Spring 5-17-2013

# The FII Model as an Investment in Patience: Exploring Time Preferences in Medellin, Colombia

Jennifer Graham
*University of San Francisco*, jlgraham@usfca.edu

# The FII Model as an Investment in Patience: Exploring Time Preferences in Medellin, Colombia

*JEL Classifications C93 I38 O12*

Key Words: *Field Experiments*, *Time Preferences*, *Poverty Alleviation Programs*, *Development*

Master's Thesis
International and Development Economics

Jennifer Graham

Department of Economics
University of San Francisco
2130 Fulton St.
San Francisco, CA 94117

e-mail: *jlgraham@usfca.edu*

May 2013

Abstract: The motivation for this research is to explore the success behind the Oakland based Family Independence Initiative (FII) as a model for poverty alleviation. During the period of June-December 2012, nearly 200 small business owners in Medellin, Colombia participated in a field experiment intended to replicate the FII model by randomizing the treatments of setting goals, receiving conditional payments, and participating in self-help groups, as well as the combinations thereof. The data shows that the subjects in the full FII treatment group achieve more goals and have significantly higher monthly sales than those subjects in any other treatment or control group. Given its success, this research explores the merits of a change in subjects' time preferences as a mechanism explaining the changes in behavior caused by participation in the FII program. The subjects' time preferences were measured via survey using a combination of the binary choice and fill-in-the-blank methods on three different occasions throughout the experiment. The data indicates that participating in the FII experiment does indeed change subject's time preferences, suggesting they become more patient and less present-biased over time. Examining how time preferences can change over time is particularly useful when discussing poverty alleviation, as inter-temporal choices affect a range of behaviors such as saving, borrowing, and various types of investment, all of which affect economic well-being.

The author wishes to thank the Mayor's Office of Medellin, Colombia, in particular El Banco de las Oportunidades, for their partnership in the FII experiment. Thank you to our gracious host family, the enumerators, and the participants, without whom this project would not have been possible. A very special thank you goes out to the members of Team Colombia and our adviser.

# 1. Introduction

The Family Independence Initiative (FII) began in Oakland, California in 2001 implementing a new and innovative poverty reduction program. The program has since spread to cities around the United States, including Boston, San Francisco, and Honolulu. The FII shows findings that suggest it is possible to reduce poverty by focusing on the notion of goal achievement accompanied by small financial incentives and group support. The FII organizes affinity groups made up of low income families of different cultural backgrounds within a geographical area, provides them with some helpful tools to succeed in attaining self-set goals, and offers an incentive to motivate continued progress in achieving their goals (Castuera et al 2004). The program aims to act as a bottom-up approach, as it emphasizes family ties and social networks over the assistance of professional staff (Miller, 2011). The organization's internal reports show substantial improvements in welfare in all program locations. The FII states that the participants have experienced a 23 percent increase in average household income, a 240 percent increase in average savings, a 17 percent increase in home ownership, and as well as increases in children's school grades and attendance rates (Miller, 2011; Castuera et al 2004). Encouraging accountability, empowerment, and self-starter attitudes seems to have an effect on the participants' behaviors. This indicates that psychological motivators and indicators could have an important relationship with economic outcomes, and therefore substantial implications for economic development policy both domestically and abroad.

Given the apparent success of the FII model, a field experiment was conducted in Medellin, Colombia in June through December 2012 with the goal of exploring the possible reasons for the FII accomplishments. The primary purpose of the FII experiment in Medellin was to assess whether the FII framework is indicative of a successful poverty alleviation model that can be applied more generally, or whether the success can be attributed to other unknown factors or circumstances specific to the areas in which the program has already been implemented. More specifically, the FII experiment aimed to assess the extent to which each one of the FII components – setting goals, being involved in self-support groups, and receiving small economic incentives based on achievement – contributed to the behaviors of participating individuals.

The experimental data from the FII experiment conducted in Medellin not only show that subjects in the FII treatment group were more likely to achieve their goals, but provide

some evidence that the FII subjects' businesses experienced higher revenues due to the experiment as well. However, these findings are not the focus of this research. Now that it is known that FII experiment had a statistically significant impact on the subjects, the next step is to assess the potential causes of these behavior changes. The objective of this particular research is to understand through which mechanisms the subjects' attitudes and behaviors were affected. While there could be a multitude of factors that affected goal achievement and revenues (or lack thereof) among the subjects of this study, this paper will focus on the relationship between participating in the FII experiment and changes in the subjects' time preferences.

Economists have long recognized that people's perception of time affects how they evaluate many decisions in their lives, ranging from economic decisions to decisions about health care (Wilson, 2011; Robberstad & Cairns, 2007). It can even affect how one treats the natural environment (Kirby et al., 2002). Examining these relationships is particularly useful when discussing models for poverty alleviation, as inter-temporal choices affect a range of behaviors such as saving, borrowing, and various types of investment (including in education and health care), all of which affect economic well-being (Anderson et al., 2004; Camilo et al., 2008). Because economic development in general is related to time preference, questions now arise as to whether or not a person can become more patient, perhaps engendering better economic outcomes. This research adds to the growing amount of literature that explores if various measurements of time preferences can change over time, and if so, how this occurs. Thus the following two research questions are explored:

(1) To what extent does participating in the FII experiment affect measures of the subjects' discount rates?
(2) To what extent does participating in the FII experiment affect measures of the subjects' present bias?

The findings of this paper illustrate that the subjects in the treatment group representing the full FII model did not become more patient, but did exhibit significantly lower estimations of present-bias over time as compared to the other treatment and control groups. The rest of this paper is organized in the following manner. Section 2 reviews the relevant literature on time preferences, economic development, and goal setting. Section 3 examines the

sample and methodology. Section 4 discusses the models, hypotheses, and data analysis for the two research questions respectively. And finally, the results, policy implications, and conclusions will be presented in Section 5.

## 2. Literature Review

This section reviews the literature to see what evidence exists to indicate whether or not a program like FII could impact participants' time preferences. It examines specifically measurements of present bias and discount rates. While the majority of academics agree that time preferences are important factors in decision-making and economic development, there is some contention in the field as to the nature of that relationship. To fully explore all of the components and previous findings associated with this research, the literature review has been divided into four broad topics. First, the theoretical background on time preferences is reviewed. Next, the literature on present bias and discount rates and their respective associations with economic outcomes will be discussed, in that order. And finally, the literature review concludes by remarking on the findings regarding the relationship specifically between the various components of the FII model – goals, groups, and incentives – and time preferences.

### *2.1 Theoretical Modeling of Time Preferences*

Since the seminal works of Irving Fisher (1930) and Paul Samuelson (1937), economists have given a lot of explanatory power to time preferences as drivers for individuals decision-making. Their initial theoretical work involving time preferences came about within the context of utility maximization across time periods. It was noted by Samuelson that consumption in a future time period is not as valuable as consumption in the current time period (1937). In his models of constant discounted utility, Samuelson accounts for these differences in preferences across time by incorporating an exponential discounting function that discounts the value of consumption in future periods by a constant parameter, the discount rate. This work led to what is seen as the traditional form of discounting, the exponential discounting model (Hausman, 1979). One of the assumptions of this model is that the marginal rate of substitution between two periods only depends on their distance apart in time. In other words, the exponential discounting model assumes that discount rates are dynamically consistent, where the valuation falls by a constant factor each day regardless of how far into the future one looks (Hausman, 1979). This implies that the only difference across individuals is

equal to the differences in actual borrowing or lending rates and also that the discount rates for the same people across time remain constant (Fisher, 1930).

Unfortunately, the majority of the empirical findings suggest that the assumptions about time preferences within the exponential discounting model do not hold up in real life (Luhmann, 2013; Rohde, 2010;). Herrnstein was one of the first to suggest that time preferences could vary over time, stating that the subjective value of consumption in the future is likely inversely related to the length of the delay (Chung & Herrnstein, 1967). Richard Thaler (1981) was one of the first to present experimental evidence to the contrary of the exponential discounting model. In his experiment, subjects were asked to write down the amount that would make him or her indifferent to receiving a hypothetical lottery prize now or at a specified time in the future. The delay times ranged from three months to ten years. Thaler's results suggest that discount rates are not constant over time, and that they are negatively correlated with the length of the delay (1981). The works of Herrnstein and Thaler, along with others, inspired an alternative type of discounting, the hyperbolic discount model. With hyperbolic discounting, consumption over future time periods is discounted by a hyperbolic discount function. Mathematically, this allows for results similar to Thaler's where the valuation falls quickly for a short delay period and more slowly for long delay periods, i.e. the discount rate is higher for a shorter delay period than for a longer delay period.

### *2.2 Present Bias Literature*

In his recent research comparing hyperbolic and exponential discounting models, Christian Luhmann states that the majority of studies that have looked for evidence of hyperbolic discount functions have at least found the existence present bias (2013). In other words, according to Luhmann, most empirical studies have found that preferences do shift in the direction expected under hyperbolic discounting, regardless of whether or not the absolute values of the discount rates properly fit the exact function (Luhmann 2013). This is an important point for this research. While the research questions listed in the introduction of this paper are not specifically interested in identifying the exact shape of the subjects' discount function, the assumptions about the shape of the function come into play when assessing present bias. Thus, it is useful to examine the empirical comparisons of the models because discussing the fit of the models demonstrates what others have found in the way of discount rates as a function of delay time, which gives some indication of the existence of present bias in

general. In other words, exponential discounting models do not allow for present bias, whereas hyperbolic discounting models do. This is because individuals with a hyperbolic discount function are more patient in the near future and grow more patient as the delayed rewards get further and further away, which is essentially the definition of present bias (Luhmann, 2013).

