

# **Informing Retirement Savings Decisions: A Field Experiment on Supplemental Plans**

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## **ABSTRACT**

Although supplemental saving plans can be an important part of an individual's financial security in retirement, contribution rates remain low, particularly among those with lower salaries and less education. We report findings from an intervention that provided information on key aspects of the employer-provided supplemental saving plans to older public employees in North Carolina. Among workers participating in a supplemental plan, individuals who received an informational flyer increased their contributions in the months following the intervention relative to the control group. In contrast, individuals who were not enrolled in a retirement saving plan were not moved to begin contributing to a supplemental plan. The results suggest that informational interventions can induce workers who are already engaged in the saving process to reassess their level of retirement preparedness.

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# **Informing Retirement Savings Decisions: A Field Experiment on Supplemental Plans**

## **I. Introduction**

Ensuring adequate retirement income is of foremost policy importance. But there is a tradeoff between financial security during an individual's working years and financial security in retirement. We present results from a field experiment that was designed to spur individuals to reassess their retirement savings decisions. The results of this informational intervention provide insights into the tradeoff between saving for the short/medium-term (for consumption during working years) and saving for the long-term (to provide income for the retirement years).

Our field experiment sent several versions of an informational intervention to randomly selected groups of older North Carolina state government employees. Our experimental design tailored one set of interventions to workers with positive balances in a supplemental saving plan (participants) and a different set of interventions to workers without savings in a supplemental plan (non-participants). Our treatments provided information to older workers with an emphasis on either tax advantages, longevity risk, personalized risk selection, or liquidity. Among participants, we find a small and statistically significant impact on retirement savings among treated workers. The group receiving the flyers was about 2.4 percentage points more likely to make a net change in contributions in the 9 months following the receipt of the flyer than the control group who received no flyer. This treatment effect represents approximately 14 percent of the sample mean. Non-participants did not respond to our intervention, which is consistent with the fact that non-participants who are over age 50 have consistently decided over many years not to contribute to a retirement saving plan.

Our intervention targeted public sector workers in North Carolina who were more than 50 years old. By focusing on older workers, we examine the role of informational interventions in the context of individuals who may be hard to encourage to increase their rate of savings. We expect that older workers are less likely to change their retirement saving behavior because their tenure in the workforce has given them numerous opportunities to formulate and implement retirement plans or to indicate their unwillingness to engage in saving additional funds for retirement. Workers who have for years declined the opportunity to enroll in a retirement saving plan may be expressing their preference for current consumption over saving for additional consumption in retirement. In fact, Biggs (2017) concludes that if low income, working-age households reduce their take-home pay in order to contribute to retirement plans their standards of living in retirement may exceed that while they are working. Thus, it may not be surprising that public employees with lower earnings have optimally chosen not to contribute to a supplemental retirement saving plan.

Alternatively, older workers may be resistant to changing saving behavior because the framing of policy interventions typically emphasizes compound interest as the key benefit of saving for retirement. This incentive is less important for older workers who have fewer remaining years to build savings (Clark, et al., 2014). Although compounding is an important benefit of retirement plans, older workers still experience several benefits from savings in employer-provided retirement plans. We designed our informational intervention to emphasize the benefits that older workers experience from increased retirement savings. For example, individuals may find that primary employer-provided defined benefit pension plans are inadequate to insure against longevity risk. Cost-of-living adjustments (COLA's) are typically

not guaranteed and usually are less than the annual increase in the Consumer Price Index leaving individuals susceptible to inflation risk in retirement.

Further, individuals may have not anticipated cost of medical expenditures in late life and thus find that income from Social Security and employer pensions is insufficient to achieve the desired level of consumption or to cover an unanticipated health or income shock at older ages. Thus, supplemental retirement saving plans can help workers obtain sufficient wealth prior to retirement and insure against unexpected health or income shocks.<sup>1</sup> Further, contributions can be made pre-tax and grow tax-deferred until withdrawal. We present results from a field experiment that was designed specifically to spur older workers to reassess their retirement savings decisions highlighting these alternative motivations for participation in retirement saving plans.

Voluntary saving plans may be underutilized due to insufficient understanding of these plans, behavioral biases that lead to inaction, or a lack of financial literacy. Choi, Laibson, and Madrian (2004) show the importance of clarity in plan design. Behavioral factors associated with undersaving include hyperbolic discounting (Laibson, 1997), a lack of self-control (Thaler and Shefrin, 1981), and procrastination (Choi, Laibson, Madrian, and Metrick, 2003). Further, the behavioral economics literature has stressed the role of framing, which matters for retirement savings as well. For example, Goldin, Homonoff, and Tucker-Ray (2017) find larger responses to an intervention that emphasized low rather than high contribution rates. Finally, financial literacy has been shown to play an important role in saving and other financial decisions and increased financial literacy has been promoted as a policy priority (Lusardi, 2005; Van Rooij,

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<sup>1</sup> Throughout this discussion, the term “supplemental retirement saving plans” refers to employer-provided retirement saving plans such as 401(k) and 457 plans that are based on payroll deductions as contributions to the plans.

Lusardi, and Alessie, 2012; Hastings, Madrian, and Skimmyhorn, 2013; Lusardi and Mitchell, 2014.). On the other hand, non-participation or participation at low levels could be the result of a well-formulated retirement plan, and individuals may have adequate wealth accumulated through outside savings vehicles and pension plans.

Bernheim and Rangel (2005) argue for interpreting the results of policy interventions without paternalistic prior beliefs on welfare enhancing behavior at the individual level. Thus, we consider both increases in contributions and net changes. Our informational intervention led a small but significant number of older workers to change their retirement savings behavior. Low cost interventions like ours are thus a valid tool to improve retirement income security when targeted to individuals who are already engaged in the saving process. These results indicate that there is a role for information provision in ensuring the retirement preparedness of workers, even those nearing retirement.

## **II. Background on Supplemental Saving Plans**

This study considers state government employees in North Carolina. North Carolina is a particularly interesting state to study given its large size and mix of urban and rural population. All state employees in North Carolina are covered by a standard defined benefit pension plan and retiree health insurance. State employees in North Carolina also have access to two state-managed supplemental retirement saving plans: NC 401(k) or NC 457. Both plans are managed by Prudential and have similar investment options.<sup>2</sup>

Individuals contribute a fraction of their salary to an account that accumulates without any tax on investment returns until the time of the withdrawals. Both 401(k) and 457 plans allow

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<sup>2</sup> Clark, Pathak, and Pelletier (2017) and Clark, Hanson, Morrill, and Pathak (2016) explore how plan differences affect choices between 401(k) and 457 plans.

employees to make pre-tax contributions. The North Carolina plans also offer Roth options that allow employees to contribute after-tax dollars to the plan. At the time of the experiment in 2014, annual dollar limits imposed by the IRS on employee contributions were \$17,500 in both plans, and both plans had the same age 50 and over catch-up provisions that allow older workers to contribute an additional \$5,500 per year. IRS regulations allow public employees to contribute up to the maximum in both plans. Thus, a state government employee over the age 50 could contribute up to a total of \$46,000 in combined contributions.<sup>3</sup>

Distributions without tax penalties are allowed at retirement after age 55 in the 401(k), while the 457 plans allow such distributions at termination of employment at any age. This may be an important distinction as many public employees retire from their career state jobs in their early 50s. In-service distributions are allowed prior to age 59½ in 401(k) plans with a 10 percent tax penalty. In-service distributions are not allowed in 457 plans. Thus, workers who wish to maintain the ability to access their fund prior to retirement may be more likely to contribute to 401(k) plans. Both plans allow rollovers to other retirement saving plans or IRAs.

Most of the evidence on voluntary retirement saving plans is derived from the analysis of private sector 401(k) plans. These plans are often the only retirement plan offered by firms, so they are actually primary rather than supplemental retirement plans. While many of the same behavioral factors affecting private workers saving decisions in primary 401(k) plans will be relevant to workers considering participation in supplemental plans, individuals covered by a defined benefit plan with access to a supplemental plan may have determined that their retirement savings (pension plus Social Security) to be adequate.

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<sup>3</sup> These contribution limits have been increased so in 2017, participants can contribute up to \$18,000 annual with catch-up contributions of \$6,000 allowed for employees over age 50.

### **III. Design of the Intervention**

The North Carolina Retirement System sent our informational flyers to a randomly selected group among active state employees ages 50-69 with valid email addresses. Individuals were first grouped according to pre-treatment participation status in a supplement plan. The Retirement System selected all workers who had an active account with a balance of more than \$1 and year to date contributions of less than \$10,000 to form the current participants sample. The current non-participants sample consisted of workers with no current account. Details of the data construction are included below.

#### **A. Current Participants**

We developed alternative versions of an informative flyer aimed at increasing contributions to the supplemental retirement saving plans. The participant group was randomized into a control group and three treatment groups (Baseline, Longevity, and Tax Advantage). The control group received no flyer. Figure 1 displays the informational interventions that were sent to those in the treated participants group. The baseline group received a flyer with general information about the supplemental saving plans, including a direct link to the plan provider's website to facilitate activity. The baseline flyer also provided information on catch-up provisions, which raise yearly contribution limits for individuals ages 50 and older. Note that all employees in our sample population qualify for this benefit. Given our focus on older workers, information about these catch-up provisions was a key part of the design.

