Planning for Retirement? The Importance of Time Preferences

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This Version: March 2016

Ensuring retirement income security is a priority for individuals, employers, and policymakers. Using merged administrative and survey data for public sector workers in North Carolina, we explore how workers' characteristics and preferences are associated with planning and saving for retirement. After demonstrating the importance of financial literacy and individual and household characteristics, we find that the way individuals discount consumption in the future is associated with the extent of their retirement planning and preparedness. We find that measures of time preferences have more predictive power than measures of risk preferences in explaining how individuals plan their consumption path over a long horizon. The findings also suggest that individuals who engage in retirement planning are better prepared upon arriving at their retirement age. We confirm that stated retirement plans predict actual retirement behavior.

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I.   Introduction

Economists have understood the importance of risk and time preferences in household decision making since Adam Smith and earlier (Ashraf, Camerer, and Loewenstein, 2005). We study the role of these fundamental preference parameters in explaining individuals' retirement planning and decisions regarding retirement saving. Understanding how individuals plan for retirement is key to designing both government and employer policies related to retirement timing and to retirement income security.

We study multiple aspects of an individual's retirement planning behavior using data from detailed administrative records on public employees in North Carolina linked to a large-scale survey. Our results indicate that risk and time preferences are quantitatively significant determinants of an individual's retirement planning behavior. Interestingly, when explaining the degree to which, and the ways in which, an individual plans for retirement, our measures of time preferences hold more predictive power than risk preferences. Our primary measure of retirement planning is derived from self-reports on a survey. We confirm the robustness to alternative measures of planning including activities using an online retirement planning tool available to all employees. In addition, we consider other more typical objective aspects of retirement planning such as supplemental savings contributions and wealth accumulation.

We conclude that there is an important role for time preferences in understanding decision making in regards to retirement planning and preparedness. For example, demonstrating the key role of time preferences in retirement planning decisions allows us to clarify the appropriate role of policy interventions that seek to "nudge" individuals toward increased retirement savings and retirement preparedness (Bernheim and Rangel, 2005). When

an individual's optimal decisions depend on preferences that employers and policymakers cannot observe, the welfare implications of commonly suggested interventions are ambiguous (Bernheim, Fradkin, and Popov, 2011). Governments and employers seek to choose policies that are Pareto-improving and to avoid policies that harm the welfare of (at least some) individuals. Without learning exactly what behavioral model most closely fits with the decision making of individuals who are planning for retirement, policymakers cannot weigh the costs and benefits of policies or understand the distributional effects. Given our results that time preferences (both impatience and time inconsistency) are a driving factor behind the retirement planning behavior that we observe, the framework of Bernheim, Fradkin, and Popov (2011) implies that paternalistic controls (e.g., defaults) are welfare improving. One implication is that our results support using the default contribution rate on supplemental savings plans as a policy tool to increase the retirement preparedness of workers.

There is an emerging literature on retirement planning and its effect on economic wellbeing in retirement, but less is known about public employees who may behave differently than private sector workers. Public sector employees, including state, local, and federal governmental employees, comprise approximately 18 percent of the U.S. non-farm labor force.[1] In general, public sector workers are more likely to be covered by defined benefit (DB) pension plans and retiree health insurance. The model of deferred compensation, in combination with a relatively stable size of the workforce, may attract workers who are particularly risk averse or who demonstrate more "patience" towards the timing of compensation and consumption. Because public workers seem to have different risk and time preferences (Bellante and Link,

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[1] See Bureau of Labor Statistics, Current Employment Statistics, http://www.bls.gov/web/empsit/ceseeb1b.htm, [accessed October 2, 2014].

1981) and receive very different compensation packages than their private sector counterparts, results from studies examining the retirement planning and preparedness of private sector workers do not necessarily apply to public sector workers.

A growing literature has emphasized the importance of financial literacy. Lusardi and Mitchell (2014) provide a detailed review of research on financial literacy and its relationship to planning and wealth accumulation. Lusardi and Mitchell (2007) examine survey responses from the HRS and conclude that financial literacy predicts planning and that planning affects saving and wealth accumulation. These studies highlight the importance of two significant relationships: the relationship between financial literacy and planning, and the relationship between planning and retirement wealth accumulation. We build on this work by emphasizing the importance of risk and time preferences in addition to financial literacy.

While risk preferences have received a lot of attention in the literature, only a few papers have emphasized the importance of time preferences in determining retirement planning behavior. Similar to our findings, time preferences play an important role in determining retirement decision making in the results presented by Brown and Previtero (2014), Bradford, Courtemanche, and Heutel (2014), and Brown, Farrell, and Weisbenner (2015). In contrast, Ameriks, Caplin, and Leahy (2003) and Binswanger and Carman (2012) find no statistically meaningful predictive power for time preferences in retirement planning or wealth accumulation.

Our empirical analysis examines public sector workers in North Carolina, which is a large state that is diverse in terms of economic activity, urbanicity, and demographic characteristics. Our sample includes active workers ages 50-64. Our data are derived from survey responses linked to administrative records maintained by the North Carolina Retirement

System Division (RSD).[2] By using both administrative records and survey responses, the data have several indicators of a worker's behavior in regards to retirement planning and include both subjective and objective measures along several key dimensions. To study the role of risk and time preferences, the survey includes items based on similar questions used in the Health and Retirement Study to categorize respondents as more or less risk averse and more or less patient (Barsky and Juster, 1997). Further, the survey includes questions that assess respondents' financial literacy objectively in addition to questions that elicit a self-assessed measure of financial knowledge. The survey also includes a question on the sources of information that respondents typically rely on when making financial and retirement decisions.

This study explores several aspects of planning, including subjective and objective measures of planning, supplemental plan participation and contribution levels, wealth accumulation, planned age at retirement, and plans for working after retirement from a career job in the public sector. Combining survey and administrative data allows us to include both subjective and objective measures, which provides a more comprehensive picture of retirement planning and preparedness. Our final exercise is to show that planned retirement behavior, as self-reported on our survey, is predictive of actual retirement behavior, as shown in the administrative records. To do so, we ask whether the decision to retire shortly after our survey is associated with an individual's planned retirement age. We find clear evidence that stated plans matter: planned retirement age is highly correlated with whether an individual has indeed retired.

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[2] These data were gathered as part of a larger project titled "Challenges to Retirement Readiness in the North Carolina Public Sector Workforce." The original dataset includes active workers ages 50-69. Because we are interested in retirement plans prior to the actual retirement decision, this study excludes workers over age 65. More details on the full data and project can be found at:
https://sites.google.com/a/ncsu.edu/retirementstudy/

The extensive nature of our data (combining survey data and administrative data) allows us to provide evidence that self-reported plans are an important aspect of understanding retirement behavior.

II. Administrative and Survey Data on North Carolina Public Sector Workers

On most dimensions, North Carolina is broadly representative of the nation in terms of its size, the diversity of the population, and the structure of its public pension plans. Almost all full-time employees working for a state agency in North Carolina, as well as teachers employed by local public school systems, are required to enroll in the Teachers' and State Employees' Retirement System (TSERS).[3] Most municipal, county, and other local governmental employers participate in the Local Governmental Employees' Retirement System (LGERS). The Retirement System Division of the Office of the State Treasurer manages both plans.

The data are derived from a survey of public sector workers merged with corresponding administrative records maintained by the North Carolina Retirement Systems Division. The administrative records contain detailed information about each employee including earnings, job information, years of service, and creditable service. We observe basic demographic information in the administrative data, and we supplement this demographic information with responses to survey questions about race/ethnicity, education level, and marital status, as well as various questions about their spouses' characteristics (if applicable). We combined these data with records of participation in the state-managed NC 401(k) and NC 457 plans.[4]

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[3] One exception to this is that university faculty have the option of enrolling in TSERS or participating in a defined contribution plan managed by the University of North Carolina system. Faculty electing to be in TSERS are included in our sample while those selecting the optional retirement plan are not.

[4] Appendix A describes the data and sample in more detail.

The first column of Table 1 presents descriptive statistics for the full sample. Salary, age at survey, and years of service are derived from the administrative records.[5] From these values, we impute the number of years until each individual is first eligible for early/reduced retirement benefits and full/normal retirement benefits.[6] We consider both because approximately 40 percent of individuals ultimately retire and claim an early/reduced benefit, so likely both dates are salient to workers.[7] The average salary is $52,477, and average tenure is 16.6 years.

[Table 1]

Retirement planning, our main outcome of interest, is measured in several alternative ways. We include several variables, both subjectively and objectively measured, to illustrate the robustness of our findings and to provide support that we are capturing economically important behaviors associated with retirement planning. To study retirement decision making, we consider three categories of variables: a direct self-reported measure of retirement planning, objective measures of aspects of the retirement plans, and observed results of retirement planning, each described below.