Since Herrnstein and Thaler's works, many economists have done research comparing the exponential discounting model to hyperbolic discounting model, and the results are somewhat mixed, although they do tend to favor the hyperbolic discounting model or one of it's adaptations. The model comparison is often done by using structural estimation techniques and comparing which model best fits the data. Exponential discounting is most commonly used theoretical modeling, which makes sense because a similar equation is used by banks to calculate compound interest. Glenn Harrison and his colleagues confirm its topicality when they show no evidence of discount rates changing over time when conducting a time preference experiment on Danes, although several scholars – the authors included – have noted that Danes might not be a very representative subject pool (Harrison et al., 2002; Harrison et al, 2004). Additionally Anderson, et al. (2004) find evidence from survey and experimental data collected in Vietnam that the discount rates vary over variables other than time, such as age and gender. These studies imply that no present bias existed among their subjects.

Many economists have found evidence that the hyperbolic discounting model better fits their empirical data. Tanaka, Camerer, and Nguyen (2010) find support for the hyperbolic discounting model when using survey and experimental data in Vietnam. Bauyer and Chytilova (2010) find similar support in their experimental data from Uganda. Burks and his colleagues (2011) compare four different models of time preferences and find that the quasi-hyperbolic model outperforms the rest, due to the extensive present-bias found in the data. Additionally Luhmann finds that when allowing for various front-end delays in his experiment with American college students his data is most consistent with the hyperbolic discounting model, although it is not a great fit. Due to this he concludes that individuals' preferences do exhibit present-bias, but not as much as indicated by hyperbolic discounting models, which is a common finding among the experimental research (2013). The hyperbolic shape of all of the data collected in the aforementioned experiments allows for the assumption that present bias existed among their subjects at the time of the experiments.

As previously mentioned, this paper's goal is not to extract which discount function best describes the subjects in the FII experiment, but rather to assess to what extent present bias

exists within the subjects and how that changes over time. The following studies focus on the existence of present bias itself rather than the shape of the discount function, much like this study does. It is useful to examine present bias, because it is associated with undesirable behaviors, such as procrastination, lack of savings, and a higher probability of quitting their job (Burks et al., 2011). People with present bias tend to be impatient today and delay undesirable tasks to the future, where they imagine themselves to be much more patient (Rohde, 2010). However, when the future becomes today, the cycle starts all over. For example, Michal Bauer and his colleagues perform a similar study to the FII experiment, except it was conducted in rural India. They use the binary choice method to elicit both the subjects' discount rates and measures of present bias (Bauer et al 2012). They consider a subject to be present biased if their indifference point in the future choice is at least two choices later than the indifference point in the contemporary choice. They find that people with present bias tend to borrow more to make up for low levels of savings, even after controlling for measures of patience. When regressing present bias on other observables factors, they find no observable or behavioral explanation for the existence of present bias in their subjects (Bauer et al., 2012). Tanaka et al. (2010) structurally estimate a present bias parameter based on a 75 binary choice protocol in rural Vietnam and also do not find any of their observables offer any explanatory power. However, Burks et al. (2011) do find that cognitive ability is correlated with lower present bias, although this is merely an association. It is important to keep in mind, that while these correlations are important and informative, they are only correlations. For example, Bauer and his colleagues did not utilize any econometric technique in order to claim a true causal effect in their interpretation, and simply discuss the results as "associations" (2012). Overall, there is evidence that present bias is an indicator of certain behaviors, but there seems to be a gap in literature in terms of causal determinants of present bias or the changes therein.

### *2.3 Discount Rates Literature*

In addition to establishing the shape of individuals' discount functions, researching the relationship between time preferences and behavioral outcomes is an important aspect of behavioral and development economics. Although an extensive amount of literature has been written about time discounting, much of it has been based on laboratory experiments done in developed countries; namely the work of Glenn Harrison in Denmark and Uwe Sunde in Germany have been significant contributions (Bauer et al, 2012). However, there are also

several studies that have conducted field experiments outside of the lab in developing countries in order to study subjects' behavioral choices. These are more in line with the FII experiment in Medellin. The results of some of these experiments will be discussed below. As development economists, these results are important because they have the potential to provide not only descriptive power in terms of why certain people are poor and others are rich, but also can implicate specific policy options as preferable over others.

Through the use of survey and experimental data collection, there has been a wide variety of research conducted that aims to assess the role of discount rates in individuals' decision-making. However, this evidence is mixed. There is a lack of consensus in terms magnitudes (and sometimes the signs) of the correlations between the characteristics of people and their discount rates. The word 'correlation' is used here because much of the research conducted regarding time preferences cannot claim causality. In other words, a measure of time discounting is included in the econometric model as either a dependent or independent variable, but no econometric or experimental technique has been utilized to distinguish between a causal effect and a correlation that could exist for any number of reasons. In the case of time preferences endogeneity, two-way-causality and omitted variable bias, are of particular concern (Bauer & Chytilova, 2010).

Measures of discount rates have been associated with a variety of covariates in econometric models. One of the most common indicators that is said to be associated with discount rates is income (or wealth). Tanaka et al. (2010) find negative correlations between discount rates and income in Vietnam. In other words, the higher one's income, the lower the discount rate (or the higher their level of patience). Interestingly, Anderson et al. (2004) find no correlation between income and discount rates, while Kirby et al. finds a negative correlation with income but no correlation with wealth accumulation in Bolivia (2002). In their experiment in India, Bauer et al also do not find any correlation between income and discount rates (2012). However, in Uganda Bauer and Chytilova find a more broad result (as they were not able to directly measure income) that individuals who face less income pressures have lower discount rates (2010). Overall, the relationship between income and discount rates appears to be mixed.

Other descriptive characteristics typically correlated with discount rates are age, gender, and level of education. In terms of age, Kirby et al. (2002) and find a positive correlation with discount rates in Bolivia, as do Bauer and Chytilova (2010) in Uganda. In other words, both studies find that people discount faster as they become older. This relationship is

consistent with the lifetime income hypothesis, where people are assumed to dynamically optimize consumption partially based on their life expectancy (Bauer et al, 2010). However, Anderson et al. (2004) find a negative correlation with subjects from Vietnam. In terms of gender, Rubalcava et al. find that Mexican women are more patient than their male counterparts (2009). Castillo et al. find a similar result with their experimental data on elementary school-aged children in the United States (2011). This same result is found in the aforementioned studies conducted by Kirby et al (2002) and Bauer and Chytilova (2012) in Bolivia and India respectively. However, Anderson et al. (2004) and Bauer et al (2010) find no significant difference in discount rates between men and women. The results for education levels are also somewhat contentious. Harrison et al. (2002) finds a positive correlation between discount rates and education levels among the Danes. Similarly Burks et al. find that levels of education are positively correlated with discount rates. However, Kirby et al. (2002) finds the opposite in Bolivia. Based on these studies, even the relationship between discount rates and the most common control variables appears to be quite ambiguous.

One likely contributing factor to the lack of consensus regarding discount rates and their relationships to the various aforementioned observables is the issue of causality. Perhaps all of the mixed results are a symptom of the fact that economists are still striving to be able to econometrically determine the direction of causality between economic outcomes and discount rates (Tanaka, et al. 2010). One can easily see how a specific discount rate could determine a specific economic outcome, like income or level of savings. However, it could be that a specific economic situation, like having a low income, determines one's discount rate. Both scenarios, or a dynamic combination of the two, seem plausible.

Becker and Mulligan's paper "The Endogenous Determination of Time Preference" is most notable for being the first to model how a discount rate is formed, and will be heavily relied on to inform the analysis of this research (1997). Their model allows for varying discount rates both within and among individuals across time and across different decisions. They also suggest that one's discount rate can permanently change if he or she partakes in any number activities that they argue will ultimately adjust how the individual perceives himself and his or her future (Becker & Mulligan, 1997). These activities can include setting goals, education, and religious practices. This means that the discount rate is not considered to be exogenous, predetermined by biology or other factors, but that it can be actively adjusted if an individual wishes to do so. They argue that this can be happen when an individual increases the amount of

time and money spent on imagining oneself in the future. These imagining and investment processes are considered to increase the perceived likelihood of future pleasures, and therefore their value increases as well. This analysis can apply to the FII model, in that setting goals and working toward their completion could certainly expand one's imagination of future possibilities.

The notion of intentionally investing in patience to attempt to change one's discount rate is a relatively new research topic within the field, partially because isolating a causal effect for time preferences can be quite difficult econometrically. However, examining how one could potentially become more patient – like the FII experiment in Medellin – has many development implications, as previously discussed. Bauer and Chytilova utilize the analysis from Becker and Mulligan's endogenous time model and state that education can be classified as an investment in patience (2010). While education and time preferences theoretically suffer from a myriad of endogeneity issues, Bauer and Chytilova are able to examine the causal relationship between education and patience due to the use of an instrumental variable technique. Their result is consistent with Becker and Mulligan's endogenous time preference model, and robust to various instruments and specifications. They find that more education caused individuals' discount rates to fall, implying more patience, as the endogenous time preference model would suggest (Bauer & Chytilova, 2010). The FII research could produce similar results, as aiming to achieve goals, seems like a similar investment in patience.