[Figure 1]

The longevity and tax advantage group received the baseline flyer plus additional information that had a specific target. Figure 1 illustrates the additional text within a red box. The longevity flyer was a negative framing and included information on average life expectancy

when retiring at age 65 and the need to save to offset any future out-of-pocket medical expenses. The tax advantage flyer was a more positive framing by emphasizing the tax-advantaged nature of supplement saving plan contributions. The tax advantages of saving for retirement through supplemental saving plans are frequently discussed among economists and financial advisors but it is unclear how widely understood this information is for a typical individual in the population (Lusardi and Mitchell, 2014).

### **B. Current Non-participants**

The non-participant group was randomized into a control group and four treatment groups (Baseline, Longevity, Liquidity, and GoalMaker). Figure 2 displays the informational interventions that were sent to treated non-participants. As with participants, the control group received no flyer. The baseline group received a flyer including a direct link to open an account and emphasizing catch-up provisions. Similar to the participants group, the longevity group received the baseline flyer with additional information targeted toward extended time spent in retirement. The liquidity group received the baseline flyer with additional information emphasizing the availability of supplemental plan withdrawals for older workers prior to retirement.<sup>4</sup> Finally, the GoalMaker group received the baseline flyer with additional information about the ease of personalizing investment decisions through a risk tailoring feature known as GoalMaker.<sup>5</sup> GoalMaker allows individuals to select a specific risk profile for their investments by answering a series of straightforward questions, thereby avoiding choice overload

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<sup>4</sup> Note that only non-participants received a flyer emphasizing the ability to take in-service distributions out of concern that we might inadvertently encourage withdrawals from those who already have supplemental retirement savings in the state-managed plans.

<sup>5</sup> A description of GoalMaker is provided by Prudential at:  
<http://www.retire.prudential.com/media/managed/iratoolkit.pdf>, [accessed July 10, 2017].



or a reliance on financial sophistication. GoalMaker automatically alters the investments in the saving account to fit the risk profile selected by the participant. The objective of this intervention was to reduce the concerns of individuals who doubted their ability to manage investment accounts about participating in a retirement saving plan.

[Figure 2]

### **C. Data**

With the North Carolina Retirement System, we developed a sample of 14,560 active workers at NC state agencies, ages 50-69 as of November 2014.<sup>6</sup> The sample includes individuals enrolled in the Teachers' and State Employees' Retirement System (TSERS) who have never previously retired or claimed long-term disability, who are actively employed through December 31, 2014, and who have an email address available on record.<sup>7</sup> The sample excludes individuals with an active account with an account balance below \$1 or year to date contributions exceeding \$10,000. In addition, the sample excludes individuals with outstanding loans against their pension account balance, suspended accounts, or those who received employer contributions in 2014.

The Retirement System provided us with administrative data on all sample individuals at three points: October 31, 2014, December 31, 2014, and August 15, 2015. The administrative records allow us to construct data on whether the individual has an active account and, if so,

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<sup>6</sup> More information about the data is provided in Appendix A.

<sup>7</sup> Teachers and other school personnel are excluded from this study because all North Carolina school districts also offer employees the opportunity to invest in 403(b) plans and in some cases, locally-managed 457 plans. We do not have access to the contributions and account balances in any locally-managed plans that are widely used by teachers. Thus, these individuals were deleted from the sample.

what type of plan, balance in each plan, and year-to-date contributions in each plan.<sup>8</sup> We supplement these cross-sectional data with longitudinal data from October 1 – December 31, 2014, which include observations on account openings and contribution changes (increases or decreases) and the exact date the change was made. For those who made a contribution change, we observe the original contribution level and the new contribution level.<sup>9</sup> Finally, for all individuals, we observe years of service, salary, state agency of employment, age, and gender.

Table 1 presents characteristics of employees in our full data and then separately for current participants and current non-participants. Column (4) presents p-values of the differences between participants and non-participants. Throughout, we use nonparametric tests for consistency with the experimental economics literature; discrete variables are tested using a difference in proportions test, while continuous variables are tested using a difference in medians test. In all analysis, we summarize continuous outcomes using medians. About 44 percent of the sample is male, and men are no more likely to be participants than women. Even though the sample is restricted to those ages 50 and older, the median age of non-participants is about one year older. More importantly, we impute age at hire for individuals and observe that the median age of non-participants, 45 years old, is about 5 years older than participants. This suggests that non-participants may be more likely to have worked prior to state agency employment and may have outside retirement savings (e.g., a 401(k) plan from prior employer). We do not have data on individuals' access to or participation in supplemental plans outside of the state-managed supplemental retirement saving plans.

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<sup>8</sup> Appendix A provides detail on how these terms are defined in our data.

<sup>9</sup> Plan participants may elect to make contributions of a given amount or at a given rate (percent of salary). Using 2014 salary information, we convert rate contributions to amounts.

[Table 1]

We observe that non-participants have a lower median salary than participants. This is consistent with those with lower earnings having higher replacement rates from Social Security, thus indicating a lower need for additional retirement savings (Biggs 2017). Individuals with lower annual earnings also may have less ability to save given demands for current consumption. We also observe that the median years of service for participants is 18 relative to only 12 for non-participants. Given the similarity in median age, the difference in years of service between the groups is likely due to age at hire (as noted above).

#### **D. Validity of Experimental Design**

The retirement system sent email flyers containing information on supplemental saving plans over a three day period: Wednesday, November 12 through Friday, November 14, 2014.<sup>10</sup> To demonstrate the validity of randomization, Table 2 presents summary statistics for individuals in the treatment and control groups separately for participants and non-participants. In Panel A, the treatment-to-control demographic differences are statistically insignificantly different for both participants and non-participants. Panel B shows two measures of saving behavior for participants. The pre-treatment plan balance of the treatment and control groups are very similar. The median total balance is \$16,363 for the treatment group and \$16,368 for the control group. For year-to-date contributions, the median contribution through October 31, 2014 is \$1,000 for

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<sup>10</sup> The flyers were distributed by the Retirement Systems Division (RSD) at the North Carolina Department of State Treasurer (DST). To avoid an excessive increase in call volume in the supplemental plan administrator's call center, the distribution of flyers was staggered over the course of three days (November 12, 13, and 14, 2014). To reduce the load on email servers, two waves were distributed each day (8:00 AM and 8:05 AM).

both the treatment and controls groups. Despite having the same medians, the p-value from a medians test suggests a statistically significant difference between year-to-date contributions (i.e., slightly more treated individuals have an above-median year-to-date contribution relative to control individuals).<sup>11</sup> Given that these differences are small (again, the medians are exactly the same), we conclude that this is not a large concern.

[Table 2]

As a further demonstration of pre-intervention similarity between the treatment and control groups, we graphically present daily rates of contribution increases for those with a non-zero balance as of October 31, 2014 (i.e., the participant sample). A local polynomial regression fitted curve is overlaid.<sup>12</sup> Figure 3 illustrates these values for the month of October, which is prior to the intervention but also includes the open enrollment period. In Figure 3, we see treatment and control groups have similar patterns of contributions.

[Figure 3]

The daily rates of contribution increases among participants are small, where the average day in October saw 0.2 percent (i.e., two-tenths of one percent) of the participants sample

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<sup>11</sup> A two-sample medians test asks whether one group has a statistically dissimilar proportion of individuals for whom the variable takes a value above the median. When there is a mass point in the distribution at the median, “median ties” can confuse the interpretation of the test. For the treatment group, 48.52% of Total YTD Contributions are below \$1,000, 7.84% are equal to \$1,000, and 43.64% are above \$1,000. For the control group, the percentages are 48.93%, 9.99%, and 41.07%. The distribution of YTD Contributions is shown in Appendix Figure B1. This figure is consistent with the validity of randomization for this variable.

<sup>12</sup> A local polynomial regression is a nonparametric technique for flexibly modeling associations between two variables. Figures 3 and 4 use a bandwidth of seven days. Beyond the daily rates of contribution increases in Figures 3 and 4, Appendix Figures B2 and B3 present daily rates of contribution changes.

increase their contribution. It is not surprising that, on a randomly chosen day of the year, few individuals log into their supplemental saving plan provider's website to change their contribution. Further, note that October is the annual enrollment month for public sector employees to make elections for the State Health Plan in North Carolina. We were aware of the focal nature of October for a number of employee-benefit-related decisions, including obviously the health plan but also decisions regarding retirement savings. The timing of our intervention reflected a desire to avoid the annual enrollment month, worrying that the increased level of underlying activity in October would make precise estimates more difficult to obtain. The fitted curves for both the treatment and control groups present an intuitive pattern: slightly more activity at the beginning of October (when open enrollment begins) and at the end of October (just before open enrollment closes), relative to the middle of the month. There are no apparent treatment-control differences in the month prior to the intervention.

Figure 4 presents these daily rates for the month of November. The vertical line is the first date that a flyer was sent. Prior to November 12, we again see that treatment and control experienced similar contribution rate increases. We also observe that the average daily rate of contribution increases between November 1 and November 9 was around 0.1 percent. It is important to keep this scale in mind when interpreting the treatment effects that are discussed in the next section. The effect of the receiving the intervention is clearly shown to the right of the vertical lines in Figure 4. Contribution increases are strikingly higher in the treatment group as compared to the control group and the effect is concentrated just after the flyer was sent.