A. Self-Reported Retirement Planning

For our main measure of retirement planning, we construct a 'subjective' indicator from the response to a survey question aimed at determining the extent to which a respondent has thought about retirement and formulated a retirement plan. Each respondent had the option to indicate that she: (1) has a retirement plan; (2) has thought about retirement but does not have a

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[5] Using the administrative data, we calculate the age of respondents at time of survey for the email sample and the age of respondents as of June 1, 2014 for the print sample.

[6] Table A.2 explains in detail how years until eligible for early/full retirement is calculated.

[7] Using supplemental data provided by RSD, the authors calculate that 15.2% of our sample initiated benefits by August 2015. Of these, 38.6% claimed benefits under early retirement.

plan; or (3) has not thought about retirement at all. While 'thinking about' retirement is a somewhat nebulous concept, having made a retirement plan is a concrete indication of having planned. We define a measure of 'subjective planning' to be whether the individual reports having a retirement plan.[8] Columns 2 and 3 of Table 1 show mean values for those that have or have not made a retirement plan, respectively. We observe that those who have planned have higher salaries, are closer to retirement, have more years of service, and are older.

Interestingly, we find that for both men and women, individuals who are married are more likely to report having made a retirement plan. This could be due to the need to coordinate between spouses or might reflect having a spouse that has already begun the retirement process. Gustman & Steinmeier (2000), Michaud (2003), Banks, Blundell, & Casanova (2010) examine why a significant share of spouses retire within one year of each other, independently of their age difference.[9] Leisure complementarities or similar preferences and social security spousal benefits are responsible for a large portion of observed joint retirements (Casanova, 2010). While we do not explicitly model joint retirement behavior in this paper, results not shown demonstrate that public employees whose spouse has already retired are more likely to report having made a retirement plan and to themselves retire sooner than employees who did not report having a retired spouse.[10]

In Table 1, we also observe that planners are more likely to have a college degree than non-planners, are less likely to be non-white, and are more likely to own their home. Our survey

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[8] We describe sensitivity tests using alternative parameterizations further below. Our preferred definition of subjective planning (have a retirement plan) has a stronger association with preferences than a more inclusive definition.

[9] Among our married sample with an already retired spouse, 16 percent plan to retire within one year.

[10] Public employees with a retired spouse were more likely to have a retirement plan (58 percent versus 50 percent) and an earlier planned retirement age (4.7 years until retirement versus 6.1 years).

was distributed by hard-copy for individuals who did not provide an email address to their employer. Thus, it is not surprising to find that print sample respondents were more likely to be non-planners. We explore the associations between demographic characteristics and planning further below using multivariate regression analysis.

B. Alternative Planning Measures

While making a plan is an important step in retirement preparedness, one must also engage in behaviors to achieve those goals, such as acquiring financial literacy and saving in supplemental retirement saving plans. We propose several outcomes that reflect additional aspects of an individual's retirement planning behavior. By combining survey and administrative data, we are able to construct measures for a variety of nuanced characteristics of the planning process to provide a fuller understanding of planning to go beyond our main measure discussed above.

First, we draw an objective measure of planning from the administrative data. These data indicate actions by individuals from an employee's use of the Online Retirement Benefits through Integrated Technology (ORBIT) website. ORBIT allows members of the retirement systems to access their retirement account information, including account balances in 401(k) and 457 plans, and to engage in a more intensive form of planning by requesting a "self-service estimate" of their pension benefit.[11] We classify individuals as planners using two measures (1) if they have logged into the ORBIT website within the past 12 months or (2) if they have

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[11] While technically an individual can determine their expected annual benefit using the annuity formula, the actuarial factors used by RSD in the calculation of benefits are somewhat sophisticated. In fact, staff at RSD indicate that the member services staff at RSD and the employers' human resources staff regularly refer workers to the ORBIT Self-Service Estimator to obtain estimated benefit information rather than conducting the calculation on behalf of the employee (personal correspondence with RSD staff).

requested a self-service estimate from ORBIT in the past 12 months.[12] We chose to use a 12-month timeframe because RSD sends communications encouraging employees to login to ORBIT to review their personal benefit account several times a year and provides an annual benefit statement that is only accessible through ORBIT. Thus, we believe that a member actively planning for retirement would likely check their ORBIT account and conduct a self-service estimate at least annually.[13]

At the top of Table 2, we see that 67.5 percent of the sample has logged into ORBIT in the past year, while 53.6 percent have also requested a self-service estimate from the website. While these numbers may seem high, the reader should remember that this is a sample of public employees aged 50-64 who are near to their planned retirement age. These "objective" measures of planning are strongly correlated to the self-reports indicating that the respondent has developed a retirement plan. Comparing Columns 2 and 3 we see that planners are more likely to log into ORBIT and more likely to request a self-service estimate.

[Table 2]

Next, we consider two indicators of participation in supplemental retirement savings plans: (1) a self-reported measure of participation in any 401(k), 403(b), or 457 plan, drawn from the survey, and (2) an indicator of participation in the state-managed 401(k) or 457 plans, taken from the administrative records. Participation in a supplemental plan is an action that illustrates an active decision as part of one's retirement planning behavior. In parallel with our two measures of retirement planning, we refer to the first measure as "subjective supplement plan

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[12] To be precise, our measure is about activities between August 19, 2013 and August 18, 2014.

[13] Results using alternative timeframes are described in footnote 22 and Appendix D.

participation" and the second as "objective supplement plan participation." Table 2 shows that around 74 percent of individuals responded that they participate in a supplemental retirement savings plan, which is much higher than the 44 percent participation rate we observe in the administrative data. Note that local government employers, including school districts, have the option to offer a locally-managed supplemental plan. So, for employees at non-state governmental employers in North Carolina, we cannot observe objectively whether the individual is saving in a locally managed plan. However, when considering only those individuals who work at a state government agency, we still observe substantially higher self-reported participation rates.[14] We believe this may be due to a misunderstanding among survey respondents of the difference between being enrolled the primary defined benefit plan and supplemental retirement saving plans.[15]

Next, we consider a survey question on the reported level to which a respondent is contributing to all supplemental retirement savings plans, including 401(k), 403(b), and 457 plans as well as IRAs (own and spouse's, if applicable). Table 2 shows that, on average, 73.7 percent of individuals report participating in a supplemental plan, while 44.2 percent participate in one of the two state-managed plans. The average self-reported contribution level among

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[14] Clark, et al. (2016 forthcoming) provide a detailed examination of participation in and contributions to supplemental retirement saving plans of public school personnel. Over half of the school employees who contribute to a supplemental retirement saving plan are enrolled in locally managed 403(b) and 457 plans. These contributions are not included in the administrative records from the state retirement system.

[15] Appendix B provides the exact wording of the question, which asks about participation in any "retirement savings plan with my current public employer (e.g., 401(k), 403(b), 457(b) plan)." We find that about 13% of the population incorrectly self-reports participating but are not participating according to the administrative records. Thus, we believe our survey measure may be overstating participation for all our workers.

participants is around 9 percent of salary.[16] Comparing again across Columns 2 and 3, we see

that those who self-report having made a retirement plan are also more likely to be saving and,

conditional on contributing, are saving a higher fraction of their salaries.

Wealth is self-reported on the survey, where respondents choose which of a set of

categories best represents their household current savings and investments. Respondents are

asked to include savings, several enumerated categories of investments, account balances in any

defined contribution plans, and estimated values of any business owned; respondents are asked to

exclude the value of their primary residence and savings in any defined benefit plans. In these

data, the reported wealth level of the average individual is just below $200,000. For comparison,

using data from the 2013 Survey of Consumer Finances, Rosnick and Baker (2014) find that the

median non-housing wealth of households headed by someone ages 55-64 was $89,300. Here,

we observe large differences in accumulated wealth by subjective planning where planners have

over $284,000 in assets compared to just $97,000 among non-planners.

C. Additional Aspects of Retirement Planning

In addition to the above measures of planning, we have survey-reported information on

two key components of a retirement plan. First, the survey includes a question on planned age of

retirement, that is, the age at which the respondent plans to "stop working full-time for your

current employer and begin receiving retirement benefits." The average age of planned

retirement is 63. About 6.4 percent of the sample did not report a planned age of retirement.

Second, respondents were asked if they planned to work after retirement, which is coded as zero

if an individual reported a plan to "completely retire and not work at all." Individuals indicating

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[16] Respondents were allowed to express their contribution level in terms of percentage of salary or dollar
amounts, which we then converted into percentage terms using administrative salary.

that they plan to work full-time or part-time were given a value of one for this measure. In these data, 73 percent of individuals plan to work after retirement. About 2 percent of the sample did not report if they intended to work or not in retirement.