Truly observing this causal relationship is rare in the literature. Bauer and Cytilova state in 2010 that they are not aware of any other study that can fully depart from the observed correlation between discount rates and covariates. However, two other studies will be discussed here because they at least are able to pin down the direction of causality. They do this are able to do this because they evaluate discount rates first, and then measure a subsequent outcome and compare those. So, both studies can say with confidence that committing a certain action in the future could not affect the discount rates in the past. The first is Burks et al (2011). They garner various measures of time preferences and compare those numbers with the attendance of a job training program. They use a probit estimation with robust non-clustered standard errors to estimate that a one standard deviation increase in the discount rate (subjects become more impatient) engenders a lower probability of quitting the difficult job training (Burk et al, 2011). Furthermore Castillo et al (2011) use the same technique of exploiting the dynamics to at least pin down the direction of causality. They take measures of discount rates with children and

correlate them with disciplinary referrals the following year. The dependent variable is number of disciplinary referrals received, and they find that an increase in impatience is associated with an increase in the number of referrals (Castillo et al 2011). The authors choose an OLS estimation, clustering standard errors at the school and classroom level. While both of these studies are able to pin down the direction of causality simply due to the dynamic nature of their data, they are not able to econometrically resolve the possibility of an additional omitted variable that is affecting both their impact variables and the outcomes. The FII experiment stuffers less from this problem because of the randomization involved, and this is where the FII experiment adds to the literature.

*2.4 Time Preferences and the FII Model*

As noted by the literature above, there is some evidence that setting goals, receiving achievement-based financial incentives, and being in a group could affect subjects' time preferences. However, each component could affect time preferences differently so it is useful to examine each one individually. When looking to the incentive component, the most comparable program being implemented in the developing world today is that of the conditional cash transfer. In 2009, Rubalcava et al. find evidence that the conditional cash transfer program, PROGRESSA in rural Mexico, is a contributing factor to their observations that women were more patient than men. This points to the fact that incentives and other forms of empowerment (also found in FII) could lead to more patience (Rubalcava et al., 2009).

When looking to the goal component, a particularly useful study is that by Ida et al (2011). Theirs is one of the few studies to take measurements of discount rates pre and post intervention like the FII research, rather than *ex post* or one-time measurements like the vast majority of empirical studies (2011). The authors study the effect of discount rates on the probability that one will succeed at quitting smoking. They find that discount rate is actually a good predictor of success in smoking cessation. More pertinent to this research, they also find the reverse effect, where successfully quitting smoking further differentiates the discount rates (Ida et al, 2011). So people who succeeded became even more patient and those who failed became even more impatient after their respective successes or failures. This is a great indicator that goal-achievement programs can indeed affect participants' time preferences.

The literature on the relationship between groups and time preferences is somewhat lacking. However, Bauer et al. conduct research among micro finance borrowers that are

members of self-help groups in India (2012). They find evidence that the women who borrow are more present-biased than those who do not, and that the self-help micro finance groups actually provide a commitment device (Bauer, et al. 2012). In other words, they find that the women who are more present-biased tend to join the self-help group due to it's required weekly payment structures, and that this helps them mitigate the consequences of their present bias. This is consistent with a finding in Kenya that suggests that present-biased individuals use the social pressure of ROSCAs as a commitment device to save more than they otherwise would (Gugerty, 2007). This implies that being part of a group that holds its members accountable, as found in FII, can act as a commitment device for people with existing present bias, potentially decreasing present bias over time.

As evidenced by all of the above literature, this research is particularly topical, as there exists surprisingly little research that estimates a causal effect of how time preferences are formed, and this is especially true in developing countries (Bauer and Chyitlova 2010). The FII project is also novel because it is a wholly experimental intervention, where we can control for some of the many biases and endogeneity issues found in previous empirical works. Additionally, the dynamic evolution of discount rates with respect to economic outcomes, goal-setting, achievement-based incentives, and group participation has not been studied before in this fashion to the researcher's knowledge. Thus, the results could prove to be a valuable addition to this literature, as well as have poignant and useful policy implications for economic development.

# 3. Methodology and Sample Description

### *3.1 Context – Medellin, Colombia and Banco de las Oportunidades*

Colombia is located in the Northwestern region of South America, and is considered by the World Bank to be an upper-middle income country. However, poverty is a large concern in rural areas and among internally displaced populations. The population of the country is just under 50 million people, with 45.5 percent of the population below the country's poverty line and 18 percent are living on less than $1.25 per day (UNFPA, 2011). Despite its "upper-middle income" classification, the dispersion of income is rather unequal, as the share of income for poorest quintile is less than three percent (UNFPA, 2011). The FII experiment was conducted in Medellin, the second largest city in Colombia. It is located in the state of Antioquia, which is in the northwestern part of the country. It has a population of roughly 2.5 million people, with

38 percent of the population living under the poverty line, and ten percent in living extreme poverty (Municipality of Medellin, 2010). The city has recently been recognized for it's innovative development programs and acknowledged as a global city on-the-rise (Wall Street Journal, 2013; The Guardian, 2012). Thus, Medellin proved to be an ideal place to implement the FII model due to its relatively strong institutions and a culture of entrepreneurship.

The FII experiment was conducted in conjunction with Banco de las Oportunidades, a public micro finance institution (MFI) in Medellin. Banco de las Oportunidades is operated by the mayor's office of Medellin, and offers low-income residents of Medellin access to a variety of social programs within which to participate. All members of the MFI must live in and operate a business in Medellin or it's various suburbs. The members must be within the bottom three (of six) federally designated income brackets, also referred to as strata. Additionally, the members must be between the ages of 18 and 64 years of age, and can be either male or female. All must have what the MFI considers to be an acceptable credit score, and must not have an outstanding loan with any other financial institution or NGO. The majority of the MFI's members participate in at least one of various programs. These programs include solidarity groups, microfinance loans, community development centers, a program devoted to local artisans, and a program devoted to innovative entrepreneurs.

### *3.2 Experimental Design*

One hundred fifty-nine subjects were recruited to participate in the FII experiment, and were randomly selected from the database of Banco de las Oportunidades. After consenting to participate, the subjects were randomly assigned into five different treatment groups. The experiment was designed in such a way that the effect of each component of the FII model – groups, goals, and incentives – could be separately observed. Figure 1 is a matrix illustrating structure of the experimental design. Every group within the matrix declares a goal and has varying group and incentive components. The subjects in Treatment Group II declare goals, but do not receive achievement-based incentives, nor are they part of a group. Rather, they received a payment each meeting that was equivalent to what we believed would be the average payout of those subjects in the achievement-based incentives group (30,000 COP, or roughly 17 USD). The subjects in Treatment Group III declared goals, and were part of a group. These subjects took part in group meetings, discussed their goals, and filled out a survey each meeting. They had the same incentive scheme as Group II, as they were both in the "no prize"

treatment group, which means they had a non-conditional payment structure. The subjects in Treatment Group IV declared goals and were paid based on their achievement of those goals. These subjects declared one goal per month, and were paid under the achievement-based conditional payment structure. If the subject achieved their declared goal, they were paid what amounted to be approximately one day's wage in Medellin (35,000 COP, or roughly 20 USD). If they did not achieve their goal, the subjects were paid enough money to cover their transportation costs (5,000 COP, or roughly 3 USD). They were paid based on verifiable records of achievement, which were examined at every meeting when the subjects completed a survey. The subjects in this treatment group did not attend group meetings, as they were in the "no group" treatment. Subjects in Treatment Group V declared goals, were paid by the achievement-based conditional payment structure, and participated in group meetings. Treatment Group V represents the full FII model, as it contains all three components.

To hold true to the FII model, all of the subjects in each of the four treatment groups (excluding the control groups) met every four weeks. During these monthly meetings, each subject was asked to choose a goal to work towards achieving from a predetermined list of 14 goals provided by the enumerators. The list of goals is shown in Figure 2. In addition to choosing a goal, the subjects in each treatment group were asked to report on his or her goal achievement from the previous four weeks by filling out a survey of about 20 questions inquiring about each of the possible goals. The Goal Survey is provided in Appendix A. At the end of each meeting, each subject provided proof of their goal achievement (if applicable), were paid according to their level achievement and/or payment structure, and selected a goal to work towards for the next four weeks. Depending on treatment group, subjects discussed their progress with their group in the monthly meetings as well. There were a total of seven meetings in the time period of June through December 2012. Each subject in the four treatment groups completed an additional survey at baseline, the mid-point, and at the end of the FII experiment. The Baseline, Mid-Point, Endline Survey is provided in Appendix A. This survey contains questions regarding the subjects' self-esteem, risk aversion, reference points, economic indicators, social capital, and discount rates.

Aside from the groups within the matrix, two external control groups, Control Group A and Control Group B, were included. The control groups A and B did not declare goals, did not receive achievement-based incentives, or attend group meetings. The subjects in each control group received a show up fee (25,000 COP, or roughly 14 USD) each time they filled out a

survey. The two control groups did not meet monthly, and thus had a different survey schedule than the four treatment groups. Control Group A filled out the Goal Survey and the Baseline, Mid-point, Endline Survey once in June for the baseline, once at the midpoint, and again in December for the endline measurements. The subjects were asked to recall the monthly Goal Survey data for each month up until their last meeting, so a balanced panel could be formed. Control Group B was surveyed only one time at the endline. These subjects were asked to recall the previous six months to answer goal-related questions about their behavior during the same timeframe of the FII experiment. The subjects in Control Group B were made aware of the dates of various holidays and other notable dates as a tool to assist in accurate responses. Again, having six months worth of data on past behavior allows for a balanced panel dataset to be formed. This dual control group design was used in an effort to minimize the effect of any additional goal achievement of the subjects in Control Group A due to a potential framing effect of the survey questions asking about goal achievement outcomes.