[Figure 4]

Figure 3 and the left panel of Figure 4, along with results in Table 2, demonstrate the validity of the experiment design and the similarity of the treatment and control groups. We

proceed with analysis of treatment relative to control using post-intervention data only, consistent with our setting of a randomized controlled trial.

#### **IV. Treatment Effects of the Informational Intervention**

##### **A. Aggregate Results for Participants**

The right panel of Figure 4 previews the main result that, among participants, the intervention was associated with more contribution increases in the treatment group relative to the control group. To get a better sense of magnitudes, Table 3 shows the rates of contribution increases and decreases. Here, the post-intervention period is defined as following the receipt of the email through December 31, 2014.<sup>13</sup> In all treatment columns, we test statistical significance relative to the control group using a difference in proportions test.

[Table 3]

The treatment group increases its contributions at a rate of 2.8 percent, cumulatively over the late November/December period. This is statistically significantly higher than the 1.8 percent rate for the control group, for a treatment effect of 1.0 percentage points. The treatment group also decreases contributions at a higher rate, 0.7 percent versus 0.5 percent, but this difference is not statistically significant. Interpreting these results requires additional information about individual's preferences and financial state. If we adopt a presumption that individuals are undersaving, then the appropriate metric for the effect of the intervention is the

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<sup>13</sup> That is, the activity of an individual in the treatment group is included in this analysis beginning of the day she received the flyer (either November 12, 13, or 14). For the control group, the control period starts November 12, which is conservative in the sense that any activity in the control group during any intervention send day is included for the control group, potentially increasing the control rate that we are netting out.

rate of contribution increases minus the rate of contribution decreases. If we instead rely on revealed preferences, the appropriate metric is the rate of contribution changes.

Our approach to the ambiguity in interpreting the results of policy interventions is to present a full picture of individuals' actions following the intervention. Table 3 thus shows the rate at which individuals made any change to their contribution rate.<sup>14</sup> All activity includes changes that left one's contribution rate identical to the pre-treatment rate (e.g., a rate increase of \$1,000, followed by a rate decrease of \$1,000). Treated individuals were statistically significantly more like to make any contribution changes at a rate of 3.6 versus 2.4 percent.

Next, we exploit the detailed nature of our data by following individuals through August 15, 2015, which is nine months after the intervention. We refer to this time period as medium-term actions. First, we observe that major account status changes were not affected by the treatment. These actions include the individual retiring, otherwise closing an account, suspending the account, or taking some other action that results in their account no longer being listed as "active" in the data. It is not surprising to see that our informational flyer did not influence these actions. For the sample of individuals with no major account status changes, the outcomes of interest are similar as before. Here, we can only observe net contribution changes because the cross-sectional data from August 15, 2015 do not allow us to construct a panel of contribution changes. Not surprisingly, we observe higher rates of activity overall in the medium-term. The medium-term is approximately 9 months, so we would anticipate contribution changes to be about 6 times the magnitude of the short-term actions. However,

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<sup>14</sup> It should be noted that we do not observe one-time contributions, so all results will understate the total behavioral response to the intervention.

these nine months involve moving into a new calendar year and tax preparation season, both of which may induce individuals to reassess their retirement decisions.

In Table 3, among active account holders in the medium-term, the control group increased contributions at a rate of 12.8 percent and made net changes at a rate of 15.3 percent. For treated individuals across all treatments, all rates are higher. The treatment effects are 2.1 percentage points for contribution increases and 2.4 percentage points for contribution changes. Each of these effects is statistically significant. The outcome of the intervention is meaningful for participants, irrespective of our perspective for the appropriate metric for interpreting the results (presumption of undersaving or revealed preferences).

Finally, Panel B of Table 3 presents the effect on balances or contribution changes in dollars, conditional on making a medium-term net contribution change. Conditional on making a change, balance and contribution changes are similar across treatment and control groups. Thus, our intervention moved some participants into changing their contribution rates but did not lead to larger contribution levels among those who made changes.

The means reported in Table 3 suggest that the tax advantage treatment led to more contribution increases than either the baseline or longevity treatments. As shown in Appendix Table B1, the differences between treatments are not statistically significant in a regression context.<sup>15</sup> The results in Table 3 suggest that the longevity treatment was associated with the smallest movements in contribution changes relative to the other treatments. The tax advantage treatment was designed to emphasize the tax-favored nature of contributions to supplemental

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<sup>15</sup> The comparisons across treatment types should be treated with caution. Our study is well powered to detect an effect size of 1.2 percentage points with a sample size of 6,344, where our participant sample has 6,554 workers. However, we do not have sufficient power to detect effects in the subsamples for each treatment.



saving plans. This is one of the typical framings for retirement savings interventions. The longevity treatment was designed with our sample of older workers specifically in mind, where we highlighted the life expectancy of the typical retiree in our sample. The results in Table 3 suggest that, in our sample, a negative framing (reminding individuals that they may grow very old and sick) did not outperform a positive framing (reminding individuals that contributions lower their tax bill).

## **B. Regression Results**

In a randomized controlled trial, we expect that including covariates will not meaningfully affect the treatment effect found in the pairwise comparisons of the previous section. This is exactly what we see in Table 4. Here, we provide estimates of average marginal effects from a Probit model regression with four outcomes as defined in Table 3 above: short-term increase, short-term any change, medium-term increase, and medium-term net change. As found in Table 3, when no controls are included the effect of the treatment is a one percentage point increase in the probability of increasing contributions. A one percentage point increase is approximately 40 percent of the mean of 2.5 percent, which represents a large treatment effect. Column (2) includes a host of individual controls available in the administrative records. Agency fixed effects are grouped into five categories.<sup>16</sup> Overall, men are more likely to increase contributions, as are those

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<sup>16</sup> There are a total of 34 agencies. We group the smaller agencies into two categories: agencies as those with fewer than 100 employees in our sample and those with between 100 and 1,000 employees in our sample. The three largest agencies have separate controls: Department of Health and Human Services, Department of Public Safety, and Highway Administration. Relative to the small agencies, employees at Health and Human Services and the Highway Administration were about 1 percentage points less likely to have a net increase in contributions.

with lower salaries and higher initial balances.<sup>17</sup> As expected, the estimated effect of the intervention is unchanged by adding these control variables. Column (2) again shows an identical point estimate.

[Table 4]

Next, Table 4 presents results for an alternative dependent variable: making any change in contributions after the intervention and before December 31, 2014. The estimated impact of the intervention is 1.2 percentage points or about 36 percent of the sample mean of 3.3. Columns (5)-(6) indicate that receiving the flyer led to a 2.2 percentage point higher probability of increasing contributions over the subsequent nine months. Relative to a mean contribution rate of 14.4 percent, this represents about 15 percent of the mean. Similarly, when considering whether the employee made a net change in contributions (either an increase or decrease), we see that the intervention increased the likelihood of making a net change by 2.4 percentage points relative to a sample mean of 17.2 percent (about 14 percent of the mean). Thus, even among individuals who rarely change their contributions, our informational intervention changed behavior by an economically and statistically significant amount.

Unfortunately, our effect size is not sufficiently large to detect meaningful differences between subsamples of our data. Appendix Table B1 presents regression estimates with an interaction term for the various treatment types. We fail to reject that the detailed intervention types were more influential than the baseline in increasing contributions. However, as noted above, these results should be interpreted with caution as we do not have sufficient power in subsamples to detect small differences between treatment types. Similarly, Appendix Table B2

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<sup>17</sup> Initial balance is included in the model quadratically; as with other variables, the average marginal effect is shown.

presents results where the main treatment variable is interacted with a dummy variable for various subgroups to determine any statistically significant differences in treatment effects among particular groups. The column headers indicate the category for the interaction term. We find no statistically significant differences by gender, salary level, age at hire, or years until eligible for retirement benefits. We do see that the short-term treatment effect is only statistically significant for those with above median initial balance in the plan. This is consistent with the results discussed next for those who had no supplemental retirement savings through the state-managed plans.

## **V. Non-participants**

Table 5 presents the results for non-participants. These are individuals who have had numerous opportunities to begin saving additional funds in their state government employer-sponsored supplemental saving plans. As emphasized in the introduction, our non-participant sample may consist of individuals with a preference for current consumption over saving for additional consumption in retirement. These individuals are covered by both a defined-benefit pension plans and Social Security. Further, some individuals in our non-participant sample may in fact be participating in a supplemental saving plan, perhaps through a previous employer or a spouse's employer.

[Table 5]

For non-participants, we show the results in terms of the same outcomes as before. However, with non-participants, increasing their contribution either requires that they restart contributing to an inactive plan or open a new plan and begin contributing.<sup>18</sup> The effect sizes in every cell in Table 5 are quite small, with 0.6 percent (i.e., six-tenths of one percent) of the

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<sup>18</sup> The non-participant sample is restricted to those who did not retire before December 31, 2014 and who do not have terminated status on an account.

control group increasing their contribution from the intervention until the end of 2014. This is statistically insignificantly larger than the rate for the treatment group.

Concerning specific treatment types, the longevity treatment repeats the treatment used for participants. As before, the longevity treatment effect is slightly smaller than the baseline treatment effect but the difference is not statistically significant. The liquidity treatment emphasized the availability of supplemental plan withdrawals for older workers prior to retirement. The GoalMaker treatment emphasized the ease of personalizing investment decisions through a risk tailoring feature known as GoalMaker, as described in Section III.B. The liquidity and GoalMaker treatment effects are smaller than the baseline treatment effect but the differences are small. The same basic pattern holds for all outcomes in Table 5: small rates of activity for non-participants with no evidence of a positive treatment effect. The one exception is that the GoalMaker treatment lowered the probability of increasing and making net changes to contributions in the medium term. For all outcomes, we conclude that the rates of activity in the non-participant group are so small that we cannot draw any conclusions beyond the fact that our intervention did not significantly affect saving behavior for non-participants.