Finally, we construct a respondent's perceived necessary replacement rate, calculated using survey data. The survey provides information on a respondent's expected income needed in retirement. If the respondent self-reported as married, the replacement rate is calculated by dividing expected needed retirement income by the sum of own salary and spouse's salary, both salaries reported on the survey. If the respondent did not self-report as married, only own salary is used to calculate the replacement rate. The mean perceived replacement rate is around 85 percent, which is very close to the often-discussed rule of thumb of 80 percent (TIAA-CREF, 1994), despite the fact that we asked for expected retirement income needed instead of asking for a replacement rate directly. Expected retirement income was not reported for 25 percent of respondents.

Interestingly, we find that among planners, the expected replacement is much closer to the recommended 80 percent, while non-planners have a perceived needed replacement of 88.1 percent. Planners are also less likely to leave questions on the aspects of their retirement plan blank. Non-planners were less likely to report planned retirement age, employment plans after retirement, as well as expected income needed in retirement.

III. Risk and Time Preferences

Using several aspects of retirement planning, along with the measures of retirement planning discussed above, we explore the predictive power of risk and time preferences in understanding decision making in this important setting.

Preference Elicitation

The literature has established the predictive power of risk and time preference in explaining the full range of economic behaviors. Our measures of risk and time preferences are adapted from questions in the HRS (Barsky and Juster, 1997). On risk preferences, respondents were given a hypothetical situation in which they would choose one of two new jobs, one with a constant income and one with an income that is 100 percent higher or 20 percent lower (with the increase or decrease equally likely). Among respondents who answered this question, 67.5 percent chose the safe job (more risk averse) and 19.6 percent chose the risky job (less risk averse) while 12.9 percent reported that they did not know which job they would choose. Column 1, Table 3, Panel A, presents the means for the set of risk and time preference variables.[17]

[Table 3]

We included two questions to assess a respondent's level of patience. The benefit frame asks whether a respondent, upon reaching 65 years of age, prefers $1,000 per month in Social Security benefits or $500 per month plus an up-front, lump sum payment of $80,500. The lottery frame asks whether a respondent prefers to take a $1,000 windfall gain today or wait for one year and receive $1,200 instead. On the benefit frame, 34.2 percent of individuals chose the larger monthly benefit (more patient), while 49.7 percent chose the up-front payment and the smaller monthly benefit (less patient). Of the rest, 16.1 percent did not choose a payment but rather reported "don't know" as their answer. On the lottery frame, 46.5 percent of individuals chose the larger, later payment (more patient), while 46.5 percent chose the smaller, sooner payment

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[17] See Appendix C for a detailed description of the questions and responses.

(less patient). Only about 7 percent of the respondents chose "don't know" as an option under the lottery framework.

In Columns 2 and 3, Table 3, Panel A, we compare these measures of risk and time preferences among those that report having made a retirement plan (Column 2) and those that have not (Column 3). We see that planners are more patient using both frames and more risk averse. These associations are examined further in a regression framework below.

There are several differences in the two framings of our time preference questions: the benefit frame involves high stakes payments of gains that are anticipated, while the lottery frame involves a lower stakes payment of windfall gains. Behavioral economics has presented a substantial amount of evidence that individuals treat gains asymmetrically depending on the stakes and depending on whether the gains are anticipated, which affects which "mental account" individuals perceive them as belonging to (Thaler, 1990). Using both questions, we are able to identify heterogeneity in a respondent's tolerance for delay as well as her reported preference over delayed gains under different mental frames.

Further, the benefit frame involves a choice between two decisions that both involve payments in the future (i.e., at 65 years old), while the lottery frame involves a choice between a payment today and a payment in the future. This difference has been termed a "front-end delay" and has been shown to be important for a full understanding of time discounting (Coller and Williams, 1999). Burks et al. (2012) have shown the importance of eliciting both a standard discount rate and a discount rate that accounts for present biasedness. Our lottery frame question with no front-end delay jointly elicits time preferences and the degree of present biasedness.[18]

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[18] In addition to the differences discussed above, the benefit frame of our time preference questions elicits preferences between two options that depend on one's subjective life expectancy. That is, an up-front

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The findings that we discuss next reveal interesting differences between two alternative measures of time preferences. Time preferences elicited with a lottery frame are more robustly associated with decision making relative to time preferences elicited with a benefit frame. In a similar spirit to these findings, Anderson and Mellor (2009) find that risk preferences elicited from a question involving windfall gains has more predictive power in their setting than those from a question involving anticipated gains. Specifically, the authors ask whether respondents prefer inheriting a certain level of wealth or a risky level of wealth (windfall) as well as whether they prefer a job with certain income and a job with risky income (anticipated). We are unaware of existing work that presents a direct comparison of alternative framings of a time preference elicitation, but it is important to understand the frame of mind in which individuals conceptualize hypothetical questions concerning their latent characteristics. Our results, along with those in Anderson and Mellor (2009), suggest that windfall gains may be a cleaner framing of survey questions that are designed to elicit preferences. We chose not to include a windfall gain framing of the risk preference question, but our findings suggest future work should incorporate both anticipated and windfall gains.

Finally, Loennqvist et al. (2011) find that unincentivized survey questions outperform incentivized tasks in the measurement of preference parameters, because unincentivized survey questions are more highly correlated with actual decisions and are more robustly elicited. This supports our categorization of individuals are more or less patient using unincentivized survey questions, as opposed to constructing incentive compatible tasks and paying individuals as a function of their responses.

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payment and a smaller month benefit is preferred by individuals who expect to have fewer remaining years, ceteris paribus.

Related Literature on Risk and Time Preferences and Retirement

Using these measures of risk and time preferences, we explore their role in determining an individual's retirement planning behavior. The related literature is broad, but only a few papers have specifically considered time preferences and retirement decision making. Brown, Farrell, and Weisbenner (2015) look at the retirement-related financial behavior of procrastinators versus non-procrastinators, where procrastinators are defined as individuals who delayed choosing a health care plan until the final day of the enrollment period. Their results show that procrastinators are 2.4 percentage points less likely to participate in a supplemental retirement plan and contribute 10 to 15 percentage points less in defined-contribution plans. Presenting a similar set of findings, Brown and Previtero (2014) measure procrastination using a five survey questions on the tendency to delay decisions.

Bradford, Courtemanche, and Heutel (2014) provide evidence that time preferences are correlated with health behaviors (e.g., smoking, binge drinking, and having health insurance), credit card balances, and savings. They find that both time consistent and present biased discounting influence health behaviors, energy use, and financial decisions. They also show that present biasedness is positively and significantly associated with non-retirement savings and less strongly and significantly associated with having retirement savings.

In contrast to these papers (and ours), two related papers find that risk and time preferences do not have a strong association with retirement planning or wealth accumulation. Binswanger and Carman (2012) provide a nuanced measurement of retirement planning behavior by differentiating among three types of behavior: working out a formal retirement plan, using a rule of thumb, and having neither a plan nor a reliance on a rule of thumb. The authors find that rule-of-thumb adopters behave in similar ways to planners in their savings decisions, and both

types of individuals save meaningfully more than individuals who follow an unsystematic approach to retirement savings. However, Binswanger and Carman (2012) find no statistically significant association of time and risk preferences with planning behavior and wealth accumulation. Using survey data from a sample of TIAA-CREF participants, Ameriks, Caplin, and Leahy (2003) also find no statistically meaningful predictive power for risk and time preferences.

C. Financial Literacy

Over the past decade, economists have examined the role of financial literacy on various types of economic behavior including retirement planning and saving in supplemental retirement saving plans. Lusardi and Mitchell (2014) provide a comprehensive assessment of studies that estimate the impact of financial literacy using responses to specific literacy questions and self-reported levels of literacy. The introduction of the same questions into the Health and Retirement Survey and in other such surveys (including our own) has allowed researchers to compare the effect of literacy in many diverse situations.

An additional aspect of financial literacy and retirement planning shown in Table 3 is drawn from a survey question on the source of information an individual uses when making important financial decisions. We create a binary variable equal to one if the respondent indicates that they use any of the following sources of financial information that we deem to be "formal" sources of information: employer's (or spouse's if applicable) office of human resources, one-on-one telephone counseling, financial advisor, current provider of a supplemental retirement savings plan, or another financial service provider. Around 67 percent of individuals reported using at least one of these formal sources of information when making important financial decisions. Informal sources of financial information are considered to be

family, friends, coworkers or supervisors, as well as newspapers, retirement planning books, business magazines, financial planning websites and any other internet sources. Informal sources were consulted by 18 percent of the sample while 14.2 percent did not rely on any of the aforementioned sources of information.

