal decision making over fixed periods of time and reject Hypothesis 3.

With respect to dynamic consistency, recall that Figure 2 presented a choice between \$100 on the last day of the experiment or $\$100 + x$ five weeks thereafter. As such, we use $BRate$ to assess dynamic consistency as manifest by no systematic inconsistency across the bi-weekly sessions. If hyperbolic or quasi-hyperbolic discounting were present, we would expect elicited discount rates to increase at some point over the four sessions. To this end, we estimate

$$BRate = \beta_0 + \beta_1 ARate + \beta_2 session2 + \beta_3 session3 + \beta_4 session4 + v_i + u_{it} \quad (2)$$

Note that instead of using the dummies *positive* and *negative*, we control for the mood manipulation by using $ARate$ as an independent variable. To allow for gender differences in quasi-hyperbolic discounting, we estimated separate models for females and males utilizing a fixed effects Tobit model.

The marginal effects from estimating equation (2) are reported in Table 3. Evidence of dynamic inconsistency is captured by the coefficients on the dummies for each session, β_k for $k \in \{2, 3, 4\}$. For men, the significant positive coefficient on the $session4$ dummy variable suggests that discount rates in session 4 are larger than those in session 1. Thus, when men encountered Figure 2 in session 4, their three-week discount rates were, on average, approximately 1.7% higher than those elicited in session 1 (ceteris paribus). For women, the results are strikingly different. The significant positive coefficient on the dummy variable

for *session*2 indicates that when women encountered Figure 2 in session 2, their three-week discount rates were, on average, approximately 2.3% higher than those elicited in session 1 (ceteris paribus).

Given these coefficients, we are able to reject our hypothesis regarding dynamic consistency (Hypothesis 2). Indeed, these changes in discount rates over the course of the experiment are consistent with models of hyperbolic and quasi-hyperbolic discounting. To illustrate, consider a quasi-hyperbolic model (e.g. Laibson, 1997; O'Donoghue and Rabin, 1999, 2001) in which preferences are represented by

$$U_t(x_t, x_{t+1}, \ldots, x_T) = \left(\frac{1}{1+r}\right)^t u(x_t) + \gamma \sum_{\tau=t+1}^{T} \left(\frac{1}{1+r}\right)^\tau u(x_\tau) \qquad (3)$$

where $\gamma \in (0,1)$ characterizes quasi-hyperbolic discounting via a present-bias and $r \in (0,1)$ is a time-consistent discount rate. Thus the individual weighs the present more heavily than the future (by a factor of γ) but discounts all future time periods consistently. For example, at time t an individual's discounted marginal utilities for periods $t+1$ and $t+2$ differ by the factor $\frac{1}{1+r}$. However, when the above discounted marginal utilities are evaluated at time $t+1$, these discounted marginal utilities differ by $\frac{\gamma}{1+r}$.

In terms of this model, our results imply that males' present-bias parameter γ falls between the present and two weeks in the future. We are able to pinpoint this since men's discount rates are significantly higher when making choices in session 4 (between the present and five weeks in the future) but not significantly higher when making their choice in session 3 (between two weeks and seven weeks in the future). Similarly, for women the parameter γ falls between five and nine weeks into the future. The fact that the coefficients of *session*3 and

*session*4 in the women's regression are insignificant is still consistent with models of hyperbolic and quasi-hyperbolic discounting: Women's present-bias parameter γ falls between five and nine weeks into the future, so when choosing between two periods farther than nine weeks into the future or when choosing between two periods less than five weeks into the future, discount rates will not differ.

Thus, we find a difference in the character of quasi-hyperbolic discounting between the genders: While both genders display hyperbolic discounting, men exhibit a present bias that is much closer to the present than that of women. As such, the gender differences (or lack thereof) in intertemporal decision making may in part be due to differences in the manner in which hyperbolic discounting is exhibited. Thus, our findings serve as a bridge between research identifying gender differences in single period discount rates (e.g. Coller and Williams, 1999; Eckel and Grossman, forthcoming) and research identifying no differences (e.g. Harrison et al., 2002), suggesting that these differences may be due to alternate ways in which individuals display their present biases.

4 Conclusion

In this paper, we experimentally explored the consistency of single period discount rates, dynamic consistency, and the effects of induced mood/affect on intertemporal decision making. While we find no evidence of inconsistency in single period discount rates, we find gender differences in the character of dynamic inconsistency and the effect of mood on decision making.

With respect to dynamic inconsistency, we find that men display a present bias which manifests itself earlier than that displayed by women. This helps explain some of the differences across laboratory and field experiments, some of

which identify gender differences and others that do not. It is interesting to note that, while many have argued that women display greater patience than men in intertemporal choices, our results suggest that this may simply be an artifact of the way in which present-biases differ across genders. Thus, it is not that individuals of different genders necessarily weigh the future differently, but that "the present looms larger" for men sooner than it does for women.