The analysis provided later in this paper relies heavily on the fact that the subjects were asked to set goals. Therefore, a more in-depth discussion of this process is warranted. Each subject within the four treatment groups was asked to pick a goal from a preset list of 14 goals (Figure 2), which was unchanged throughout the experiment. The goals on this list were chosen by the researchers for a few important reasons. First, prior to the experiment's inception, focus groups were held during which a survey was administered. The survey asked questions such as, "If you could change one thing about your business, what would it be?" The topics ranged from business, to home and family life, to the individuals themselves. This survey provided a framework around which to base the goals. The second reason these particular goals were chosen is that all of them are verifiable. In other words, the researchers were able to think of a relatively easy and inexpensive way that the subjects could provide proof that his or her goal was achieved. This proof was required in order for the goal to be recorded as achieved. Figure 2 illustrates the required verification method for each goal, as well as the relative frequencies each goal was chosen. The most frequently chosen goals were to save a certain amount per month, to keep accounting of the family business, to attend one of the various 40-hour courses given by the Banco de las Oportunidades, and to make a payment on an outstanding debt. These, as well as most of the other goals, require planning ahead, a contemporaneous sacrifice in order to see some future benefit, and imagining one's life in the

future which is in line with what Becker and Mulligan would consider to be an investment in patience (1997).

As previously mentioned, the subjects' discount rates were elicited on three separate occasions throughout the experiment. This was done via survey using a combination of Mazur's (1987) binary choice protocol and a fill-in-the-blank protocol. On each occasion during which discount rates were measured, the subjects were asked to choose between a receiving a hypothetical amount of Colombian pesos now, or a larger amount at a time in the future. If a subject chose the "now" option, the survey instructs him or her to proceed to the following question. The second question has the same initial monetary value, but asks the subject to choose between that and an even larger amount of money in the same future period. If still the subject chose the "now" option, the survey asks him or her to write down how much they would be willing to accept in order for them to wait the designated time period to receive payment. This was done for future delays of one, six, and twelve months. There was intentionally no front-end delay employed so that the degree of present bias can be evaluated.

The discount factor for each subject is calculated by subtracting the original amount (200,000 COP) from the amount the subject stated he or she would be willing to accept, and then dividing by the original amount. This is done so that the discount rate times the amount the subject is willing to accept should be equal to the original amount. In other words, it is the point at which the subject is assumed to be indifferent between the two amounts, and thus the discount factor represents rate at which the subject truly discounts money, or the discount rate. For the purposes of this study, it is important to note that the main interests are the differences of the time preferences across time and across treatment groups within our sample, and not necessarily in the particular absolute values. All of the subjects faced the same protocol, and it is feasible to assume that any biases in terms of effort and understanding are not systematic across treatment groups, and are consistent within the same individual over the six month time period.

*3.3 Sample Description*

Table 1 is a table of summary statistics that indicates some notable characteristics of the sample, and shows that the subjects in the treatment and control groups were not significantly different from each other at the inception of this study. The table shows that the control group started out on average more patient, with less income, more educated, slightly more women, and older in age. None of these differences are statistically significant, which shows that the

randomization was successful. Thus, any divergence in these variables can arguably be attributed to the experimental intervention. However, compared to those in the control, the subjects in the treatment groups are significantly (p=0.02) more present-biased. This is not ideal but it does mean that if there is a statistically significant decrease in present bias over time in the treatment groups, this effect will actually be underestimated. However, it could also mean that any small significant effect might not be able to be observed with this data. Some additional characteristics of our sample are that 21 percent of the subjects have only an elementary school education, 66 percent of the subjects have attended at least high school and/or taken courses from a technical or trade school. Only five percent of the subjects are illiterate. The average age of participants is 40.4 years. While all of our subjects have their own businesses, the most common business types are in the realm of food and beverages (33 percent), artisan and craft activities (18 percent), and textiles and/or manufacturing (14 percent). The remaining 35 percent of the subjects' businesses are split into categories including services, technology, trade and commerce, and agriculture.

It is useful to further examine the baseline levels of discount rates by treatment group, income level, education, and gender to inform the interpretations later on in the analysis. Present Bias is a function of these discount rates, so it further informs that analysis as well. Table 2 illustrates that baseline discount rates by treatment group are not statistically different from each other, regardless of how the data is cut. However it should be noted that both the FII treatment group variable and the general group treatment variable contain subjects that started off more impatient than the rest, significant at the 15 percent level. This will be important later on in the analysis section of this model. Additionally, in Table 3 illustrates that the males in the sample had higher discount rates at baseline, and that people with an income strata of 3 or above also had higher discount rates. The gender difference is consistent with the literature, but the lower income brackets having more patience is inconsistent with most findings, although neither of these differences are statistically significant. And finally, those that have a high school education or less are also more impatient than those who have higher than a high school education, which is also significant with the literature, though not statistically significant. Again, it can be assumed based on this information that any systematic change in the subject's rates by treatment group can be attributed to the FII experiment.

Another characteristic of the data is that it can take a panel form. One hundred fifty nine subjects total subjects were initially included in the FII experiment, and were asked about their

time preferences during three different time periods. This allows for the formation of a long panel dataset, which can be used examine each subject *i* across time *t*. However, if a subject missed either the midpoint or endline meetings, they have a missing value for their discount rate for that meeting. A total of 31 subjects missed either the midline or the endline meeting, which is nearly one fourth of the total sample. Notably, it is very possible that attrition in the FII experiment is correlated with time preferences, which could bias any econometric estimates provided by this study. Thus, Table 3 is provided to demonstrate that the baseline time preferences of those people who missed a follow up meeting in the FII experiment do not significantly differ from those who did not miss any meetings. The t-test comparing the discount rate between those subjects that missed one or more of the follow up meetings shows that while the people who missed a meeting were on average more impatient at baseline, it is not statistically significant. When looking to present-bias, it turns out that those who missed a meeting were less present biased than those who did not, though it is also not statistically significant. Furthermore, when looking to the lower portion of Table 3, it is evident that the number of people who missed at least one of the follow up meetings is fairly consistent across group. Based on the results in the table, the attrition rate does not appear to be correlated with the dependent variables or the independent variables of interest. Thus, the analysis can proceed with the assumption that all missing values are missing as if random.

# 4. Models, Hypotheses, and Analysis

Based on the analysis provided in studies performed in conjunction with this one, it has been established that the subjects in the FII treatment group experienced statistically more behavioral and economic changes than those in the other treatment and control groups. Now, the next step is to attempt to identify a mechanism through which this is occurring. This section will explore several models as ways to explore a change in time preferences as a possible mechanism.

## *4.1 Model 1 – The FII Model and Discount Rates*

Model (1) is meant to answer the first research question: To what extent does participating in the FII experiment affect measures of the subjects' discount rates? As mentioned, the dataset is in panel form. However, the data does not meet the assumptions

appropriate to run a random effects panel regression, and all of the variables of interest are fixed over time, meaning that a fixed effects panel regression would yield zero coefficient estimates. Thus, this model is run in Stata as a pooled OLS estimation, with time dummy variables and clustered standard errors at the individual level to account for the fact that each subject's error term in one period is likely to be corrated with his or her error terms in the other time periods. This is a violation of the OLS assuptions and would lead to biased estimates. Using the time dummy variables and clustering the standard errors in this way, the model acts as a fixed effects model and, as such, is able to generate a within estimator. Thus, the formal model is presented below in reduced form.

$$DiscountRate_{it} = \beta_1 Goal_{it} + \beta_2 Group_{it} + \beta_3 Incentive_{it} + \beta_4 FII_{it} + \beta_5 X_{it} + e_{it}$$

In Model (1), the dependent variable is individual *i's* discount rate in time *t*. This is a continuous variable and is calculated by survey question with hypothetical payoffs, where a higher discount rate represents a lower level of patience. Recall that each subject *i* has three different measures of their discount rate per time *t*, differing in the length of delay the subject has to hypothetically wait to receive their money. To reiterate again, the subjects were asked if they would prefer money in the current time period or an increased amount in one, six, or twelve months. The rates have all been annualized and averaged so that each subject has one discount rate per time *t* represented in this model, which accounts for potential dynamic inconsistency. Furthermore, after examining the distribution of the values of the subjects' discount rates, the residuals, and squared residuals, it has been determined that the errors are heteroskedastic and logging the discount rate variable is warranted. This has been done in all regressions for Model (1).

The left-hand side variables of interest are *Goal*, *Group*, *Incentive* and *FII*. They are all binomial dummy variables that take a value of one if the subject is in the treatment group corresponding with its name. The *FII* variable is the interaction of all three. These treatment status variables remain constant through the entirety of the experiment. As evidenced by the Experimental Design matrix, unless the subject is in Group II, or the Control, he or she will have a value of one for at least two of these variables. To avoid multicolinearity and biased estimates, the *Control Group* dummy variable has been left out of the estimation. The *X* represents a vector of individual-specific covariates. Contained in this vector are the variables *Education*, *IncomeStrata*, *Gender* and *Age*. *Education* is an ordinal variable that can take values from zero to six. Zero represents no education and six represents a graduate degree or higher.

The variable *IncomeStrata* represents the number assigned to each individual by the Colombian federal government that takes a value between one and six. The government uses these numbers to determine how much federal assistance each household receives; one represents the lowest level income. *Gender* is a binomial dummy variable where one is equal to female. *Age* is listed in years.