Comparing Columns 2 and 3, Table 3, Panel B, we see that those who self-report having made a retirement plan are more financially literate, both subjectively and objectively measured. Planners are also more likely to have sought formal advice and less likely to report seeking financial information from informal sources. These comparisons show a clear link between financial literacy and retirement planning.

IV. Results: Retirement Planning and Individual Preferences and Characteristics

A. Subjective Planning

In Tables 1-3, we considered the differences in sample means among planners and non-planners. Our main measure of planning is subjective and is drawn from a self-report in the survey data of having made a retirement plan. In pairwise comparisons, planners are shown to be more patient and more risk averse. We now consider these associations in a regression framework holding demographic and economic characteristics constant. Table 4 presents estimates of a linear probability model regression of subjective planning on risk and time preferences, financial literacy, and a host of demographic and economic characteristics.

[Table 4]

The first column of Table 4 reports a specification that includes only risk and time preferences and financial knowledge. In our sample of older public employees in North Carolina, we find that individuals who are more patient in the benefit frame are 6.1 percentage points more likely to have made a retirement plan, holding constant patience as measured in the lottery frame. Similarly, holding other preference measures constant, being more patient in the

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lottery frame is also associated with a 6.1 percentage point higher probability of having made a retirement plan. The estimate coefficient on risk preferences is not statistically significant but is also not statistically significantly different than either of the effects for time preferences.[19]

Financial literacy has long been shown to matter in retirement decision making and this is the case in these results as well. In Column 1, Table 4, high financial literacy (as measured by answering all 3 financial literacy questions correctly), medium financial literacy (as measured by answering all 2 financial literacy questions correctly) and self-reported financial knowledge on a scale of 1-7 are all individually associated with a higher likelihood of having made a retirement plan. Next, in Column 2, Table 4, we include economic and demographic characteristics. The variable "years until eligible for full retirement" is calculated "objectively" using age at survey and years of service data from the administrative records. Because of concerns over collinearity, we present results only including this variable and years of service.[20] We see that individuals with a longer time period until eligible for retirement are less likely to have already planned for retirement.[21]

Controlling for having a college degree, tenure, and preferences, we find that having a higher salary is still associated with a higher probability of planning. Gender and marital status

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[19] The literature has demonstrated that risk and time preferences interact in complex ways. Andersen et al. (2008) and Jamison, Karlan, & Zinman (2012), among others, show that eliciting both sets of preferences jointly is important for a full understanding of their role. In unreported results, we considered these interactions but did not find strong evidence that the large effects we find of time preferences on planning have meaningful interactions with risk preferences. More patient individuals are more likely to plan, irrespective of whether the individual was more or less risk averse.

[20] Appendix Table D.1, Column 1 includes a specification with age rather than years of service. The results are nearly identical, and the estimated coefficient on age is small and positive.

[21] We do not present estimates including years until early retirement separately because it is highly collinear with years until full retirement.

are interacted to create three categories, with married females as the omitted group. We see that married females have the highest propensity to plan, which may be due to the retirement planning of an older spouse. In support of this conjecture, in results not shown, we find that marital status is no longer significant after controlling for spousal characteristics (e.g., age and salary). Both male and female unmarried individuals are less likely to have made a retirement plan relative to married women.

Next, we see that homeowners are more likely to report having made a retirement plan, as are those reporting to be in excellent or very good health. Individuals with dependent children (defined as having children depend on the individual for more than half of their financial support) and those working at a university are significantly less likely to report having made a retirement plan, holding all else equal. We also find that individuals who were given our print survey, rather than the online survey, are less likely to report having made a retirement plan. While this may reflect some difference in the response due to the survey type, it more likely reflects some characteristic of individuals who caused them to be excluded from the email sample. Any individual in the administrative records for which an email address was available was sent the email survey.

Including both measures of time preferences allows us to isolate specific dimensions of time preferences and their effects on retirement planning. While including both frames as regressors complicates the interpretation of differences between more and less patient individuals, it allows us to look more deeply at the components on time preferences. The benefit frame involves a high stakes payment of gains that are anticipated with a "front-end delay." In contrast, the lottery frame involves a lower stakes payment of windfall gains with no front-end delay (i.e., choice between a payment today and a payment in the future). We observe that the

lottery frame of our patience elicitation has more predictive power than the benefit frame in explaining retirement planning behavior. We conjecture that respondents conceptualized the question involving their Social Security benefits in a way that elicited their time preferences jointly with their comfort level with their existing retirement savings. Further, the benefit frame includes a life expectancy aspect that is not present with the lottery frame. Because of these confounding factors, we conjecture that individuals responded to the question framed as having won a lottery in a way that more cleanly elicited their true degree of patience.

Overall, we find that time preferences and financial literacy are important in understanding retirement planning behavior. Below, when we consider several other aspects of retirement planning, our measures of time preferences continue to have a stronger association, relative to our measures of risk preferences, in determining retirement decision making. The analysis uses outcomes that are subjectively and objectively measured, where subjective measures are self-reported on the survey and objective measures are drawn from the administrative records. In the results that follow, we find that our measures of time preferences, and our set of regressors as a whole, have more predictive power when considering subjectively, relative to objectively, measured aspects of planning. Broadly, these results emphasize the importance of having both survey data and administrative records to present a fuller picture of retirement planning behavior.

B. Alternative Measures of Planning

We next consider a series of objectively and subjectively measured alternative proxies for retirement planning behavior. In Table 5, each column includes a parallel regression to the specification in Column 2, Table 4, except we vary the dependent variable to consider alternative measures of planning. The measures were described in more detail above in Section II.B. In

Table 2, we saw that these alternative planning measures were all positively related to the subjective planning measure but are perhaps also capturing other aspects of planning. Our main objective measures of planning rely on administrative records indicating individual activities on the ORBIT website. The first column of Table 5 considers whether an individual has logged in to the retirement system's benefit website in the past 12 months, while the second column of Table 5 considers further whether the individual used the retirement system's benefit website to receive an estimate of their benefit upon retirement (i.e., a "self-service estimate").[22]

[Table 5]

Considering ORBIT log-ins, Column 1 of Table 5 shows a positive and marginally significant association between risk aversion and planning. We also observe a positive and marginally statistically significant association between patience in the benefit frame and planning, but no significant relationship with patience measured in the lottery frame. In contrast, requests for an ORBIT self-service estimate are not significantly related to risk or time preferences in a regression context, as shown in Column 2 of Table 5. Individuals have several alternative ways of learning about their retirement benefits, including conducting their own calculation from knowing the benefit formula, their years of service, and their highest average salary over a four-year period. Thus, these results suggest that the additional information provided by a benefit estimate is not necessarily a key component of retirement planning.

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[22] In results shown in Appendix Table D.2, the estimates differ somewhat when a two-year window is used, which suggests that recent interactions with the retirement benefit website are more consistent with our other results than a definition that uses a longer period. Only 22.4 percent did not access orbit in the last 2 years. Interestingly, when using a shorter period, a 6-months window, the estimated effects are more pronounced.

In Table 5, Columns 1 and 2, the remaining explanatory variables predict these "objective planning" measures similarly to the subjective planning measure used in Table 4. Those with higher financial literacy and annual salary are found to be more likely to plan using the objective measure of requesting a self-service estimate, all else equal. We find that the further one is from eligibility for full retirement, the less likely one is to be engaging in these objectively measured planning activities. Interestingly, we see no statistically significant difference by gender-marital status group. The estimated coefficients on being in the print sample reflect that fact that individuals who provided an email address to their employer is also likely to have logged into ORBIT.

The remaining columns of Table 5 include the following additional components of the planning process, described earlier in Section II.B: supplemental plan participation (subjective and objective), supplemental plan contribution level, and wealth. In Column 3, Table 5, subjective participation equals one if the individual reported on the survey to be participating in any supplemental retirement savings plan. In Column 4, objective participation equals one if the administrative data reflect participation of the individual in one of the state managed supplemental plans, which are only a subset of the plans in which the individual could be participating. Our subjective measure of supplemental plan participation offers the advantage of asking respondents about the entire universe of supplemental savings plans in which they could be participating, while the objective measure has the advantage of avoiding the usual concerns of self-reported survey measures.[23] The disadvantage of the objective measure of participation is that, in the administrative data, we cannot observe all of types of supplemental savings plans in which an individual can be participating; in contrast, the survey asks about all types of

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[23] See Appendix B for a discussion of our self-reported measure of participation.

supplemental plans. In Column 5, contribution level is the reported percent of an individual's salary that she is contributing to all supplemental plans. Finally, in Column 6, wealth is self-reported on the survey as one's total household current savings and investments and does not include housing wealth. We recognize the host of interrelated factors that jointly determine retirement planning, retirement savings, and wealth accumulation. As a result, the analysis considers wealth because it is an observable characteristic of individuals that is (in part) associated with planning.