## **VI. Conclusion**

Policy interventions aimed at encouraging retirement saving typically emphasize the importance of compounding. This framing may be discouraging to workers late in their career who have fewer working years for account balances to meaningfully benefit from compounding. However, there are several advantages to retirement saving that benefit older workers. Retirement savings are more liquid for older workers because in-service withdrawals are allowed for workers over age 59 ½ from 401(k) plans. Further, catch-up provisions allow older workers, many who are on the verge of retirement, to save additional funds above the regular IRS

maximum contribution limits. Thus, while older workers may be harder to encourage to save, they have several reasons to take advantage of supplemental retirement saving plans.

In this study, we sent an informational intervention to a randomly selected subset of older state government employees in North Carolina. The group receiving the flyers was about 1 percentage point more likely to increase contributions in the short-term, representing about 40 percent of the sample mean. When considering a medium-term time horizon, the treatment led to a 2.4 percentage point higher probability of making a net change within 9 months relative to the control group (about 14 percent relative to the sample mean of 17.2 percent). These results suggest that our intervention led individuals to reassess their retirement savings decisions.

A low cost informational intervention should not be expected to cause large numbers of older workers to substantially increase their contribution rates to supplemental plans. However, the results of an informational intervention should be interpreted while trying to avoid paternalistic presumptions of welfare enhancing behavior at the individual level (Bernheim and Rangel, 2005). We recommend that policymakers consider interventions as a tool to increase workers' engagement in the retirement planning process, rather than a tool to increase retirement savings rates for all workers. For workers covered by a primary defined benefit pension plan and Social Security, their retirement income may be adequate without supplemental savings. Further, workers hired at older ages may have other sources of retirement savings and thus may elect not to participate in a new employer's sponsored plan. In total, interventions that target supplemental saving plan participation should keep in mind the tradeoff between financial security in retirement and financial security during working years.

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## Figure 1: Informational Flyer Design for Current Participants

### A. Current Participants - Longevity

**North Carolina** | 401k | 457  
Total Retirement Plans

# Are you saving enough for retirement?

The good news is you are currently participating in the NC 401(k) and/or 457 retirement savings plan - but you are not contributing as much as you could be.

Your employer offers both the NC 401(k) and NC 457 as tax-advantaged retirement savings options. Plus, you qualify for a catch-up provision for those ages 50 and over, which allows you to save even more.

**Did you know... If you retire at age 65, you can expect to live for 20 years in retirement, and many will live to age 90 or beyond? Even with Medicare and the State Health Plan, you may need extra funds for medical expenses or nursing home care, which can really add up!**

**Money you put aside in a NC 401K and/or NC 457 Plan today can help cover your out-of-pocket medical expenses in retirement.**

**Get Started!**

Increasing your contributions is easy...and the time is now! Simply [click here](#) to log in to your Prudential account. If you have questions about the NC 401(k) and/or the NC 457 Plan, call Prudential Retirement at 1-866-NCPlans (1-866-627-5267) or contact your Regional Retirement Education Manager.

**Help make the most of your retirement today!**

### B. Current Participants - Tax Advantage

**Did you know... Pre-tax contributions to the NC 401(k) and NC 457 are automatically deducted from your paycheck before any federal or state income taxes are taken out, therefore, reducing your taxable income? This means that saving \$400 per month for retirement is really only about \$300 out of your monthly take-home pay.\* Additionally, these contributions grow tax-deferred until withdrawal. This can really mean more money for you in retirement.**

\*Reduction in take-home pay is based on a marginal tax rate of 25%. Your tax savings may be higher or lower.



**Figure 2: Informational Flyer Design for Current Non-participants**

**A. Current Non-participants – Liquidity**

**North Carolina** | 401k | 457  
Total Retirement Plans

**Are you saving enough for retirement?**

It's not too late to start saving for your retirement.

Your employer offers both the NC 401(k) and NC 457 as tax-advantaged retirement saving options. Plus, you qualify for a catch-up provision for those ages 50 and over, which allows you to save even more.

If you find that you need to access your funds before you retire, in-service withdrawals may be taken from the NC 401(k) after age 59 ½.\*

**Get Started!**

The state of North Carolina partners with Prudential to offer you the NC 401(k) and the NC 457...and signing up is easy!

Simply [click here](#) to register for your Prudential account or to start contributing to your existing account. If you have questions about the NC 401(k) and/or the NC 457 Plan, call Prudential Retirement at 1-866-NCPlans (1-866-627-5267) or contact your Regional Retirement Education Manager.

**Help make the most of your retirement today!**

\*See plan information regarding limitations on withdrawals from your 401(k) account. According to IRS rules, a distribution from a Roth 401(k) is qualified to be tax-free if the first Roth contribution to your account remains in the account for at least 5 tax years AND a) you are 59½ or older, or b) you have separated from service due to a tax free disability retirement or death. If your withdrawal does not meet these conditions, then the Roth earnings—but not the Roth contributions—may be subject to state and federal income taxes.

## B. Current Non-participants – GoalMaker

How do you like to save? The NC 401(k) and NC 457 offer a range of investment vehicles from high growth to highly conservative, so you can make the most appropriate choice to meet your savings goals. Still not sure? Let GoalMaker® help! It's an optional, easy-to-use asset allocation program available at no additional cost that automatically guides you to an age-appropriate investment mix based on your risk tolerance and the time you want to begin withdrawing money.\* Let GoalMaker do the work for you, or personalize your NC 401(k)/NC 457 investment choices to fit *your* approach to saving for retirement!

\*Investment of your account balance according to a GoalMaker portfolio can, and will, be canceled at any time if you direct Prudential to invest your account according to an investment allocation of your own design. The GoalMaker portfolios are subject to change, including, for example, the replacement of investment options and the change of investment options as a percentage of the portfolio. You will be notified in writing in advance of any such changes. Application of asset allocation and diversification concepts does not ensure safety of principal and interest. It is possible to lose money by investing in securities.

## C. Current Non-participants – Longevity

Did you know...If you retire at age 65, you can expect to live for 20 years in retirement, and many will live to age 90 or beyond? Even with Medicare and the State Health Plan, you may need extra funds for medical expenses or nursing home care, which can really add up! Money you put aside in a NC 401K and/orNC 457 Plan today can help cover your out-of-pocket medical expenses in retirement.