*4.2 Hypothesis 1 – Achievement and Discount Rates*

Based on the theoretical findings of Becker and Mulligan (1997) and the recent empirical findings of Ida et al (2011), Rubalcava (2009), and Bauer and Chytilova (2010), there is evidence that the subjects' discount rates could be affected by participating in the FII experiment. Thus the following hypotheses are presented:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0 \qquad H_A: \beta_1 + \beta_2 + \beta_3 + \beta_4 \neq 0$$

*4.3 Analysis 1 – The FII Model and Discount Rates*

Due to the randimization component of the FII experiment, econometric identification is fairly straight-forward. In fact, according to Harrison and List (2004), in a controlled experiment like the FII experiment, a simple t-test is all that is technically needed in the way of identifying a treatment effect. Table 4 shows various t-tests, comparing the average of the discount rate meaure by treatment group and the other controls. When looking at Table 4, there are only two statistically significant differences in the means. The first is that of the goal treatment, where the people in the goal treatment are statistically more patient than those that are not (P=0.04). The second is that those in the FII treatment group (Group V) are on average statistically more impatient than those that are not (P=0.005). From the t-tests alone, it appears as though the largest effect of the FII experiment on discount rates is actually making the subjects more impatient, although it is important to keep in mind that the FII treatment group started off more impatient at baseline.

The regression output can show if the relationship observed by the t-tests holds even when including control variables and clustered standard errors. Table 5 shows the results of the pooled OLS estimation. It appears the results from the t-tests are robust to control variables and the clustering of standard errors. The *Goal* variable remains negative and statistically significant at the ten percent level for all of the estimations except for the final where age is included. This supports the result from the t-test that suggest that setting a goal

made the subjects more patient. There is no statistically significant impact of *Group* or *Incentive* on the subjects' discount rates. However, an interesting result is that the *FII* variable remains positive and statistically significant at least at the ten percent level throughout all estimations. This result implies that the subjects in the FII treatment group became more impatient over time. Notably, the *Age* variable is also positive and significant, indicating that the older a subject is, the less likely they were to become more patient over time.

The coefficients in a regression with a logged dependent variable can be somewhat tricky to interpret. The coefficient in the final estimation with all controls is 0.75. Because the dependent variable in the regression is in log form, the coeffients are interpreted as a proportional change in the discount rate, given a one unit increase in the independent variable. In the case of the *FII* coefficient, the interpretation is that being in the FII treatment group caused the subjects on average to experience approxamately a 75 percent increase in their discount rate. Thus, if the original discount rate of a subject was 100 percent, his or her discount rate increased to 175 percent. Similarly if the original discount rate is 50 percent, the coefficient is interpreted as a 75 percent increase in his or her discount rate, thus it increases to 87.5 percent. This of course is an average for those subjects in the FII treatment group only.

The results so far indicate that setting a goal has a non-significant negative effect on discount rates, and that being in the FII treatment group has a significantly positive effect on the subjects' discount rates. This result is unexpected and seems counter-intuitive, and thus merits further investigation. Table 6 shows the results from the OLS regressions estimating the effect of the treatment groups and control variables on discount rates per time period. Ideally this will provide more insight into the evolution of the discount rates over time. The final column of Table 6 shows that the *FII* coefficient only becomes significant in the last period. Figure 3 shows the histogram of the discount rates for the subjects in the FII treatment group at the endline. It appears that there are some relatively extreme outliers in the right-side tail of the distribution, which could be upwardly biasing the linear relationship between the FII treatment group and the discount rates. Therefore the results of a new specification will be explored.

Some experimental economists have called into question the comparability of discount rates, as people's perceptions of time differ amongst each other (Thaler, 1981; Luhmann, 2013). Furthermore, it is not necessarily the rate itself that is the interest of this research, but rather the relative change in patience from the beginning to the end within each subject. Therefore,

Table 7 presents an alternative estimation to answer the first research question. Rather than the dependent variable being discount rates themselves, the dependent variable is now a dummy variable called *Patience*, taking the value of a one if the subject became more patient between the baseline and the endline measurements of the discount rates. In other words, if the average discount rate decreased from the baseline to endline measurements, the subjects' value of the *Patience* variable is one. This estimation is also useful because the interpretation of the coefficients is more straightforward. It is important to note that most of the coefficients except for that of the *FII* variable have a consistent sign with the estimation in Table 5 (remember that a negative discount rate in Table 5 is consistent with becoming more patient in Table 7, a positive probability). This indicates that the two estimations are getting at relatively the same thing. Table 7 indicates that setting a goal alone makes the subjects more likely to become more patient. In the final estimation with all controls, the coefficient of the *Goal* variable is 0.141, which indicates that setting a goal made the subjects 14.1 percentage points more likely to become more patient over the course of the FII experiment. Until the last estimation, *Education* is positive and significant, which is consistent with the literature.

### *4.4 Model 2 – The FII Model and Present Bias*

Model (2) is meant to answer the second research question: To what extent does participating in the FII experiment affect measures of the subjects' present bias? As in Model (1), the dataset is in panel form, and thus the preferred estimation technique is a pooled OLS including dummy variables for time and clustered standard errors at the individual level. The formal model is provided below in reduced form:

$$PresentBias_{it} = \beta_1 Goal_{it} + \beta_2 Group_{it} + \beta_3 Incentive_{it} + \beta_4 FII_{it} + \beta_5 X_{it} + e_{it}$$

In Model (2), the dependent variable is the measure of subject *i*'s present bias in time *t*. In this study, present bias is measured by subtracting subject *i*'s logged discount rate with a twelve-month delay from his or her annualized and logged discount rate with a one-month delay. If the subject has perfectly consistent time prefernces, the annualized discount rate measurement should be the same in both periods, meaning the *PresentBias* variable will have a value of zero. If the subject exhibits present bias, where one is more impatient when presented with a choice with a shorter delay and more patient with longer delays, the *PresentBias* variable will be positive and increasing as the difference gets larger. Similarly, if the subject is future biased, more patient with a shorter delay and impatient with longer delays, the *PresentBias*

variable will be negative, and increasingly so as the difference between the two measures gets larger. This is very similar and consistent with the measurement technique Bauer et al (2012) use in their study of present bias among microfinance borrowers in India. The variables of interest and the *X* vector of covariates are the same as described for Model (1).

*4.5 Hypothesis 2 – Achievement and Discount Rates*

As indicated in the literature review, there has yet to be any significant and/or consistent empirical finding regarding how present-bias is formed and how it changes over time. However, there is evidence that self-help groups are used as a comitment device to hold present-biased individuals to commitments that they might not otherwise keep. This indicates that perhaps participating in the FII model could affect present bias. With this in mind, the following two hypotheses are presented:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0 \qquad H_A: \beta_1 + \beta_2 + \beta_3 + \beta_4 \neq 0$$

*4.6 Analysis 2 – Achievement and Discount Rates*

To begin the analysis of present bias it's important to show it exists in the first place and that it changes over time. Figure 4 demonstrates that there is indeed present bias within the data, as it is apparent that the discount rates of the subjects becomes significantly lower as the delay gets larger than one month. Richard Thaler (1981) notes that the absolute values of the discount rates are not as important compared to the difference between each subject's discount rate for the different delay times. This section explores this relative difference and how it changes over time. The analysis will again begin by examining t-tests. These are meaningful to the identification strategy due to the randomization component of this study. Table 8 shows the various pooled t-tests of the *PresentBias* variable done by treatment group, which are the variables of interest. From this table it can be gathered that both the goal treatment and the FII treatment have an effect on the level of present bias. However, the *Goal* variable is associated with a higher level of present bias, and the *FII* variable is associated with a lower level of present bias. Again, we see that these two treatments have the opposite effect on time preferences, which is interesting and at least consistent with the discount rate findings.

Looking to the regression analysis, it is evident that the preliminary results from the t-tests hold to the addition of control variables, time dummy variables, as well as clustered standard errors at the individual level. Table 9 shows the output of the pooled OLS estimation

with all of the aforementioned specifications. Again, these results indicate that being in the goal treatment group makes one statistically more present-biased, whereas the FII treatment group subjects were found to be statistically less present-biased on average. The dependent variable in this regression is the difference of two logged discount rates, and thus the coefficients should be interpreted as proportional changes in this difference. Thus, the *Goal* coefficient can be interpreted as a 67.4 percent proportional increase in the measure of present-bias, i.e. the difference between the one-month and twelve-month delay measures of the discount rates overtime. And the *FII* coefficient can be interpreted as a 52 percent proportional decrease in the measure of present-bias. Table 9 also indicates that the level of income is highly correlated with relatively lower levels of present-bias.

## 5. Discussion, Limitations, and Conclusion

It appears that the effects of setting goals and participating in the full FII model have conflicting effects in the majority of the estimations specified in this paper. While at first this might seem counter intuitive, this does not necessarily have to be the case. When looking to the effect of setting a goal on time preferences, reexamining the Becker and Mulligan (1997) endogenous time preferences model is warranted. The authors discuss at length that setting a goal, and other forms of imagining one's future, can increase the perceived likelihood of a particular future, thus making the future more valuable. When looking at this in the context of the average discount rate, this hypothesis, as well as the empirical evidence found in Uganda by Bauer and Chyitlova (2010), is very much consistent with the results presented for Model 1. The effect of the goal-setting exercise alone decreased the subjects' discount rates over time. However, how can this be reconciled with the increase in present bias seen in Model 2?

Recall that the dependent variable for Model 1 is the average discount rate across the various delay periods for subject $i$ in time $t$, and that the relative difference between the one-month delay discount rate and the one-year delay discount rate is the outcome variable in Model 2. Keeping this in mind, perhaps what is actually occurring is that imagining oneself in the future (goal-setting) only makes one's future self more patient. In other words, perhaps the one-year delay discount rate is getting lower over time due to setting a goal, but the one month stays relatively the same. This would make the overall average lower, and yet the difference between the two larger over time. The exact same trend appears to be occurring in the case of

the FII treatment group, except in the opposite directions. This indicates that there is something about the interaction of setting goals, receiving conditional incentives, and participating in a group that decreases the levels of present-bias, but has no effect (or a negative effect) on the average level of patience. It appears that the interaction of all there is indeed a unique and special combination, yielding results unmatched by any other treatment or control group.