Across the five aspects of retirement planning behavior presented in Columns 2 – 6, Table 5, risk aversion has no significant association with these outcomes. Time preferences in the lottery frame are statistically significantly related to retirement planning for subjective participation and contribution rates, as well as for wealth accumulation. Although not statistically significant, the estimated coefficients are positive in the other two specifications. The estimated coefficients on patience in the benefit frame are generally smaller, not statistically significant, and are negatively associated with contribution rates among participants, all else equal. Given the complex nature of retirement planning, we do not attempt to disentangle the simultaneous determination of each of these aspects of retirement decision making. However, the results support the interpretation that our measures of time preferences are more robustly predictive of planning behavior, relative to our measures of risk preferences.

Financial literacy and self-reported financial knowledge do not have a strong association with either participation measure. Knowledge and literacy have a positive and quantitatively large association with contribution levels and levels of accumulated wealth. When considering time until eligible for retirement, being further from objectively measured normal retirement age is associated with slightly higher probability of objectively measured plan participation. Longer

tenures are associated with higher participation rates, but lower contribution rates among participants and lower wealth accumulation. For three out of four measures of planning in Columns 3-6, we observe that, all else equal, higher earners are more likely to be planning for retirement.

As with subjective planning in Table 4, gender and marital status do have predictive power. Across all measures, married women are the most likely to plan. For subjective supplemental plan participation, married females participate in supplemental plans more often than married males and unmarried females. A similar pattern holds with supplemental plan contribution levels. Finally, for wealth, married women have significantly more wealth than married males, while single males and females both have less household wealth accumulated. While these results might be surprising, given previous research examining women retirement preparedness, we note that women in our sample, who are full-time, active, public sector employees, are more financially literate than the average population. Lusardi and Mitchell (2008) study the effect of financial literacy on retirement planning for women and conclude that older women in the US display very low levels of financial literacy and that women who display higher financial literacy are more likely to plan.

Individuals with a college degree and those who are white have more reported wealth, but these characteristics are not significantly associated with the other measures of planning, all else equal. Interestingly, homeowners are more likely to be saving and have greater non-housing wealth accumulation. Note that all teachers and university employees in North Carolina have access to at least one locally managed 403(b). It is therefore not surprising to see that they are less likely to participate in the state-managed 401(k) or 457 plans. But, it is perhaps surprising to see that subjectively measured participation rates are also lower for individuals in these

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occupations. We also see that teachers have significantly lower non-housing wealth as they near retirement as compared with other types of public sector workers in North Carolina.

C. Subjective Planning and Time Preferences: Heterogeneity

Above, we found a significant association between subjectively measured retirement planning and elicited preferences towards time where the more patient were also more likely to plan. Next, we explore this link further by comparing the association for different subsets of the population. Table 6 considers heterogeneity in the effects of time preferences on subjective planning. We use the lottery frame of the time preference elicitation because it is more robustly associated with outcomes in the earlier results. Likewise, we use subjective planning as the sole outcome of interest, given that many of the previous results are similar in qualitative terms across a number of outcomes. We prefer to investigate heterogeneity in the time preference/planning relationship using sample means rather than full regression analyses due to concerns over rerunning a regression with a large number of covariates repeatedly using small sub-samples of the data. In contrast, considering sample means ensures sufficient statistical power and allows us to make comparisons that are more straightforward.

[Table 6]

Table 6 presents results analyzing potential sources of heterogeneity in the association of time preferences and planning. First, Panel A illustrates the raw differences for the full sample. Of the 1,883 individuals for whom time preference could be measured (i.e., did not answer "don't know" to the lottery frame time preference question), 47.6 percent reported having made a retirement plan. When this sample is divided into the less patient versus more patient, we see that more patient individuals are 13 percentage points more likely to have made a retirement plan (27 percent of the sample mean).

Table 6 Panel B considers the number of years until the individual's self-reported planned age of retirement. We consider four categories of years until planned retirement, ranging from less than two years to more than ten years. This exercise excludes the 113 individuals who did not report a planned age of retirement. Intuitively, in Column 2, we see that those closer to retirement are more likely to have planned. Further, the association of time preferences and planning holds for all categories of years until retirement, but the difference is much smaller (roughly half as large) for those individuals who are furthest from retirement.

Panel C, Table 6 asks whether the relationship between time preferences and retirement planning differs by gender and marital status, which are interacted to create four categories. Here we see that 51.8 percent of married women are planners according to the subjective measure, and there is a 12.6 percentage point higher propensity to plan among more patient married females relative to less patient married females. Married males plan at similar rates as married females but the difference by time preferences is more pronounced, at 21.7 percentage points. Both single females and single males plan less than married individuals and more patient single males plan at a substantially higher rate than less patient single males. In contrast, the difference in more and less patient single females is smaller and lacks statistical significance.

Because gender is such a strong predictor of planning, and because for our sample salary is highly correlated with gender, we consider heterogeneity in relationship between planning and time preference by earnings separately for men and women. Table 6, Panel D presents the results separately for lower-paid (salary less than $50,000) and higher-paid (salary greater than or equal to $50,000) individuals. For salary interacted with gender, our results are driven by those who are lower paid, more so among lower-paid men, where we find the lowest levels of planning among those lower-paid individuals who are less patient. We again find that the

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relationship between planning and time preference is stronger for both groups of males than both groups of females.

Finally, Table 6, Panel E considers educational attainment, separating individuals who have less than a college degree from those with a college degree. As with Panels C and D, we interact education with gender. There is a meaningful association of patience and planning for three categories, with the exception of females without a college degree. This result is driven by the low levels of planning among non-college-educated females who are more patient.

D. Time Preference and Retirement Plan Characteristics

We have demonstrated that time preferences matter for several important aspects of retirement planning. Next, Table 7 considers additional components of retirement decision making. In Table 7, Panel A we see a similar pattern to that found in the previous two tables. More patient individuals are planning more and participating at a higher rate in supplemental savings plans. The planning result holds for both the subjective and objective measures, while the difference in participation rates is only statistically significant according to the subjective measure, that is, self-reported participation in supplemental plans. This echoes several earlier findings that we have more predictive power on subjective measures than objective measures.

[Table 7]

Panel B, Table 7 considers an individual's expected retirement age. First, self-reported planned retirement age is derived from a survey response as to the age at which the individual plans to "stop working full-time for your current employer and begin receiving retirement benefits." Second, calculated retirement age is constructed using the administrative data to determine the earliest age at which the individual can retire and receive a full benefit. We impute a calculated normal retirement age using age at survey and years of service, as described in

Section II. First, comparing Columns 3 and 4, we see that, on average, the patient individuals

expect to retire 0.6 years later, which is highly statistically significant and qualitatively large

considering everyone in the sample is over age 50. In contrast, there is a much smaller

difference in retirement ages of more and less patient individuals when considering the

calculated normal retirement age imputed from the administrative data.

Next in Panel B, Table 7, we calculate for the individual the difference between their

self-reported planned retirement age and our imputed normal retirement age. We see that on

average the difference in these two ages is 0.5 years, while there is a large difference between the

patient and impatient groups. The more patient individuals plan to retire 1.2 years later, on

average, than their imputed normal retirement age. This suggests that more and less patient

individuals have meaningfully different retirement plans. Further, the differences in more and

less patient individuals are not completely captured by characteristics that are observed in the

administrative data, such as the variables used in the retirement age calculation (years of service

and age at survey). This suggests that our time preference measure is discerning between

individuals who are planning for retirement in systematically different ways.

That said, we cannot draw precise interpretations of the differences in planned retirement

ages because of the multitude of factors that are involved in planning one's retirement age and

reporting these plans on a survey. Planning to retire later can be a sign of serious consideration

to one's retirement preparedness but can also be a sign of a lack comfort with one's current level

of retirement preparedness. While we cannot differentiate between these two scenarios, we

stress the importance of demonstrating that more and less patient individuals appear

systematically different in terms of retirement planning and specific retirement plans. There are

several possible interpretations of the finding that more patient individuals report later planned

retirement ages but appear in the administrative data as having the ability to retire at similar ages as less patient individuals.