Figure 3: Contribution Increases, Daily, Pre-Intervention, October

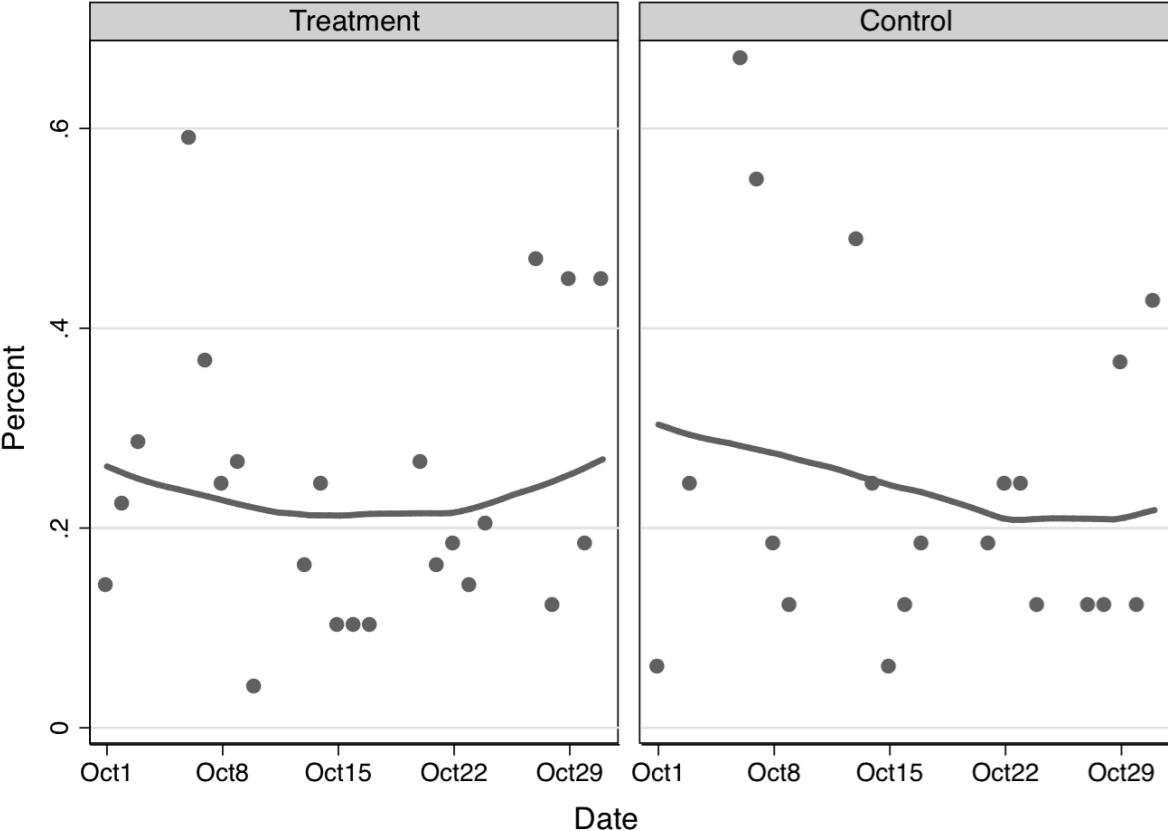
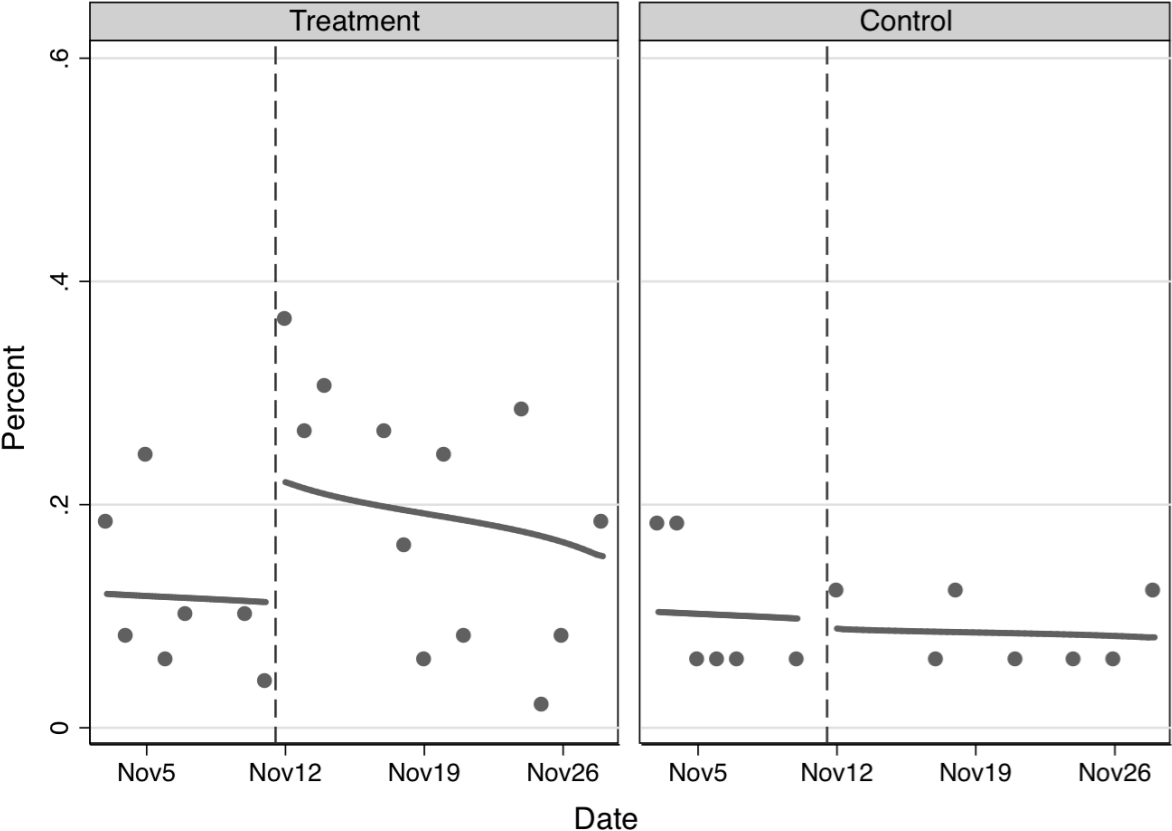


Figure 4: Contribution Increases, Daily, Pre-and Post-Intervention, November



**Table 1: Descriptive Statistics**

|                                   | Intervention<br>Sample | Participant<br>Sample | Non-<br>Participant<br>Sample | p-value of<br>difference |
|-----------------------------------|------------------------|-----------------------|-------------------------------|--------------------------|
|                                   | (1)                    | (2)                   | (3)                           | (4) =<br>(3)-(2)         |
| <b>Number of Employees</b>        | 14,560                 | 6,554                 | 8,006                         |                          |
| Male                              | 44.1%                  | 44.2%                 | 44.0%                         | 0.83                     |
| Age                               | 57.0                   | 56.4                  | 57.5                          | 0.00                     |
| Age at hire                       | 42.7                   | 39.8                  | 44.8                          | 0.00                     |
| Salary                            | \$43,854               | \$47,204              | \$41,614                      | 0.00                     |
| Missing salary                    | 2.1%                   | 1.7%                  | 2.4%                          | 0.00                     |
| Years of service                  | 14.8                   | 18.0                  | 12.1                          | 0.00                     |
| Eligible to retire                | 53.2%                  | 59.0%                 | 48.5%                         | 0.00                     |
| Years until eligible to<br>retire | 0.0                    | 0.0                   | 0.2                           | 0.00                     |

Notes: Data are derived from administrative records of public sector workers in North Carolina as of October 31, 2014. Medians of continuous variables and percentages of dichotomous variables are presented. Participants are those with a positive account balance in supplemental saving plans as of October 31, 2014 while non-participants are those with zero balance and zero contributions. Statistical significance is tested with nonparametric tests: discrete variables are tested using a difference in proportions test, while continuous variables are tested using a difference in medians test.

**Table 2: Experimental Design**

|                                 | Participants (N=6,554) |                        |         | Non-participants (N=8,006) |                        |         |
|---------------------------------|------------------------|------------------------|---------|----------------------------|------------------------|---------|
|                                 | Control<br>(N=1,641)   | Treatment<br>(N=4,913) | p-value | Control<br>(N=1,610)       | Treatment<br>(N=6,296) | p-value |
| <b>Panel A: Demographics</b>    |                        |                        |         |                            |                        |         |
| Male                            | 44.2%                  | 44.1%                  | 0.98    | 43.6%                      | 44.1%                  | 0.73    |
| Age                             | 56.6                   | 56.3                   | 0.19    | 57.5                       | 57.5                   | 0.84    |
| Age at hire                     | 39.7                   | 39.8                   | 0.82    | 44.7                       | 44.8                   | 0.76    |
| Salary                          | \$47,529               | \$47,124               | 0.71    | \$41,997                   | \$41,508               | 0.37    |
| Missing salary                  | 1.4%                   | 1.8%                   | 0.31    | 2.2%                       | 2.5%                   | 0.47    |
| Years of service                | 17.8                   | 18.0                   | 0.71    | 12.2                       | 12.0                   | 0.54    |
| Eligible to retire              | 58.3%                  | 59.2%                  | 0.53    | 46.8%                      | 48.9%                  | 0.12    |
| Years until eligible to retire  | 0.0                    | 0.0                    | 0.54    | 0.5                        | 0.2                    | 0.12    |
| <b>Panel B: Saving behavior</b> |                        |                        |         |                            |                        |         |
| Total initial balance           | \$16,509               | \$16,362               | 0.96    |                            |                        |         |
| Total YTD contribution          | \$1,000                | \$1,000                | 0.07    |                            |                        |         |

Notes: Data are derived from administrative records of public sector workers in North Carolina as of October 31, 2014. Medians of continuous variables and percentages of dichotomous variables are presented. Participants are those with a positive account balance in supplemental saving plans as of October 31, 2014, while non-participants are those with zero balance and zero contributions.

**Table 3: Current Participant Sample Post-Intervention Actions**

|  | Control      | All Treatments      | Baseline Treatment  | Longevity Treatment | Tax Advantage Treatment |
|--|--------------|---------------------|---------------------|---------------------|-------------------------|
|  | (1)          | (2)                 | (3)                 | (4)                 | (5)                     |
| <b>Panel A: Full sample</b>  |              |                     |                     |                     |                         |
| <b>Sample size</b>   | <b>1,641</b> | <b>4,913</b>        | <b>1,633</b>        | <b>1,632</b>        | <b>1,648</b>            |
| <b>Actions as of December 31, 2014:</b>                            |              |                     |                     |                     |                         |
| Increased contributions short-term                                 | 1.767%       | 2.809<br>(0.449)*   | 2.756<br>(0.520)+   | 2.390<br>(0.499)    | 3.277<br>(0.547)**      |
| Decreased contributions short-term                                 | 0.548%       | 0.651<br>(0.225)    | 0.612<br>(0.266)    | 0.735<br>(0.279)    | 0.607<br>(0.264)        |
| Made any changes to contributions short-term                       | 2.377%       | 3.603<br>(0.509)*   | 3.491<br>(0.590)+   | 3.186<br>(0.575)    | 4.126<br>(0.619)**      |
| <b>Actions as of August 15, 2015:</b>                              |              |                     |                     |                     |                         |
| Individual retired OR account is terminated, suspended, or missing | 17.794%      | 17.830<br>(1.091)   | 17.085<br>(1.326)   | 18.260<br>(1.344)   | 18.143<br>(1.339)       |
| <b>Sample size for active account holders</b>                      | <b>1,349</b> | <b>4,037</b>        | <b>1,354</b>        | <b>1,334</b>        | <b>1,349</b>            |
| Increased contributions medium-term                                | 12.750%      | 14.912<br>(1.103)+  | 15.288<br>(1.336)+  | 13.643<br>(1.307)   | 15.789<br>(1.347)*      |
| Decreased contributions medium-term                                | 2.595%       | 2.849<br>(0.517)    | 2.363<br>(0.598)    | 3.298<br>(0.653)    | 2.891<br>(0.629)        |
| Made net changes to contributions medium-term                      | 15.345%      | 17.761<br>(1.186)*  | 17.651<br>(1.428)   | 16.942<br>(1.420)   | 18.681<br>(1.447)*      |
| <b>Panel B: Sample making a medium-term net change</b>             |              |                     |                     |                     |                         |
| <b>Sample size</b>   | <b>207</b>   | <b>717</b>          | <b>239</b>          | <b>226</b>          | <b>252</b>              |
| Balance change conditional on changing                             | \$2,910.37   | 2,574.08<br>(0.528) | 2,760.32<br>(0.849) | 2,485.62<br>(0.387) | 2,564.86<br>(0.512)     |
| Contribution change conditional on changing                        | \$600.00     | 600.00<br>(0.300)   | 600.00<br>(0.213)   | 600.00<br>(0.437)   | 600.00<br>(0.506)       |