With respect to the relation between intertemporal choice and mood, we find evidence that priming with negative mood results in greater impatience only among women. This result suggests that inducing non-negative moods in women may facilitate reducing impulsiveness, maintaining self-control and the implementation of longer term goals. While this may be useful in the treatment of addictions (Gritz, 1980; Mazure et al., 2002; Mello, 1980), it may also be appropriate in long-term financial and family decisions (Turner, 1982; Woolley, 2004).

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A Sample Instructions

This is a copy of the instructions from the fourth session. Instructions for each session are available from the authors upon request. Instructions from the other sessions followed the same pattern, save for changes in the description of the games (see appendix B).

This is an experiment in the economics of decision making. During this session you will make a number of decisions. These decisions will result in a payoff which will be paid in cash. Your payment for this session is both compensation for your time as will as for the effort you put into making your decisions.

This session will consist of a number of stages. The stages will proceed as follows:

1. You will be randomly paired with another individual. The computer will randomly assign each person in the pair to the role of Person A or Person B. Person A will be allocated $10. Person A must choose how much of this amount to offer to Person B. At the same time, Person B will specify the smallest offer they will accept (the minimum acceptable offer). If Person A's offer turns out to be greater than the minimum acceptable offer, both people receive the amounts agreed upon. However, if Person A's offer is less that Person B's minimum acceptable offer, both people receive nothing.

   The rest of the session will be completed on an individual basis.

2. A number of choices will be presented to you where you are to indicate your preference over a sum of money in two weeks or a different sum of money in five weeks. For each choice, indicate which payment option you prefer. At the end of the session a random draw will be made: With a 10% chance, you will receive one of your choices on the date specified.

3. A second set of choices will be presented to you where you are to indicate your preference over sums of money. The choices will be between a sum of money on March 23 or a different sum of money on April 27. For each choice, indicate which option you would prefer. At the end of the last experimental session a random draw will be made and with a 10% chance, you will receive one of your choices on the date specified.

4. The final stage asks you to provide us with some demographic and personal information. This information is confidential.

Your payment for this session will consist of the outcome of the game in stage 1. Two people will be randomly chosen in each of stages 2 and 3 and notified in the next session.

Once everyone has had an opportunity to ask any final questions we will begin the session.

B Description of Games

The following are descriptions of the games played in each session. The results of these games are consistent with results in the existing literature (see Camerer, 2003). All experiments were conducted over a computer network using z-Tree (Fischbacher, 1999).

1. Session One: Discrete-Choice Dictator Game

   Participants were randomly matched into anonymous groups of two. Each participant was given the choice between three payoff options: (a) \$9 for self, \$0 for other person (b) \$5 for self, \$5 for other person (c) \$6 for self, \$2 for other person. The computer then randomly chose and implemented one of the partners' choices for each pairing. The distribution of chosen offers is presented below.

Option	Payoffs	Frequency
A	(9,0)	35.7%
B	(5,5)	48.8%
C	(6,2)	15.5%

2. Session Two: Redistribution Game

   Participants were randomly matched into anonymous groups of four. Each participant was allocated \$10, and had the option of redistributing their money to a public fund paying each person in the group 0.25 times the sum of all contributions within the group. That is, an individual's payoff was \$10−their contribution + 0.25 times the sum of all contributions within the group. Participants' choices were made simultaneously. Consistent with research on decision error (e.g. Anderson et al., 1998), average contributions (standard deviation) were 1.22 (1.86).

3. Session Three: Discrete-Choice Dictator Game

   Participants were randomly matched into anonymous groups of two. Each participant was given the choice between three payoff options: (a) \$10 for self, \$0 for other person (b) \$5 for self, \$5 for other person (c) \$6 for self, \$2 for other person. The computer then randomly chose and implemented one of the partners' choices for each pairing. The distribution of chosen offers is presented below.

Option	Payoffs	Frequency
A	(10,0)	79.4%
B	(5,5)	15.9%
C	(6,2)	4.8%

4. Session Four: Stylized Ultimatum Game

   Participants were randomly matched into anonymous groups of two and randomly assigned the roles of proposer and responder. The proposer was given $10 and chose how much of this endowment she was to share with the responder. At the same time, the responder indicated the minimum offer she would accept from the proposer (cf. Mitzkewitz and Nagel, 1993). If the offer was greater than or equal to the minimum acceptable offer, each player received the amount agreed upon. However, if the actual offer was less than the minimum acceptable offer, both players received nothing. The average offer (standard deviation) was 4.84 (1.23). The average minimum acceptable offer (standard deviation) was 3.36 (2.19).

Table A:

Payoff Alternative	Payment Option A (pays amount below in 2 weeks)	Payment Option B (pays amount below in 5 weeks)	Payment Preferred (circle A or B)	
1	$40	$40.80	A	B
2	$40	$42	A	B
3	$40	$43	A	B
4	$40	$44	A	B
5	$40	$45	A	B
6	$40	$46	A	B
7	$40	$47	A	B
8	$40	$48	A	B
9	$40	$49	A	B
10	$40	$50	A	B
11	$40	$51	A	B
12	$40	$52	A	B

Figure 1: Table used to elicit $ARate$.