It is possible that both more and less patient individuals plan to retire when they reach the age of "normal retirement" (i.e., the age at which they can retire and begin receiving an unreduced benefit). Under this possibility, the results in Table 7 would say that more patient individuals are systematically overestimating their age of normal retirement. However, more patient individuals have a higher propensity to plan, relative to less patient individuals, and learning one's age of normal retirement would likely be learned in the planning process. As a result, we do not believe that more patient individuals are trying to report their age of normal retirement but are simply less accurate at estimating this age, relative to less patient individuals. Given this, we interpret these results as saying that more patient individuals plan to retire later, given their age of normal retirement, and that this decision is possible the result of more patient individuals' planning behavior or preferences.

Next, Panel C, Table 7 presents the percentage of respondents who selected each answer choice on the survey question concerning plan to work after retirement. Most individuals plan to work after retirement, primarily planning to work part time, yet we see no differences between more and less patient individuals in work after retirement plans. It is striking that the post-retirement work plans are so similar across these two groups, despite the large differences on so many other dimensions including planning, supplemental plan participation, and retirement age. When interpreting these findings, it is important to keep in mind that there are many reasons why individuals do or do not plan to work after retirement. Individuals who feel their retirement savings will be inadequate may plan to work after retirement because they feel it will be necessary, while other individuals may plan to work after retirement to stay active. The former

group may include many of the individuals who are not planning and are less patient, while the latter group may include many of the individuals who are planning and are more patient.[24]

Finally, we consider the respondents' perceived necessary replacement rate. As described above, we calculate this measure as the respondent's expected income needed in retirement (as reported on the survey) divided by her current salary (as reported on the survey). The salary of the individual's spouse is included, if applicable. As shown in Panel D, Table 7, more patient individuals have a perceived replacement rate equal to 81.7 percent, on average, while less patient individuals report more income needed in retirement, relative to their current salary. The difference in the average replacement rates of more and less patient individuals is 6.2 percentage points, which is large and statistically significant. While those who are less patient plan to retire earlier and plan to work after retirement at similar rates as those who are more patient, less patient individuals perceive that they will need meaningfully more income in retirement.

One interpretation is that the income that less patient individuals perceive that they will need in retirement is inflated by their lower propensity to plan. The behavioral literature has demonstrated that many behavioral biases have ambiguous effects on savings behavior (Loewenstein and Prelec 1992). In this setting, over-consuming now, relative to one's retirement

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[24] This conclusion is supported by respondents' stated motivations for their post- retirement work plans. Planners were more likely to answer "I want to keep active" as a reason for working after retirement (68.7 percent versus 48.7 percent for non-planners). Non-planners were more likely to answer "I cannot afford to retire full-time" (43.7 percent versus 22.5 percent for planners). Similarly, planners that chose to completely withdraw from the labor force were more likely to explain their decision by answering "expect to have enough money in retirement" than non-planners (64.8 percent versus 34.3 percent). Non-planners were more likely to give reasons such as poor health (7.8% versus 3.3%) or low expected job prospects (22.3% versus 7.7%) as their reasons for not working after retirement.

years, and under-planning for consumption in retirement may jointly explain why these less patient individuals believe they will need a high level of income once retired. This high perceived level of necessary income in retirement stands in contrast to the low level of savings that less patient individuals have amassed, which is at least partially due to their lack of planning. Finally, examining the missing expected income responses, we can observe that less patient individuals were also less likely to report an expected needed income in retirement, which can also be interpreted as an indicator for their lack of planning.

V. Plan Realizations

We next consider whether the plans made for retirement are ultimately realized. While our data allow for only a short follow-up timeframe for this exercise, it is still useful to compare stated plans with actual retirement decisions. RSD provided us with a snapshot of work status as of September 2015, which can be compared with our survey data on active employees collected between April and June of 2014.[25] Thus, we can observe whether retirement plans were realized for those planning to retire within about a year (and whether those not planning to retire within a year ultimately did so).

To consider whether retirement plans are realized, we focus on individuals who reported their planned retirement age.[26] The survey asked respondents their anticipated retirement *age,* not date. Using the administrative data, we calculate the age of respondents at time of survey for the email sample and the age of respondents as of June 1st, 2014 for the print sample. We calculate the difference between self-reported planned retirement age and their imputed age at

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[25] We received our first email survey response on April 1st, 2014 and our last email survey response on June 17th, 2014. The last retirement date we observe in the administrative data is September 21st, 2015. Therefore we observe retirements approximately 15 to 18 months from completing the survey.

[26] The sample also excludes eight deceased individuals.

the time of the survey. Table 8 presents a regression analysis of plan realization and presents strong evidence that retirement plans are actually realized. The dependent variable in Table 8 equals one if the individual retired (i.e., terminated employment and initiated benefits) as of September 2015. Column 1 regresses individuals' planned years until retirement on whether they have retired. We do not impose much structure on the relationship between planned age of retirement and retiring and instead use dummy variables for planned age of retirement being the same as current age, within one year, within two years, and within three to five years. The omitted category is planned age of retirement more than five years from current age.

[Table 8]

We find that plans are highly predictive of actual retirement decisions. Individuals who reported planning to retire at their current age were 86.7 percentage points more likely to retire than those whose self-reported planned retirement age was in more than five years. This is a large effect relative to the mean retirement rate of 15.5 percent in this timeframe. Column 2 shows that this continues to be the case when we control for retirement eligibility by including the calculated years until normal retirement. Column 3 then adds the full set of regressors from the earlier regression tables; planned years until retirement continues to be strongly correlated with actual retirement. Finally, Column 4 includes calculated years until early retirement, instead of normal retirement, and finds that the results do not depend on the early/normal retirement distinction.

The effect size of planned years until retirement, as shown in Table 8, suggests that an individual is about 80 percentage points more likely to have retired (as of September 2015) if their current age is their planned retirement age. An individual is about 70 percent more likely to retire if their planned age of retirement was within a year. However, we are less interested in the

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specific effect size, and more interested in the association of planned retirement age and actual retirement age. Table 8 strongly suggests that plans matter, in the sense that stated plans from our survey are highly predictive of actual decision making in retirement from the administrative records. By combining detailed administrative records with a large-scale survey, we make a novel contribution to the literature on retirement planning in showing that stated retirement plans matter because they predict later retirement decisions.

VI. Conclusion

We study the predictive power of risk and time preferences in the determination of retirement planning behavior, including subjective and objective measures of planning, supplemental savings plan contributions, wealth accumulation, planned age at retirement, and plans for working after retirement from a career job in the public sector. After demonstrating the importance of financial literacy, we show that our measures of time preferences have an association with retirement planning that is more robust, in quantitative and statistical terms, than the association of planning with our measures of risk preferences. It is intuitive that planning for lifetime income security over a long horizon will be heavily dependent on an individual's time preferences but the literature has been more focused on risk preferences.

We show the importance of financial literacy and time preferences using a new data set that is well suited for understanding retirement planning and preparedness. By combining survey data and administrative reports, the analysis considers retirement decision making from a broad perspective. Further, our survey allows us to classify individuals as more or less patient based on their reported preference between hypothetical intertemporal income patterns. In addition to being more likely to report having formulated a retirement plan, more patient individuals participate in supplemental plans more often, contribute to supplemental plans at higher levels,

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and plan to retire at older ages. These results suggest that behavioral aspects of decision making (such as impatience and time inconsistency) tell us something important about how individuals prepare for retirement.

We find that low levels of planning are partially driven by individuals' preferences, including their behavioral biases (time inconsistency). Deriving policy implications of our results requires an understanding of the mechanisms through which these innate preferences and biases affect behavior. To do so, we draw on the insights in recent work using a field experiment to understand retirement savings decisions. Goda et al. (2015) find that it is possible to counteract behavioral biases, if the nature of these biases is understood. Given the important role we document for time preferences, the results of Goda et al. (2015) suggest that policymakers in our empirical setting could "nudge" individuals to take actions today that increase their retirement preparedness in the future. Interventions can motivate individuals to engage in planning by altering the way that individuals trade-off the costs of planning today relative to the delayed benefits of planning that are received in the future. This is suggestive that something as simple as a small incentive to attend a retirement workshop during individuals' normal work hours, while still receiving their normal pay, could increase the retirement preparedness of the workforce.