**Notes:** Coefficients indicate the proportion of individuals in that group taking the specified action. The standard error of the difference in proportions relative to the control group is reported in parentheses. An increase or decrease in contribution refers to contribution having increased or decreased as of December 31st, 2014 (short-term) or August 15, 2015 (medium-term). In Panel B, a medians test is used for balance change and contribution change and the p-value is reported in parentheses, +  $p < 0.1$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ .

**Table 4: Multivariate Regression Analysis of Participant Response**

|                                | Short-Term Increase |         | Short-Term Any Change |         | Medium-Term Increase |          | Medium-Term Net Change |          |
|--------------------------------|---------------------|---------|-----------------------|---------|----------------------|----------|------------------------|----------|
|                                | (1)                 | (2)     | (3)                   | (4)     | (5)                  | (6)      | (7)                    | (8)      |
| Treatment                      | 0.010*              | 0.010*  | 0.012*                | 0.012*  | 0.022*               | 0.022*   | 0.024*                 | 0.024*   |
|                                | (0.004)             | (0.004) | (0.005)               | (0.005) | (0.011)              | (0.011)  | (0.012)                | (0.011)  |
| Male                           |                     | 0.007+  |                       | 0.009*  |                      | 0.007    |                        | 0.012    |
|                                |                     | (0.004) |                       | (0.005) |                      | (0.010)  |                        | (0.011)  |
| Age                            |                     | -0.000  |                       | 0.000   |                      | -0.001   |                        | -0.001   |
|                                |                     | (0.001) |                       | (0.001) |                      | (0.001)  |                        | (0.002)  |
| Salary (\$1K)                  |                     | -0.003* |                       | -0.002* |                      | 0.002    |                        | 0.003    |
|                                |                     | (0.001) |                       | (0.001) |                      | (0.002)  |                        | (0.003)  |
| Missing salary                 |                     | 0.010   |                       | 0.011   |                      | -0.004   |                        | 0.005    |
|                                |                     | (0.016) |                       | (0.018) |                      | (0.039)  |                        | (0.042)  |
| Years of service               |                     | -0.001+ |                       | -0.001* |                      | -0.003** |                        | -0.004** |
|                                |                     | (0.000) |                       | (0.000) |                      | (0.001)  |                        | (0.001)  |
| Eligible to retire             |                     | -0.004  |                       | -0.006  |                      | 0.003    |                        | 0.004    |
|                                |                     | (0.007) |                       | (0.008) |                      | (0.016)  |                        | (0.018)  |
| Years until eligible to retire |                     | -0.000  |                       | 0.000   |                      | -0.002   |                        | -0.000   |
|                                |                     | (0.001) |                       | (0.001) |                      | (0.003)  |                        | (0.003)  |
| Initial balance (\$100K)       |                     | 0.027** |                       | 0.031** |                      | 0.048**  |                        | 0.060**  |
|                                |                     | (0.007) |                       | (0.007) |                      | (0.014)  |                        | (0.015)  |
| Agency FE                      |                     | X       |                       | X       |                      | X        |                        | X        |
| Sample Size                    | 6,554               |         | 6,554                 |         | 5,386                |          | 5,386                  |          |
| Mean Dependent Variable        | 0.025               |         | 0.033                 |         | 0.144                |          | 0.172                  |          |

Notes: In Columns (1) and (2), the dependent variable is whether the individual had a net increase in contributions as of December 31, 2014 (short-term). In Columns (3) and (4), the dependent variable is whether the individual made any change in contributions (increase, decrease, or both) as of December 31, 2014 (short-term). In Columns (5) and (6), the dependent variable is whether the individual had a net increase in contributions as of August 15, 2015 (medium-term). In Columns (7) and (8), the dependent variable is whether the individual made a net change in contributions as of August 15, 2015 (medium-term). Coefficients are average marginal effects from a Probit model. Initial balance (\$100K) is included in the model quadratically; as with other variables, the average marginal effect is shown. Standard errors are in parentheses. + p<0.10, \* p<0.05, \*\* p<0.01.



**Table 5: Current Non-Participant Sample Post-Intervention Actions**

|   | <b>Control</b> | <b>All<br/>Treatments</b> | <b>Baseline<br/>Treatment</b> | <b>Longevity<br/>Treatment</b> | <b>Liquidity<br/>Treatment</b> | <b>GoalMaker<br/>Treatment</b> |
|---|----------------|---------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|
|   | <b>(1)</b>     | <b>(2)</b>                | <b>(3)</b>                    | <b>(4)</b>                     | <b>(5)</b>                     | <b>(6)</b>                     |
| <b>Sample Size</b>                                  | <b>1,610</b>   | <b>6,396</b>              | <b>1,602</b>                  | <b>1,596</b>                   | <b>1,601</b>                   | <b>1,597</b>                   |
| <b>Actions as of December 31, 2014:</b>             |                |                           |                               |                                |                                |                                |
| Increased contributions short-term                  | 0.621%         | 0.469<br>(0.197)          | 0.624<br>(0.278)              | 0.376<br>(0.249)               | 0.437<br>(0.256)               | 0.438<br>(0.256)               |
| Decreased contributions short-term                  | 0.062%         | 0.016<br>(0.044)          | 0.000<br>(0.062)              | 0.000<br>(0.062)               | 0.000<br>(0.062)               | 0.063<br>(0.088)               |
| Made any changes to contributions short-term        | 0.683%         | 0.485<br>(0.201)          | 0.624<br>(0.284)              | 0.376<br>(0.257)               | 0.437<br>(0.264)               | 0.501<br>(0.271)               |
| <b>Actions as of August 15, 2015:</b>               |                |                           |                               |                                |                                |                                |
| Individual retired OR missing in 2015 cross-section | 7.019%         | 7.333<br>(0.724)          | 7.865<br>(0.926)              | 6.391<br>(0.884)               | 7.808<br>(0.925)               | 7.264<br>(0.909)               |
| <b>Sample size for non-retired and non-missing</b>  | <b>1,497</b>   | <b>5,927</b>              | <b>1,476</b>                  | <b>1,494</b>                   | <b>1,476</b>                   | <b>1,481</b>                   |
| Increased contributions medium-term                 | 2.405%         | 2.311<br>(0.436)          | 2.981<br>(0.594)              | 2.343<br>(0.557)               | 2.439<br>(0.564)               | 1.485<br>(0.506)+              |
| Made net changes to contributions medium-term       | 2.538%         | 2.345<br>(0.441)          | 2.981<br>(0.601)              | 2.343<br>(0.564)               | 2.439<br>(0.571)               | 1.621<br>(0.523)+              |

Notes: Coefficients indicate the proportion of individuals in that group taking the specified action. The standard error of the difference in proportions relative to the control group is reported in parentheses. An increase or decrease in contribution refers to contribution having increased or decreased as of December 31st, 2014 (short-term) or August 15, 2015 (medium-term). + p<0.10, \* p<0.05, \*\* p<0.01.

## **Appendix A: Data Appendix**

The data used in this paper were gathered as part of a larger project, “Challenges to Retirement Readiness in the North Carolina Public Sector Workforce,” funded by Sloan Foundation Grant Number 2013-10-20. For more information about the full project, please see the website: <http://go.ncsu.edu/publicsectorretirement>. Table A1 presents the timeline of the data releases. For this study, the Retirement System provided us with data on 14,710 active workers. All active workers with an email address ages 50 to 69 were eligible for the intervention sample. The sample excludes individuals with year to date contributions exceeding \$10,000 and those with account balances less than \$1. RSD sent 6,629 and 8,081 informational flyers to the participant and non-participant sample, respectively, and provided us with the contribution data.

Definitions of key variables are presented in Table A2. Of note, there are several types of service that could be important in our analysis. First, there is membership service, which should approximate the actual tenure of the employee minus any transferred or withdrawn service. We use membership service for our measure of job tenure. However, to be eligible for retirement benefits, individuals may also have purchased non-contributory (e.g., sick leave and vacation time) service. These latter types of service are included in our calculation of eligibility for retirement benefits. Because most non-contributory service is only reported upon retirement, we include in these calculations an additional 0.71 years of non-contributory service, which is the mean for the entire population. Years until eligible for retirement are the minimum number of years before an employee can qualify for early or normal retirement when considering all the combinations of age and years of service by which an individual can qualify. If the number of years is less than or equal to zero, the individual already qualifies for retirement.