Table B:

Payoff Alternative	Payment Option A (pays amount below on March 23)	Payment Option B (pays amount below on April 27)	Payment Preferred (circle A or B)	
1	$100	$103.33	A	B
2	$100	$108.33	A	B
3	$100	$112.50	A	B
4	$100	$116.67	A	B
5	$100	$120.83	A	B
6	$100	$125.00	A	B
7	$100	$129.17	A	B
8	$100	$133.33	A	B
9	$100	$137.50	A	B
10	$100	$141.67	A	B
11	$100	$145.83	A	B
12	$100	$150.00	A	B

Figure 2: Table B used to elicit $BRate$.

	Coef.	S.E.	p-value
Tobit Analysis			
positive	-0.393	0.528	0.456
negative	-0.604	0.511	0.237
$gender * positive$	0.653	0.778	0.402
$gender * negative$	2.208	0.832	0.008
$session2$	-0.499	0.382	0.191
$session3$	0.437	0.389	0.262
$session4$	-0.490	0.419	0.242
Pseudo-Coef.			
Females			
negative	1.604	1.191	0.017
positive	0.260	1.170	0.672
Males			
negative	-0.604	0.511	0.237
positive	-0.393	0.528	0.456

Table 1: Effect of Induced Mood in Intertemporal Choice.

	Coef.	S.E.	p-value
gender	0.268	1.302	0.837
constant	0.748	0.824	0.366

Table 2: Gender Differences in Discounting. (Reported standard errors are questionable given the dependent variable was generated in a prior regression).

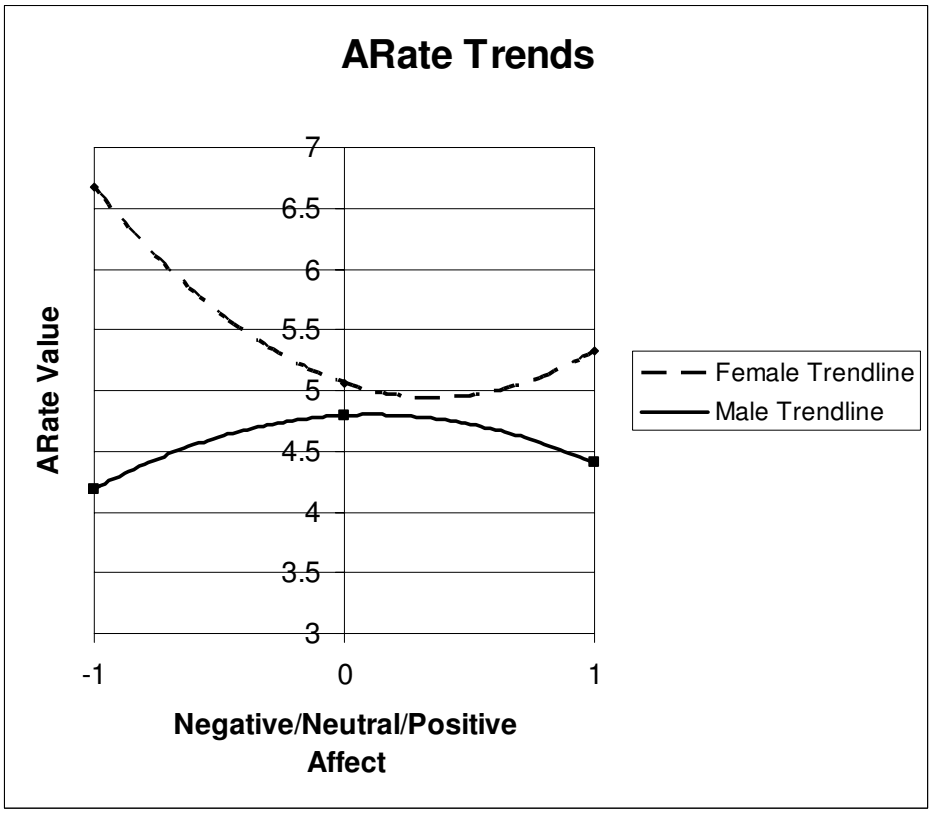

Figure 3: The Predicted Gender-Specific Effects of Negative Affect (-1) and Positive Affect (1) on ARate.

	Coef.	S.E.	p-value
Males			
ARate	0.477	0.054	0.000
*session*2	0.080	0.267	0.763
*session*3	0.212	0.271	0.436
*session*4	0.669	0.278	0.016
Females			
ARate	0.626	0.069	0.000
*session*2	0.920	0.378	0.015
*session*3	0.029	0.403	0.943
*session*4	0.359	0.453	0.427

Table 3: Evidence of Dynamic Inconsistency by Gender.