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Table 1: Descriptive Statistics

	Full Sample	Subjective Planning	
		Yes	No
	(1)	(2)	(3)
Number of Observations	2,024	954 (47.1%)	1,070(52.9%)
Demographics:			
Salary	$52,477	$57,715	$47,806
Objective years until early retirement	-0.12	-0.79	0.47
Objective years until full retirement	5.02	4.28	5.68
Earned years of service	16.63	17.57	15.79
Age at survey	56.81	57.26	56.42
Married female	45.16%	48.85%	41.87%
Single female	23.67%	19.39%	27.48%
Married male	24.31%	26.42%	22.43%
Single male	6.87%	5.35%	8.22%
College degree	63.14%	70.65%	56.45%
Non-white	22.78%	18.03%	27.01%
Home Owner	86.22%	92.56%	80.56%
Print sample	22.58%	14.47%	29.81%
Self-reported healthy	61.12%	69.50%	53.64%
Dependent children	37.06%	34.28%	39.53%
Teacher	29.74%	32.29%	27.48%
University Employee	12.94%	12.79%	13.08%

Notes: Data are from merged administrative and survey data of public sector workers in North Carolina. Means of continuous variables and percentages of dichotomous variables are presented. Subjective planning is defined as self-reporting having made a retirement plan. For details on the variable definitions, see Appendix A.

Table 2: Preferences, Knowledge, and Retirement Planning

	Number of Obs.	Full Sample (1)	Subjective Planning Yes (2)	No (3)
Number of Observations (Full Sample)	2,024		954	1,070
			(47.1%)	(52.9%)
Alternative Planning Measures:				
ORBIT Log-in past 12 months	2,024	67.49%	77.04%	58.97%
ORBIT Self-Service Estimate past 12 months	2,024	53.56%	63.84%	44.39%
Subjective supplemental plan participation	1,948	73.72%	82.10%	66.28%
Objective supplemental plan participation	2,024	44.17%	50.31%	38.69%
Self-reported contribution level among participants	1,085	8.98%	11.18%	6.31%
Self-reported non-housing wealth	1,548	$190,019	$284,021	$97,224
Additional Aspects of the Retirement Plan:				
Planned retirement age	1,895	62.75	62.23	63.23
Blank planned retirement age	2,024	6.37%	4.93%	7.66%
Plan to work after retirement	1,992	73.04%	70.26%	75.55%
Blank planned work after retirement	2,024	1.58%	0.94%	2.15%
Imputed expected replacement rate	1,508	84.57%	80.99%	88.13%
Blank on expected income or salary information	2,024	25.49%	21.38%	29.16%

Notes: Data are from merged administrative and survey data of public sector workers in North Carolina. Means of continuous variables and percentages of dichotomous variables are presented. Subjective planning is defined as self-reporting having made a retirement plan. For details on the variable definitions, see Appendix A.

Table 3: Preferences, Knowledge, and Retirement Planning

| | Full Sample | Subjective Planning | |
| | | Yes | No |
	(1)	(2)	(3)
Number of Observations (Full Sample)	2,024	954	1,070
		(47.1%)	(52.9%)
Panel A: Risk and Time Preferences			
More patient: Lottery frame	46.54%	53.46%	40.37%
More patient: Benefit frame	34.19%	39.10%	29.81%
More risk averse	67.49%	68.34%	66.73%
Panel B: Financial Literacy			
High financial literacy: 3 of 3 correct	30.73%	36.79%	25.33%
Moderate financial literacy: 2 of 3 correct	46.39%	47.06%	45.79%
Self-reported financial knowledge	4.23	4.68	3.83
Sought formal sources of financial information	67.05%	77.88%	57.38%
Sought informal sources of financial information	18.18%	14.05%	21.87%

Notes: Data are from merged administrative and survey data of public sector workers in North Carolina. Means of continuous variables and percentages of dichotomous variables are presented. Subjective planning is defined as self-reporting having made a retirement plan. For details on the variable definitions, see Appendix A.

Table 4: Linear Probability Model Estimates of Subjectively Measured Planning

	(1)		(2)	
More patient: Lottery frame	0.061**	(0.022)	0.042+	(0.022)
More patient: Benefit frame	0.061**	(0.023)	0.059**	(0.023)
More risk averse	0.030	(0.027)	0.029	(0.026)
Financial literacy: High	0.120***	(0.031)	0.054+	(0.032)
Financial literacy: Medium	0.085**	(0.027)	0.045+	(0.027)
Self-reported financial knowledge	0.117***	(0.008)	0.103***	(0.008)
Years until eligible for full retirement			-0.013***	(0.003)
Years of service			-0.002	(0.002)
Annual 2013 salary (10 k)			0.013*	(0.005)
Married male			-0.052*	(0.027)
Single female			-0.083**	(0.027)
Single male			-0.142***	(0.043)
College degree			0.032	(0.026)
Non-white			-0.021	(0.026)
Home owner			0.108***	(0.031)
Print sample			-0.121***	(0.026)
Self-reported healthy			0.070**	(0.022)
Dependent children			-0.058**	(0.022)
Teacher			0.014	(0.025)
University Employee			-0.064*	(0.032)
Mean	0.471		0.471	
Adjusted R squared	0.126		0.186	
Observations	2,024		2,024	

Notes: In all columns, the dependent variable is subjective planning, which is defined as a self-report of having made a retirement plan. Coefficients are estimated using a linear probability model. All regressions include dummies for those that answered don't know when asked the risk and time preferences questions. Standard errors are in parentheses. + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table 5: Additional Aspects of Planning

	ORBIT log-in	ORBIT self-service estimate	Self-reported supplemental plan participation	Objective supplemental plan participation	Self-reported contribution rate for participants	Self-reported non-housing wealth
	(1)	(2)	(3)	(4)	(5)	(6)
More patient: Lottery frame	-0.006	0.001	0.049[*]	0.034	1.629[*]	28,748.917[*]
	(0.018)	(0.021)	(0.021)	(0.022)	(0.763)	(13,269.588)
More patient: Benefit frame	0.036[+]	0.017	0.002	0.010	-1.057	25,327.529[+]
	(0.019)	(0.021)	(0.022)	(0.023)	(0.767)	(13,667.504)
More risk averse	0.035	0.028	-0.028	-0.029	-0.176	-17,292.073
	(0.022)	(0.025)	(0.025)	(0.027)	(0.881)	(15,588.039)
Financial literacy: High	0.036	0.069[*]	-0.001	0.039	0.923	54,210.820[**]
	(0.027)	(0.030)	(0.031)	(0.033)	(1.119)	(19,534.307)
Financial literacy: Medium	0.031	0.053[*]	-0.009	-0.009	-0.196	15,795.314
	(0.023)	(0.026)	(0.027)	(0.028)	(1.019)	(17,295.349)
Self-reported financial knowledge	0.026[***]	0.022[**]	0.006	0.011	1.183[***]	32,522.254[***]
	(0.007)	(0.008)	(0.008)	(0.009)	(0.303)	(5,104.900)
Years until eligible for full retirement	-0.015[***]	-0.010[***]	0.003	0.007[*]	-0.159	-7,451.277[***]
	(0.003)	(0.003)	(0.003)	(0.003)	(0.114)	(1,989.556)
Years of service	-0.001	0.005[**]	0.003[+]	0.012[***]	-0.160[**]	-5,003.018[***]
	(0.001)	(0.002)	(0.002)	(0.002)	(0.060)	(1,034.917)
Annual 2013 salary (10 k)	0.003	0.015[**]	0.020[***]	0.011[+]	0.057	24,919.377[***]
	(0.004)	(0.005)	(0.005)	(0.005)	(0.161)	(3,115.275)

	ORBIT log-in	ORBIT self-service estimate	Self-reported supplemental plan participation	Objective supplemental plan participation	Self-reported contribution rate for participants	Self-reported non-housing wealth
	(1)	(2)	(3)	(4)	(5)	(6)
Married male	-0.016	-0.019	-0.068**	-0.037	-2.698**	-67,161.798***
	(0.022)	(0.025)	(0.026)	(0.027)	(0.920)	(16,067.442)
Single female	0.012	-0.000	-0.089***	-0.058*	-3.449***	-108,432.037***
	(0.022)	(0.025)	(0.026)	(0.027)	(0.945)	(16,037.737)
Single male	-0.047	-0.033	-0.075+	-0.027	-3.674*	-103,916.848***
	(0.036)	(0.040)	(0.042)	(0.044)	(1.499)	(26,602.115)
College degree	0.006	-0.014	-0.001	0.026	1.454	45,741.226**
	(0.022)	(0.024)	(0.025)	(0.027)	(0.898)	(15,949.822)
Non-white	-0.035	-0.060*	0.027	0.038	-2.445**	-52,482.040**
	(0.022)	(0.024)	(0.025)	(0.027)	(0.913)	(16,390.220)
Homeowner	0.021	0.019	0.082**	0.074*	1.481	45,964.501*
	(0.026)	(0.030)	(0.031)	(0.032)	(1.178)	(19,273.694)
Print sample	-0.580***	-0.476***	0.001	0.019	-5.057***	-62,151.355**
	(0.022)	(0.024)	(0.025)	(0.027)	(0.906)	(21,930.273)
Self-reported healthy	0.014	0.018	-0.006	-0.009	0.689	19,985.389
	(0.018)	(0.020)	(0.021)	(0.022)	(0.756)	(13,118.179)
Dependent children	0.018	-0.023	-0.022	-0.011	-1.627*	-17,455.831
	(0.018)	(0.021)	(0.021)	(0.022)	(0.755)	(13,223.678)
Teacher	-0.003	0.020	-0.131***	-0.342***	-1.035	-36,570.921*
	(0.021)	(0.024)	(0.025)	(0.026)	(0.904)	(15,297.173)
University Employee	0.014	0.007	-0.134***	-0.272***	-0.972	-14,726.463
	(0.027)	(0.030)	(0.031)	(0.033)	(1.086)	(18,853.091)
Mean	0.675	0.536	0.737	0.442	8.978	190,019
Adjusted R squared	0.344	0.278	0.041	0.132	0.110	0.241
Observations	2,024	2,024	1,948	2,024	1,085	1,548

