Worker and Spousal Responses to Automatic Enrollment

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Abstract

This paper estimates the saving effects of automatically enrolling employees in retirement plans, examining a large set of firms and incorporating savings responses beyond employer-sponsored plans. We construct an original data set − using tax returns, payroll filings, and retirement distributions from information returns − for employees at 751 US-based firms that adopted automatic enrollment between 2010 and 2016. We use these data estimate the effects of the policy on retirement plan contributions, withdrawals, and net retirement savings − for both employees and their spouses − by comparing workers hired in the years before and after each firm adopted automatic enrollment. We estimate that in the first year after hiring, automatic enrollment increases plan participation by approximately 80 percent (36 percentage points) and increases retirement savings contributions (as a percent of wages) by about 50 percent (1.2 percentage points). Spouses of employees at these firms do not alter their saving behavior in response to the policy, and employees do not alter IRA contributions. However, automatic enrollment also increases the likelihood that an employee will take a withdrawal from their retirement account by 35 percent (4 percentage points). This effect is driven by employees who take withdrawals when separating from their employer. We find that savings effects are increasing in wages − with the lowest wage quintile increasing savings at roughly one-quarter the level of the top quintile − consistent with the "percent of compensation" structure of default contributions. In the medium run (after three years) the effects dissipate but remain discernible from the control group.

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1 Summary

Over the past two decades it has become increasingly common for private companies to adopt automatic enrollment as a feature of their retirement plans, a practice encouraged by federal and state government policies. Automatic enrollment refers to requiring employees to actively opt-out of contributing a portion of their compensation to an employer-sponsored defined contribution plan, such as a 401(k) plan. A large body of work examining individual companies that adopted automatic enrollment has provided evidence supporting the effectiveness of this "nudge," finding that changing the decision to save from opting-in to opting-out has large positive effects on employee participation and contributions (Falk & Karamcheva, 2019; Beshears et al., 2009; Nessmith, Utkus, and Young, 2007; Thaler & Benartzi, 2004; Choi et al., 2004; Madrian & Shea, 2001). The positive estimated effects of the policy are particularly large when compared to the relatively small effects of other interventions like increasing discretionary employer matching rates (Engelhardt & Kumar, 2007; Duflo, et al., 2006; Even & Macpherson, 2005; Munnel, et al., 2001; Kusko, et al. 1998; Papke & Poterba, 1995).

This paper provides a fresh look at the effects of automatic enrollment. We examine the savings behavior of employees at 751 large, US-based employers that adopted automatic enrollment between 2010 and 2016. We construct an original set of employer-employee-household linked data for employees at these firms from a number of tax filings, and use an event study framework to estimate changes in the saving behavior of employees hired before and after their firms adopted automatic enrollment. In our data, employees hired one year after each firm adopted automatic enrollment (and their spouses) are the "treated" population, and those hired two years before the plan change are the "control" population.

This analysis makes two primary contributions to the understanding of automatic enrollment's effect on employee retirement saving. First, we use a unique set of data in our analysis. We begin with pension plan filings for a large set of employers, which vary in size, for-profit status, industry, and plan administrator. The size and diversity of the sample represents a departure from existing work that has primarily focused on one or a handful of employers or plans administered by the same company. As a result, our estimates have a greater degree of external validity. Second, we link these plan-level data to the tax filings of employees, which provides an improved picture of total savings changes: we are able to measure savings responses beyond the employer-sponsored plan, and are able to examine several margins of responses, many of which are previously unexplored. These include possible changes in IRA contributions, spousal savings reactions, and withdrawals from retirement accounts. Incorporating these margins allows us to paint a more complete picture of the savings responses from this nudge, producing an estimate of net retirement savings across all tax-preferred retirement accounts.

Our estimates of the short run effects of automatic enrollment on participation and contributions are consistent with the findings of prior studies including Madrian and Shea (2001) and Choi, et al. (2004), which estimate large positive effects of the policy at the (one to three) firms they analyze, as well as in Beshears et al. (2019) and Falk and Karamcheva

(2019), which measure similarly positive effects of auto-enrolling government and military employees. We estimate that automatically enrolling employees in a company-sponsored retirement plan increases participation by 36 percentage points (80 percent), on average, from 44 percent to 80 percent. Average saving rates, as a percent of compensation, increase by 1.2 percentage points (about a 50 percent increase). Both increases in participation and savings are largest, in percentage and percentage point terms, for young and low-wage workers, who are otherwise unlikely to participate or contribute at high rates in our "control" sample.