**Table A1: Timeline of data collection**

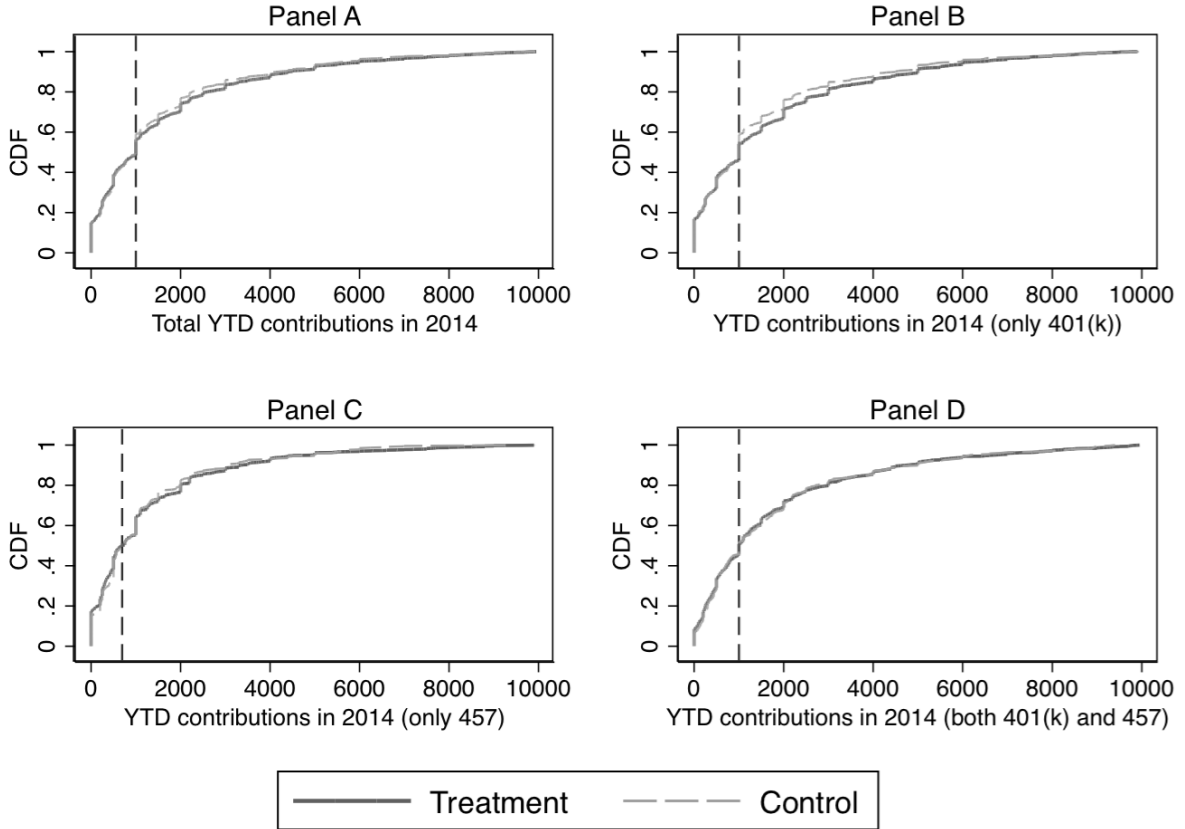
| <b>Dataset</b>                                      | <b>Dates</b>  |
|---|---|
| Pre-intervention administrative data                | October 31 <sup>st</sup> , 2014                                     |
| Intervention  | November 12 <sup>th</sup> , 2014 - November 14 <sup>th</sup> , 2014 |
| Post-intervention administrative data “short-term”  | December 31 <sup>st</sup> , 2014                                    |
| Post-intervention administrative data “medium-term” | August 15 <sup>th</sup> , 2015                                      |

**Table A2: Key variables**

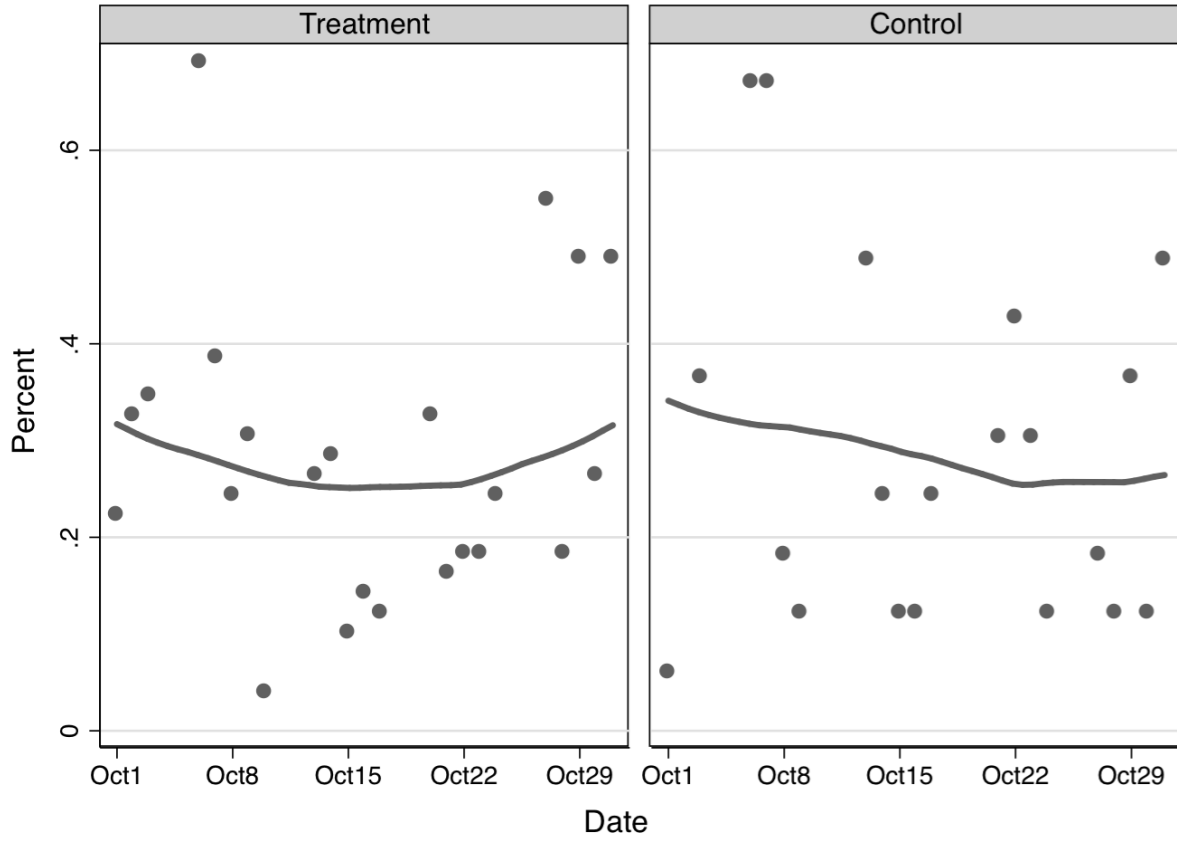
| <b>Variable</b>   | <b>Definition</b>   |
|---|---|
| <b>Demographics:</b>                                      |   |
| Years of service  | Total years of service.   |
| Age   | Age as of 10/31/2014  |
| Annual 2013 salary  | Annual salary earned in 2013.   |
| Eligible for retirement                                   | Employee qualifies for early or normal retirement when considering all the combinations of age at survey 1 and years of service by which an individual can qualify.   |
| Years until eligible for retirement                       | For individuals not yet eligible, the minimum number of years before an employee can qualify for early or normal retirement when considering all the combinations of age at survey 1 and years of service by which an individual can qualify. Equals zero for those already eligible to retire. |
| <b>Saving behavior:</b>                                   |   |
| Increased contributions short-term                        | Aggregate increase in contribution between Intervention and 12/31/2014  |
| Decreased contributions short-term                        | Aggregate decrease in contribution between Intervention and 12/31/2014  |
| Made any changes to contributions short-term              | Made any action to change contribution between Intervention and 12/31/2014  |
| Increased contribution medium-term                        | Aggregate increase in contribution between Intervention and 08/15/2015  |
| Made net changes to contribution medium-term              | Aggregate increase or decrease in contribution between intervention and 8/15/2015   |
| Balance change conditional on net change medium-term      | Change in balance from 10/31/2014 to 8/15/2015 conditional on making net changes to contribution medium-term.   |
| Contribution change conditional on net change medium-term | Amount of contribution change between the Intervention and 8/15/2015 conditional on making net changes to contribution medium-term.   |