Notes: The dependent variable is indicated in the column header. ORBIT log-in (Col. 1), ORBIT self-service estimate (Col. 2), and participation in a state-managed supplemental plan (Col. 4) are all derived from administrative records. Participation in any supplemental retirement saving plan (Col. 3), contribution rate among participants (Col. 5), and non-housing wealth (Col. 6) are all self-reported in the survey data. Coefficients are estimated using a linear probability model (Columns 1-4) or OLS (in Columns 5-6). All regressions include dummies for those that answered don't know when asked the risk and time preferences questions. Standard errors are in parentheses. + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table 6: Subjective planning by time preferences for different subsamples

	N	Full sample	Less Patient	More Patient	Difference (4)-(3)
	(1)	(2)	(3)	(4)	(5)
Panel A					
Full Sample	1,883	0.476	0.411	0.541	0.130***
					(0.023)
Panel B (N = 1,770): Self-reported years until retirement					
< 2 years until retirement	387	0.646	0.570	0.727	0.157**
					(0.048)
2-5 years until retirement	479	0.514	0.434	0.595	0.161***
					(0.045)
5-10 years until retirement	564	0.441	0.374	0.509	0.135**
					(0.041)
10+ years until retirement	340	0.326	0.282	0.367	0.085$^+$
					(0.050)
Panel C: Gender and marital status					
Female married	839	0.518	0.460	0.586	0.126***
					(.034)
Female single	448	0.384	0.362	0.406	0.044
					(0.046)
Male married	466	0.521	0.402	0.619	0.217***
					(0.045)
Male single	130	0.362	0.255	0.440	0.185*
					(0.082)
Panel D: Gender and earnings					
Female with salary less than $50k	722	0.411	0.373	0.463	0.090*
					(0.037)
Female with salary of $50k+	565	0.549	0.511	0.581	0.070$^+$
					(0.042)
Male with salary less than $50k	260	0.369	0.252	0.504	0.252***
					(0.058)
Male with salary of $50k+	336	0.577	0.504	0.621	0.117*
					(0.056)
Panel E: Gender and education					
Female without college degree	451	0.386	0.373	0.406	0.033
					(0.047)
Female with at least college degree	836	0.518	0.463	0.570	0.107**
					(0.034)
Male without college degree	232	0.371	0.273	0.490	0.217***
					(0.062)
Male with at least college degree	364	0.560	0.463	0.618	0.155**
					(0.053)

Notes: Patience is defined using the lottery framework. The sample size is 1,883 and excludes the 241 individuals who responded 'don't know' to the lottery question except in Panel B where an additional 113 respondents did not report a planned retirement age. Cells show the fraction of individuals who engaged in planning using the subjective measure of having made a retirement plan. Column 4 is the difference subtracting less patient from more patient with standard errors in parentheses. + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table 7: Alternative Measures of Planning and Time Preference

	N	Full sample	Less Patient	More Patient	Difference (4)-(3)
	(1)	(2)	(3)	(4)	(5)
Panel A					
Subjective planning	1,883	0.476	0.411	0.541	0.130***
					(0.023)
ORBIT log-in past 12 months	1,883	0.683	0.650	0.717	0.061**
					(0.021)
ORBIT self-service estimate	1,883	0.541	0.504	0.579	0.072**
					(0.023)
Subjective participation	1,815	0.740	0.710	0.769	0.059**
					(0.020)
Objective participation	1,883	0.443	0.425	0.461	0.036
					(0.023)
Panel B					
Self-reported planned retirement age	1,770	62.784	62.458	63.112	0.654**
					(0.200)
Calculated normal retirement age	1,770	61.842	61.766	61.917	0.151
					(0.196)
Difference (Subjective – Objective)	1,770	0.943	0.692	1.194	0.503**
					(0.167)
Blank planned retirement age	1,883	0.060	0.058	0.062	0.003
					(0.011)
Panel C					
Work Full time	1,883	0.116	0.118	0.114	-0.004
					(0.015)
Work part time	1,883	0.606	0.608	0.604	-0.004
					(0.022)
Not work at all	1,883	0.266	0.261	0.271	0.009
					(0.020)
Blank work after retirement	1,883	0.012	0.013	0.012	-0.001
					(0.005)
Panel D					
Imputed expected replacement rate	1,437	84.6%	87.8%	81.7%	-6.181*
					(2.513)
Blank on expected income or salary information	1,883	0.237	0.273	0.201	-0.072***
					(0.019)

Notes: Patience is defined using the lottery framework. Each row indicates a different measure of retirement planning. The sample size differs by row due to item non-response and excludes individuals who responded 'don't know' to the lottery question. Cells show the means of each measure of planning by row for the full sample (Column 2) and then by time preferences (Columns 3 and 4). Column 5 is the difference subtracting less patient from more patient with standard errors in parentheses. + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 8: Plan Realizations

	Baseline	+ Objective Retirement Eligibility	+ Covariates	Early Retirement Eligibility
	(1)	(2)	(3)	(4)
Planned age is current age	0.866***	0.800***	0.783***	0.796***
	(0.031)	(0.033)	(0.034)	(0.033)
Planned age is current age +1	0.723***	0.660***	0.655***	0.667***
	(0.021)	(0.024)	(0.024)	(0.024)
Planned age is current age +2	0.338***	0.284***	0.282***	0.293***
	(0.022)	(0.024)	(0.024)	(0.023)
Planned age in 3-5 years	0.062***	0.024	0.023	0.029+
	(0.014)	(0.016)	(0.016)	(0.015)
Years until eligible for full retirement		-0.009***	-0.006**	
		(0.002)	(0.002)	
Years until eligible for early retirement				-0.004+
				(0.002)
More patient: Lottery frame			0.006	0.007
			(0.013)	(0.013)
More patient: Benefit frame			-0.002	-0.002
			(0.013)	(0.013)
More risk averse			0.000	0.001
			(0.015)	(0.015)
Financial literacy: High			-0.048**	-0.048**
			(0.018)	(0.018)
Financial literacy: Medium			-0.031+	-0.031+
			(0.016)	(0.016)
Self-reported financial knowledge			-0.001	-0.001
			(0.005)	(0.005)
Years of service			0.002	0.002+
			(0.001)	(0.001)
Annual 2013 salary (10 k)			-0.000	-0.000
			(0.003)	(0.003)
Married male			0.036*	0.038*
			(0.015)	(0.015)
Single female			0.015	0.016
			(0.015)	(0.015)
Single male			-0.019	-0.017
			(0.025)	(0.025)
College degree			0.019	0.019
			(0.015)	(0.015)
Non-white			0.013	0.012
			(0.015)	(0.015)
Homeowner			0.023	0.023
			(0.018)	(0.018)
Print sample			-0.031*	-0.031*
			(0.015)	(0.015)
Self-reported healthy			-0.002	-0.001
			(0.013)	(0.013)
Dependent children			-0.004	-0.006
			(0.013)	(0.013)

	Baseline	+ Objective Retirement Eligibility	+ Covariates	Early Retirement Eligibility
	(1)	(2)	(3)	(4)
Teacher			0.043^{**}	0.042^{**}
			(0.015)	(0.015)
University Employee			0.004	0.004
			(0.019)	(0.019)
Adjusted R squared	0.505	0.512	0.517	0.515

Notes: In all columns, the dependent variable is claiming retirement benefits. The mean is 0.155 and the sample size is 1,888. Coefficients are estimated using a linear probability model. The omitted category is planned age of retirement being more than five years from current age. All regressions include dummies for those that answered don't know when asked the risk and time preferences questions. Standard errors are in parentheses. $+ \, p<0.10$, $* \, p<0.05$, $** \, p<0.01$, $*** \, p<0.001$.