Although the results are interesting and consistent with each other, this study is not without it's limitations. The most glaring limitation is the validity of the measurements of the discount rates themselves. The protocol used in this study and slight variations thereof are quite common in the time preferences literature. In fact, many economists have done research on protocols alone, comparing their relative results. One notable characteristic of the protocol used in the FII experiment is that the payoffs are hypothetical. This could lead to misestimation of the discount rates if the subjects do not take the choice seriously. For example, in their study Cummings et al (1995) find that the hypothetical answers were statistically different from the real ones in a non-parametric chi-squared test. Additionally, when conducting a meta-analysis of over 29 studies, List and Gallet (2001) find that the preferences elicited by hypothetical questions are overstated by a factor of three times the real amount. Another unique aspect of this protocol is that it combines the binary choice method and the fill in the blank method. Weatherly et al (2011) conduct an experiment that compares the two methodologies with the same subjects and finds differences in the discount rates elicited by each method, and that the fill-in the blank method typically yields higher discount rates.

On the contrary, Locey et al (2011) find that hypothetical payoffs produce no different results than real payoffs in two different experiments eliciting different measures of discount rates. They argue that hypothetical rewards realistically apply to everyday life. Furthermore, the subjects were being paid for their general participation in the study, which perhaps compelled them to give more careful consideration to the questions than they otherwise would have. Also it is important to keep in mind that the absolute discount rates themselves are less important. In other words, the values themselves can be seen as arbitrary, as long as the relative changes in these values for each subject remain unbiased. As long as there is an assumption that each subject was consistent over the course of the study, and a decrease in the discount rate from one period to the next truly represents an increase in patience, then the

dummy variable estimation and present bias estimations should largely avoid this limitation because they highlight the movement within each subject as the outcome variables.

The success of the FII experiment merits further research. While the mechanism for its success does appear to be somewhat through the change in time preferences of the subjects, the discovery of further mechanisms remains an important task. If development economists could not only understand that FII works, but also exactly *how* and *why* it works, replication could have serious and positive consequences for the developing world. Given the findings of this study, as well as the other studies conducted in conjunction with the FII experiment, it has important policy implications in and of itself. It indicates that a model such as the FII model can be used as a relatively cheap tool to inspire the achievement of development-oriented goals, speaking to a new model of poverty alleviation. Additionally this study is unique because it is one of the few empirical studies that measures the same subjects' discount rates over time, and demonstrates how they can be changed. Thus, continuing to pursue development programs like the FII model that can change subjects' tendencies to be present-biased could have tangible and desirable economic outcomes for the world's poor.

Works Cited


Anderson, C. L., Dietz, M., Gordon, A., & Klawitter, M. (2004). Discount rates in Vietnam. *Economic Development and Cultural Change, 52*(4), 873-887. Retrieved from URL: http://www.jstor.org/stable/10.1086/381111

Bauer, M., & Chytilova, J. (2010). The impact of education on the subjective discount rate in Ugandan villages. *Economic Development and Cultural Change, 58*(4), 643-669.

Bauer, M., Chytilova, J., & Morduch, J. (2012). Behavioral foundations of microcredit: Experimental and survey evidence from rural India. *American Economic Review, 101*(2), 1118-39.

Becker, G., & Mulligan, C. (1997). The endogenous determination of time preference. *The Quarterly Journal of Economics, 112*(3), 729-758. Retrieved from http://www.jstor.org/stable/2951254

Beteman, Milford. 2012. "Medellín emerges as a Latin American trailblazer for local economic growth". *The Guardian.* Retrieved from http://www.guardian.co.uk/global-development/poverty-matters/2012/apr/03/medellin-trailblazer-local-economic-growth?intcmp=122

Burks, S. V., Carpenter, J., Gotte, L., & Rustichini, A. (2011) Which measures of time preference best predict outcomes? Evidence form a large-scale field experiment. *Institute for the Study of Labor Discussion Paper Series, 5808*, 1-23.

Camilo Cardenas, J., & Carpenter, J. (2008). Behavioural development economics: Lessons from field labs in the developing world. *Journal of Development Studies, 44*(3), 311-338. Retrieved from http://dx.doi.org/10.1080/00220380701848327

Castillo, M., Ferraro, P. J., Jordan , L. J., & Petrie, R. (2011). The today and tomorrow of kids: Time preferences and educational outcomes of children. *Journal of Public Economics, 95*, 1377-1385.

Castuera, M., Chao, M., Miller, M., & Sadowski, K. (2004). Pathways Out of Poverty, Early Lessons of the Family Independence Initiative The First Two Years of Operation 2001-2003. Retrieved January 4, 2012 from http://www.fiinet.org/reports/FII-Two-Year-Report-Pathways-out-of-Poverty.pdf

Fisher, I. (1930), The Theory of Interest, (New York: Macmillan).

Gugerty, M. K. (2007). You can't save alone: Commitment in rotating savings and credit associations in Kenya. *Economic Development and Cultural Change, 55*(2), 251-282.

Harrison, G. W., Cummings, R. G., Rustrom, E. E. (1995). Homegrown Values and Hypothetical Surveys: is the Dichotomous Choice Approach Incentive Compatible?" *American Economic Review*, 85, March, 260-266.

Harrison, G., Lau, M., & Williams, M. (2002). Estimating individual discount rates in Denmark: A field experiment. *The American Economic Review, 92*(5), 1606-1617.

Harrison, G. W., Lau, M. L., & Elisabet , E. R. (2010). Individual discount rates and smoking: Evidence from a field experiment in denmark. *Journal of Health Economics, 29*, 708-717.

Hausman, J. (1979). Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables. *Bell Journal of Economics, 10*(1), 33-54.

Herrnstein, R. J., & Chung, S. (n.d.). Choice and delay of reinforcement. (1967). *Journal of the Experimental Analysis of Behavior*, *1*(10), 67-74.

Ida, T., Goto, R., Takahashi, Y., & Nishimura, S. (2011). Can economic-psychological parameters predict successful smoking cessation? *The Journal of Socio-Economics*, *40*, 285-295. Retrieved from http://www.sciencedirect.com/science/article/pii/S1053535711000060

Kahneman, D., & Tversky, A., (1979). Prospect theory: An analysis of decision under risk. *Econometrica*,*47*(2), 263-292. Retrieved from http://3xfund.com.cn/images/article008.pdf

Kirby, K., Godoy, R., Reyes-Garcia, V., Byron, E., Apaza, L., Leonard, W., Perez, E., & Vadez, V. (2002). Correlates of delay-discount rates: Evidence from Tsimane' Amerindians of the Bolivian rain forest. *Journal of Economic Psychology*, *23*, 291-316. Retrieved from http://www.ugr.es/~pbg/rte/kirby.pdf

List, J. A., & Gallet, C. (n.d.). What experimental protocol influence disparities between actual and hypothetical stated values?: Evidence from a meta-analysis. (2001). *Environmental and Resource Economics*, (20), 241-254.

Locey, M., Jones, B. A., & Rachlin, H. (2011). Real and hypothetical rewards in self-control and social discounting. *Judgment and Decision Making*, *6*(6), 552-564.

Luhmann, C. C. (n.d.). Discounting of delayed rewards is not hyperbolic. (2013). *Journal of Experimental Psychology: Learning, Memory, and Cognition*, doi: 10.1037/a0031170

Mazur, J.E. (1987). An adjusting procedure for studying delayed reinforcement. In M. L. Commons, J. E. Mazur, J. A. Nevin, & H. Rachlin (Eds.), *Quantitative Anal- yses of Behavior: Vol. 5. The Effect of Delay and Intervening Events on Reinforcement Value* (pp. 55–73). Hillsdale, N.J.: Erlbaum.

Miller, M. (2011). The uphill battle to scale an innovative antipoverty approach: The experience of the Family Independence Initiative. New American Foundation. Retrieved from http://www.fiinet.org/reports/Uphill%20Battle%20New%20America.pdf

Municipality of Medellin. 2010. *Cultura E Medellin*. P.57 - 67. Retrieved from http://www.culturaemedellin.gov.co/sites/CulturaE/PublishingImages/LIBRO_CULTURA_E.pdf

Rohde, K. (n.d.). The hyperbolic factor: A measure of time inconsistency. (2010). *Journal of Risk and Uncertainty* , *41*, 125-140.

Robberstad, B., & Cairns, J. (2007). Time preferences for health in northern Tanzania: An empirical analysis of alternative discounting models. *Pharmacoeconmics*, *25*(1), 73-88.

Rubalcava, L., Teruel, G., & Thomas, D. (2009). Investments, time preferences, and public transfers paid to women. *Economic Development and Cultural Change*, *57*(3), 507-538. Retrieved from http://paa2008.princeton.edu/download.aspx?submissionId=81825

Samuelson, P. (1937). A Note on measurement of utility. *Review of Economic Studies*, 4(2), 155-161.

Tanaka, T., Camerer, C., & Nguyen, Q. (2010). Risk and time preferences: Linking experimental and household survey data from Vietnam. *American Economic Review*, *100*(1), 557-571. Retrieved from http://pubs.aeaweb.org/doi/pdfplus/10.1257/aer.100.1.557

Thaler, R. (1981). Some empirical evidence on dynamic inconsistency. *Economic Letters*, *8*(3), 201-207. Retrieved from http://dx.doi.org/10.1016/0165-1765(81)90067-7

United Nations Population Fund. (2011). *Country profiles: Colombia*. Retrieved from http://www.unfpa.org/public/_ns/YWRleGVyby1mZC1wb3J0bGV0OjpkZXhlcm8tZmQtcG9ydGxldDo6LTYyYTZhNDI5OjEyOTk2MDgxYzg3Oi03ZmYxfGVhY3Rpb249MT12aWV3RGF0YVZpZXc_/cache/bypass/appid/310297_1/home/sitemap/countries

Wall Street Journal. (2013). *City of the year*. Retrieved from http://online.wsj.com/ad/cityoftheyear

Weatherly, J. N., & Derenne, A. (2011). Comparing delay discounting rates when using the fill-in-the-blank and multiple-choice methods. *The Journal of General Psychology*, *4*(138), 300-318.