## Appendix B: Extra Figures and Tables

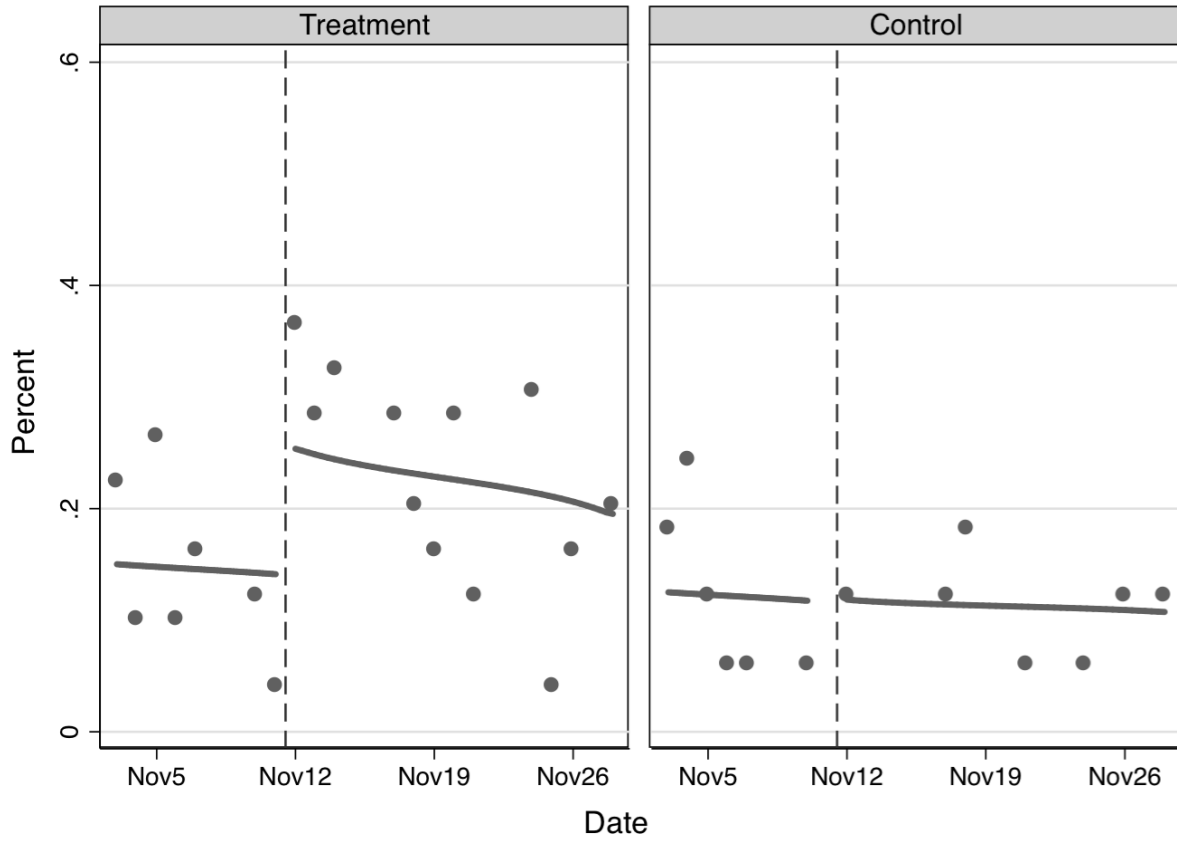
Appendix Figure B1:



Appendix Figure B2: Contribution Changes, Daily, Pre-and Post-Intervention, October



Appendix Figure B3: Contribution Changes, Daily, Pre-and Post-Intervention, November



**Appendix Table B1: Heterogeneity by Treatment Type**

|                           | Short-Term<br>Increase<br>(1) | Short-Term<br>Any Change<br>(2) | Medium-Term<br>Increase<br>(3) | Medium-Term<br>Any Change<br>(4) |
|---------------------------|-------------------------------|---------------------------------|--------------------------------|----------------------------------|
| All treatments            | 0.011*<br>(0.005)             | 0.012*<br>(0.005)               | 0.025+<br>(0.013)              | 0.024+<br>(0.014)                |
| x Longevity treatment     | -0.004<br>(0.005)             | -0.004<br>(0.006)               | -0.016<br>(0.013)              | -0.007<br>(0.014)                |
| x Tax advantage treatment | 0.004<br>(0.005)              | 0.004<br>(0.006)                | 0.004<br>(0.013)               | 0.009<br>(0.014)                 |
| Sample Size               | 6,554                         | 6,554                           | 5,386                          | 5,386                            |
| Mean Dependent Variable   | 0.025                         | 0.033                           | 0.144                          | 0.172                            |

Notes: In Column (1) the dependent variable is whether the individual had a net increase in contributions as of December 31, 2014 (short-term). In Column (2), the dependent variable is whether the individual made any change in contributions (increase, decrease, or both) as of December 31, 2014 (short-term). In Column (3), the dependent variable is whether the individual had a net increase in contributions as of August 15, 2015 (medium-term). In Column (4) the dependent variable is whether the individual made a net change in contributions as of August 15, 2015 (medium-term). Specifications are identical to Table 4 with controls except with additional interaction terms included as indicated. Coefficients are average marginal effects from a Probit model. Standard errors are in parentheses. + p<0.10, \* p<0.05, \*\* p<0.01.



**Appendix Table B2: Heterogeneity in Treatment Effects**

**Panel A: Short-Term Increase in Contributions (N = 6,554)**

|                      | Male    | Above Median Salary | Above Median Age at Hire | 20+ Years of Service | 5+ Years until Eligible | Initial Balance above Median | Initial Balance > 90 <sup>th</sup> Percentile |
|----------------------|---------|---------------------|--------------------------|----------------------|-------------------------|------------------------------|---|
|                      | (1)     | (2)                 | (3)                      | (4)                  | (5)                     | (6)                          | (7)   |
| Baseline Treatment   | 0.005   | 0.010               | 0.017*                   | 0.008                | 0.013**                 | 0.003                        | 0.011*  |
|                      | (0.006) | (0.005)             | (0.006)                  | (0.005)              | (0.004)                 | (0.006)                      | (0.004)                                       |
| Treatment x Category | 0.014   | 0.002               | -0.014                   | 0.008                | -0.013                  | 0.018+                       | -0.006  |
|                      | (0.011) | (0.010)             | (0.010)                  | (0.012)              | (0.009)                 | (0.012)                      | (0.012)                                       |

**Panel B: Short-Term Any Change in Contributions (N = 6,554)**

|                      | Male    | Above Median Salary | Above Median Age at Hire | 20+ Years of Service | 5+ Years until Eligible | Initial Balance above median | Initial Balance > 90 <sup>th</sup> Percentile |
|----------------------|---------|---------------------|--------------------------|----------------------|-------------------------|------------------------------|---|
|                      | (1)     | (2)                 | (3)                      | (4)                  | (5)                     | (6)                          | (7)   |
| Baseline Treatment   | 0.005   | 0.015*              | 0.021**                  | 0.011+               | 0.016**                 | 0.007                        | 0.014*  |
|                      | (0.007) | (0.006)             | (0.007)                  | (0.006)              | (0.005)                 | (0.007)                      | (0.005)                                       |
| Treatment x Category | 0.020+  | -0.006              | -0.017                   | 0.006                | -0.016                  | 0.012                        | -0.013  |
|                      | (0.013) | (0.011)             | (0.011)                  | (0.013)              | (0.010)                 | (0.012)                      | (0.012)                                       |

Continued on the next page...

**Appendix Table B2 continued:**

**Panel C: Medium-Term Increase in Contributions (N = 5,386)**

|                      | Male    | Above Median Salary | Above Median Age at Hire | 20+ Years of Service | 5+ Years until Eligible | Initial Balance above Median | Initial Balance > 90 <sup>th</sup> Percentile |
|----------------------|---------|---------------------|--------------------------|----------------------|-------------------------|------------------------------|---|
|                      | (1)     | (2)                 | (3)                      | (4)                  | (5)                     | (6)                          | (7)   |
| Baseline Treatment   | 0.017   | 0.021               | 0.034*                   | 0.029*               | 0.029*                  | 0.010                        | 0.025*  |
|                      | (0.015) | (0.015)             | (0.015)                  | (0.014)              | (0.011)                 | (0.016)                      | (0.011)                                       |
| Treatment x Category | 0.012   | 0.001               | -0.025                   | -0.019               | -0.041                  | 0.024                        | -0.027  |
|                      | (0.023) | (0.023)             | (0.022)                  | (0.022)              | (0.025)                 | (0.023)                      | (0.031)                                       |

**Panel D: Medium-Term Net Change in Contributions (N = 5,386)**

|                      | Male    | Above Median Salary | Above Median Age at Hire | 20+ Years of Service | 5+ Years until Eligible | Initial Balance above median | Initial Balance > 90 <sup>th</sup> Percentile |
|----------------------|---------|---------------------|--------------------------|----------------------|-------------------------|------------------------------|---|
|                      | (1)     | (2)                 | (3)                      | (4)                  | (5)                     | (6)                          | (7)   |
| Baseline Treatment   | 0.013   | 0.032+              | 0.034*                   | 0.034*               | 0.030*                  | 0.016                        | 0.028*  |
|                      | (0.016) | (0.016)             | (0.016)                  | (0.014)              | (0.012)                 | (0.017)                      | (0.012)                                       |
| Treatment x Category | 0.028   | -0.015              | -0.020                   | -0.025               | -0.033                  | 0.016                        | -0.033  |
|                      | (0.025) | (0.024)             | (0.024)                  | (0.024)              | (0.029)                 | (0.024)                      | (0.034)                                       |

Notes: Specifications are identical to Table 4 with controls except with additional interaction terms included as indicated. Coefficients are average marginal effects from a Probit regression model. The dependent variables are Panel A: short-term any change in contributions and Panel B: medium-term net change in contributions. Median salary is \$47,204; median age at hire is 39.8; median initial balance is \$16,392; and 90<sup>th</sup> percentile of initial balance is \$97,561. Standard errors are in parentheses, + p<0.10, \* p<0.05, \*\* p<0.01.