Wilson, R. (2011). The contribution of behavioral economics to political science. *Annual Review of Political Science*, *14*, 201-223.

Zauberman, G., Kim, B., Malkoc, S., & Bettman, J. (2008). Discounting time and time discounting: Subjective time perception and intertemporal preferences. *Journal of Marketing Research*, *45*, 543-556. Retrieved from http://faculty.fuqua.duke.edu/~jrb12/bio/Jim/discounting time.pdf

## Figure 1: Experimental Design

| I Control Groups<br>A: n=19<br>B: n=21 | | **Social network** | |
|---|---|---|---|
| | | **No group** | **Group** |
| **Individual Incentives** | **No prizes** | II Goals, no prizes, no group<br>n= 27 | III Goals, no prizes, group<br>n=32 |
| | **Prizes** | IV Goals, prizes, no group<br>n=30 | V Goals, prizes, group<br>n=30 |

## Figure 2: List of Goals

| | Goal | Verification Method | Frequency | Percent Chosen |
|---|---|---|---|---|
| **1** | Attend and complete at least ONE of workshops in marketing and sales, accounting, administration or entrepreneurship offered by El Banco de las Oportunidades or your local development center (Cedezo) | Registration form and certificate of completion | Repeatable | 11.11% |
| **2** | Update or create a business plan for your business | Present documents | Once | 7.24% |
| **3** | Begin or continue to keep accounting of your company or business, and show the gains and losses statement | Present accounting documents | Repeatable | 16.16% |
| **4** | Pay off an outstanding debt (minimum $ 60,000 Colombian Pesos) | Receipt (with date) | Once per debt | 10.77% |
| **5** | Purchase a machine, tool, or equipment for your business (minimum $ 60,000 Colombian Pesos) | Receipt (with date) | Repeatable | 6.06% |
| **6** | Create and implement a marketing strategy for your business (website, social networking sites, etc. for those businesses that apply) | Present documents/ websites | Once | 9.09% |
| **7** | Obtain any of the following licenses or registrations that you do not currently have (only if required for your business): Registry with tax board, Operation, Sanitation, Food Handling, Public Space | Present the application to the enumerator and/or group | Once for each registration | 5.89% |

| | Goal | Verification Method | Frequency | Percent Chosen |
|---|---|---|---|---|
| **8** | Participate in a job fair, exhibition, or other business event organized by El Banco de las Oportunidades or your local development center (Cedezo) | Certificate of participation | Repeatable | 6.40% |
| **9** | Save at least $ 15,000 (Colombian pesos) every week for next four weeks in a savings account -- If you do not have a savings account, we suggest you open an account in a cooperative | Bank statement | Repeatable | 20.20% |
| **10** | Make a payment to improve your credit score (minimum $ 60,000 Colombian Pesos) | Credit score data base online | Repeatable | 1.52% |
| **11** | Purchase a durable good for your home (minimum $ 60,000 Colombian Pesos) | Receipt (with date) | Repeatable | 4.21% |
| **12** | Apply yourself or help a member of your family apply for at least one of the grants or scholarships offered by the municipality for higher education | Present the application | Once | 0.34% |
| **13** | Attend a course for adult literacy (learning to read and write) | Certificate of attendance | Repeatable | 0.51% |
| **14** | Join the Social Security System (Health and Pension) | Membership certification | Once | 0.51% |

**Figure 3: Histogram of FII Treatment Group's Discount Rates (Endline)**

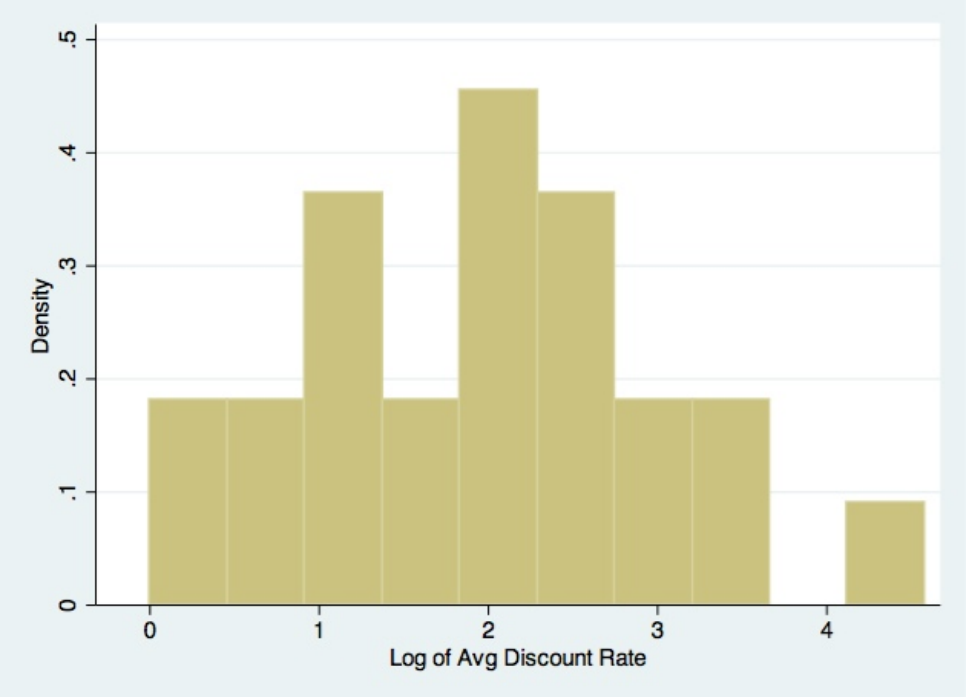

**Figure 4: Present Bias – Shape of the Discount Function**

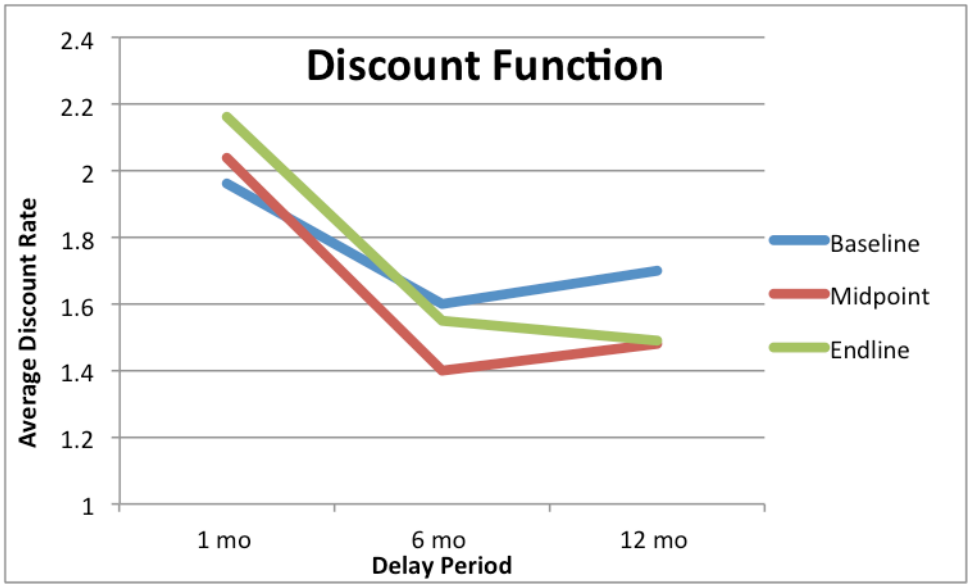

**Table 1: Summary Statistics at Baseline: Treatment and Control**

| | *Treatment* | | | | | *Control* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | Mean | Std. Dev | Min | Max | Obs | Mean | Std. Dev | Min | Max | T-test |
| Discount Rate | 114 | 1.7 | 1.13 | -0.98 | 6.1 | 19 | 1.9 | 1.3 | -0.98 | 4.02 | -0.710 |
| Present Bias | 114 | 0.33 | 0.87 | 0.17 | 0.50 | 19 | -0.21 | 1.24 | -0.80 | 0.39 | 2.357 |
| Income Strata | 116 | 2.5 | 0.93 | 1 | 5 | 18 | 2.39 | 0.92 | 1 | 5 | 0.547 |
| Education | 119 | 2.29 | 1.38 | 0 | 6 | 19 | 2.63 | 1.21 | 1 | 5 | -1.031 |
| Gender | 119 | 0.59 | 0.49 | 0 | 1 | 19 | 0.53 | 0.51 | 0 | 1 | 0.5045 |
| Age | 119 | 40.03 | 11.7 | 18 | 67 | 19 | 42.6 | 10.5 | 26 | 60 | -0.913 |

**Table 2: T-tests – Baseline Avg. Discount Rates by Treatment**

| **Mean** | **Mean** | **T-stat** | **P-value** |
|---|---|---|---|
| Goal Treatment<br>1.71 | Control<br>1.89 | -0.71 | 0.48 |
| Incentive Treatment<br>1.67 | Non-Incentive<br>1.78 | 0.54 | 0.59 |
| Group<br>1.91 | Non-Group<br>1.59 | 1.56 | 0.12 |
| FII<br>2.02 | Non-FII<br>1.65 | 1.49 | 0.14 |
| High School or Below<br>1.78 | Above High school<br>1.64 | 0.67 | 0.50 |
| Female<br>1.62 | Male<br>Mean = 1.88 | -1.28 | 0.21 |
| Bottom 2 Strata<br>1.68 | 3 and above<br>1.78 | -0.51 | 0.62 |

**Table 3: T-test of Time Preferences based on Attrition**

| Discount Rates | Obs. | Mean | Std. Err. | T-stat | P-value |
|---|---|---|---|---|---|
| Missed meeting | 31 | 1.89 | 0.95 | 0.88 | 0.38 |
| Did not miss meeting | 102 | 1.68 | 1.21 | | |
| **Present Bias** | **Obs.** | **Mean** | **Std. Err.** | **T-stat** | **P-value** |
| Missed meeting | 31 | 0.05 | 0.15 | 1.41 | 0.16 |
| Did not miss meeting | 102 | 0.32 | 0.15 | | |

| # of subjects who missed a meeting, by treatment group | Control | Group2 | Group3 | Group4 | Group5 |
|---|---|---|---|---|---|
| | 6 | 7 | 5 | 7 | 6 |

**Table 4: T-tests – Pooled Avg. Discount Rates by Treatment**

| Mean | Mean | T-stat | P-value |
|---|---|---|---|
| Goal Treatment 1.55 | Control 1.91 | -2.09 | 0.04 |
| Incentive Treatment 1.62 | Non-Incentive 1.6 | 0.15 | 0.88 |
| Group 1.69 | Non-Group 1.54 | 1.32 | 0.19 |
| FII 1.93 | Non-FII 1.52 | 2.86 | 0.005 |
| Female 1.54 | Male 1.72 | -1.51 | 0.13 |
| Bottom 2 Strata 1.59 | 3 and above 1.62 | 0.18 | 0.85 |

**Table 5: Pooled OLS – Average Discount Rate**

| VARIABLES | Discount Rate | Discount Rate | Discount Rate | Discount Rate | Discount Rate |
|---|---|---|---|---|---|
| Group | -0.004 | 0.036 | -0.006 | -0.015 | -0.056 |
| | (0.219) | (0.247) | (0.246) | (0.254) | (0.248) |
| Incentive | -0.232 | -0.211 | -0.166 | -0.174 | -0.227 |
| | (0.221) | (0.219) | (0.209) | (0.211) | (0.203) |
| Goal | -0.441* | -0.438* | -0.479* | -0.466* | -0.405 |
| | (0.245) | (0.252) | (0.245) | (0.248) | (0.245) |
| FII | 0.657** | 0.621* | 0.652* | 0.655* | 0.750** |
| | (0.313) | (0.328) | (0.333) | (0.335) | (0.316) |
| Income strata | | 0.005 | 0.072 | 0.072 | 0.043 |
| | | (0.096) | (0.092) | (0.092) | (0.088) |
| Education | | | -0.109 | -0.108 | -0.044 |
| | | | (0.083) | (0.083) | (0.087) |
| Gender | | | | -0.041 | -0.014 |
| *female=1* | | | | (0.156) | (0.157) |
| Age | | | | | 0.017** |
| | | | | | (0.007) |
| Constant | 1.978*** | 1.966*** | 2.070*** | 2.082*** | 1.285** |
| | (0.226) | (0.324) | (0.344) | (0.361) | (0.537) |
| Observations | 356 | 345 | 345 | 345 | 345 |
| R-squared | 0.063 | 0.061 | 0.073 | 0.073 | 0.096 |

Clustered (individual level) standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: All regressions include time and meeting location dummy variables

**Table 6: OLS Regressions by Time Period – Average Discount Rate**

| | *Baseline* | | *Mid-Point* | | *Endline* | |
|---|---|---|---|---|---|---|
| VARIABLES | Discount Rate | Discount Rate | Discount Rate | Discount Rate | Discount Rate | Discount Rate |
| Group | 0.183 | 0.196 | -0.091 | -0.142 | -0.124 | -0.242 |
| | (0.307) | (0.325) | (0.327) | (0.349) | (0.297) | (0.327) |
| Incentive | -0.322 | -0.334 | -0.154 | -0.125 | -0.189 | -0.132 |
| | (0.308) | (0.284) | (0.343) | (0.302) | (0.310) | (0.280) |
| Goal | -0.299 | -0.119 | -0.650* | -0.692* | -0.386 | -0.452 |
| | (0.349) | (0.322) | (0.370) | (0.354) | (0.348) | (0.315) |
| FII | 0.541 | 0.521 | 0.623 | 0.708 | 0.809* | 0.952** |
| | (0.431) | (0.435) | (0.458) | (0.438) | (0.421) | (0.423) |
| Income strata | | -0.056 | | 0.111 | | 0.093 |
| | | (0.109) | | (0.152) | | (0.111) |
| Education | | 0.132 | | -0.118 | | -0.204* |
| | | (0.124) | | (0.099) | | (0.113) |
| Gender | | -0.125 | | -0.019 | | 0.177 |
| *female=1* | | (0.224) | | (0.240) | | (0.195) |
| Age | | 0.021* | | 0.011 | | 0.017* |
| | | (0.010) | | (0.010) | | (0.009) |
| Constant | 2.013*** | 0.918 | 2.124*** | 1.679** | 1.908*** | 1.445** |
| | (0.285) | (0.708) | (0.300) | (0.695) | (0.292) | (0.633) |
| Observations | 133 | 133 | 113 | 113 | 110 | 110 |
| R-squared | 0.051 | 0.094 | 0.072 | 0.107 | 0.074 | 0.184 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: All regressions include a meeting location dummy variable

**Table 7: Pooled Linear Probability Model – Patience Dummy Variable**

| VARIABLES | Patience Dummy | Patience Dummy | Patience Dummy | Patience Dummy | Patience Dummy |
|---|---|---|---|---|---|
| Group | -0.047 | -0.064 | -0.054 | -0.058 | -0.055 |
| | (0.053) | (0.054) | (0.054) | (0.053) | (0.054) |
| Incentive | -0.051 | -0.053 | -0.064 | -0.067 | -0.063 |
| | (0.059) | (0.062) | (0.064) | (0.063) | (0.065) |
| Goal | 0.108* | 0.127** | 0.139** | 0.145** | 0.141** |
| | (0.055) | (0.058) | (0.056) | (0.057) | (0.058) |
| FII | 0.070 | 0.085 | 0.079 | 0.080 | 0.073 |
| | (0.077) | (0.078) | (0.077) | (0.076) | (0.080) |
| Income strata | | 0.000 | -0.017 | -0.017 | -0.015 |
| | | (0.019) | (0.018) | (0.018) | (0.018) |
| Education | | | 0.027* | 0.028* | 0.023 |
| | | | (0.015) | (0.016) | (0.018) |
| Gender | | | | -0.018 | -0.019 |
| *female=1* | | | | (0.036) | (0.037) |
| Age | | | | | -0.001 |
| | | | | | (0.002) |
| Constant | 0.393*** | 0.367*** | 0.339*** | 0.344*** | 0.398*** |
| | (0.064) | (0.079) | (0.082) | (0.083) | (0.128) |
| Observations | 371 | 360 | 360 | 360 | 360 |
| R-squared | 0.231 | 0.228 | 0.232 | 0.232 | 0.233 |

Clustered (individual level) standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: All regressions include time and meeting location dummy variables

**Table 8: Pooled T-tests of Present-Bias by Treatment**

| Mean | Mean | T-stat | P-value |
|---|---|---|---|
| Goal Treatment<br>0.56 | Control<br>-0.03 | 3.73 | 0.00 |
| Incentive Treatment<br>0.44 | Non-Incentive<br>0.50 | -0.46 | 0.64 |
| Group Treatment<br>0.49 | Non-Group<br>0.46 | 0.28 | 0.78 |
| FII<br>0.23 | Non-FII<br>0.54 | -2.31 | 0.02 |

**Table 9: Pooled OLS – Present Bias**

| VARIABLES | Present Bias | Present Bias | Present Bias | Present Bias | Present Bias |
|---|---|---|---|---|---|
| Group | 0.121 | 0.040 | 0.054 | 0.057 | 0.047 |
| | (0.184) | (0.199) | (0.203) | (0.203) | (0.201) |
| Incentive | 0.064 | 0.100 | 0.084 | 0.087 | 0.076 |
| | (0.197) | (0.204) | (0.202) | (0.208) | (0.202) |
| Goal | 0.645** | 0.650** | 0.665** | 0.660** | 0.674** |
| | (0.276) | (0.289) | (0.293) | (0.299) | (0.303) |
| FII | -0.576** | -0.530* | -0.541** | -0.542** | -0.520* |
| | (0.258) | (0.270) | (0.272) | (0.273) | (0.268) |
| Income strata | | -0.111 | -0.134* | -0.134* | -0.141* |
| | | (0.071) | (0.076) | (0.077) | (0.077) |
| Education | | | 0.038 | 0.038 | 0.052 |
| | | | (0.055) | (0.055) | (0.061) |
| Gender | | | | 0.014 | 0.019 |
| *female=1* | | | | (0.135) | (0.136) |

| | | | | | |
|---|---|---|---|---|---|
| Age | | | | | 0.004 |
| | | | | | (0.006) |
| Constant | 0.146 | 0.402 | 0.365 | 0.361 | 0.190 |
| | (0.266) | (0.321) | (0.331) | (0.334) | (0.500) |
| Observations | 354 | 343 | 343 | 343 | 343 |
| R-squared | 0.096 | 0.093 | 0.095 | 0.095 | 0.096 |

Clustered (individual level) standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Note: All regressions include time and meeting location dummy variables