However, we also estimate that in the short run (the calendar year after an employee is hired), automatic enrollment is also associated with a 4 percentage point (35 percent) increase in the likelihood of employees withdrawing funds from an existing retirement account. The effect on withdrawals is especially large for new employees in the bottom quintile of the wage distribution for our sample (those with annual wages under $30,100), who are nearly 80 percent more likely to withdraw funds from existing retirement accounts as a result of being automatically enrolled. When we control for whether or not employees remain at the firm the following year, we find that the effect on distributions is no longer statistically significant. This suggests that the effect on withdrawals is largely driven by employees withdrawing their automatically accrued savings when they change jobs, which is consistent with Goodman, Mackie, Mortenson, and Schramm (2021), who find that job changes are the primary observable cause of early withdrawals from retirement plans (i.e., leakage).[1]

Net retirement savings are similarly lower for those in the bottom earnings quintile − around $275 relative to $960 in the top quintile − which is likely due to a mix of higher withdrawals and default savings being expressed as a percentage of compensation. These findings are in line with more recent work by Beshears, et al. (2022), who find that present bias helps explain the causal impact of auto-enrollment on saving; however, that same present bias also makes it more likely that individuals withdraw these savings from their accounts before retirement.

When we examine the saving and withdrawal behavior of spouses − another potential source of offsetting for employees nudged into contributing to an employer plan − we do not discover economically meaningful effects. However, in our saving and withdrawal regressions, married individuals generally have smaller savings and withdrawal effects from automatic enrollment, in both percent and percentage point terms, which is likely due to other correlations with marriage, particularly age and wage level. The lack of response to automatic enrollment in the spouses of married employees reflects the underlying mechanism of the policy: nudging employees who are not "active" savers and will thus leave their enrollment choices at the default, whether positive or zero (Chetty et al., 2014). This logic extends to the household level. If the *household* was "actively" saving, the nudge would have no effect on the employee, and by extension the spouse or household. Similarly, if the household was

[1]While this likely reflects some employees opting out of the retirement plan after contributing for some time, this is mitigated somewhat because our measures of savings and withdrawals (for both the treatment and control) are from the year after they are hired. Pushing in the same direction: we impose a *de minimis* dollar threshold of $72.5 in 2019 dollars, one percent of the minimum earnings threshold to be counted as an employee in our data, for the participation, withdrawal, and savings variables.

passively saving, the nudge would affect employee saving, but not spousal saving.

Finally, we explore longer-horizon responses for a little over 500 companies for whom we are able to observe cohorts of employees 4 years prior to and 4 years following adoption of automatic enrollment. We see that four years after their initial hire, employees in the treated group are still more likely to participate in a retirement plan, and save at relatively higher levels compared to employees in the control group. However, the effect of automatic enrollment on saving dissipates over time. The increase in participation drops from 33 percentage points to 16 percentage points and the increase in saving (as a percent of compensation) drops from 1.35 percentage points to just 0.67 percentage points.

This decreasing effect of automatic enrollment on saving over time is due to the behavior of two distinct groups: Employees who leave the firm and employees who stay at the firm. Employees departing from the firm frequently withdraw the savings accrued through auto-enrollment. We further find that individuals in the treated group who leave the firm within the four year window are much less likely to save when they are not nudged to do so.

Employees with longer tenures are older, have higher wages, and are thus more likely to be active savers. Convergence of preferences occurs for stayers in the treated and control groups. The longer employees remain in one job the more likely they are to participate in an employer-sponsored retirement plan, regardless of automatic enrollment, and are more likely to make an active decision regarding their saving rate (whether positive or zero). This is consistent with Choukhmane (2019), who finds that initially, auto-enrolled participants increased their contributions, but over time the savings of employees hired without automatic enrollment increased to be more in line with those hired under automatic enrollment.

2 Data and Summary Statistics

2.1 Data Construction

We use retirement plan data from Form 5500, and augment these with filing attachments downloaded from the Department of Labor's (DOL) Employee Benefits Security Administration (EBSA) database. We begin by identifying companies that adopted automatic enrollment at some point between 2010 and 2016 using the Department of Labor's "Bulletin" files (which are cleaned by DOL) and we cross-reference these data with Form 5500 attachments downloaded from the EBSA database. These attachments provide details on each defined contribution (DC) plan, including eligibility requirements, employer matching rates, vesting schedules, and automatic enrollment rates. We use a text reading algorithm to identify which Form 5500 attachments mention automatic enrollment, and catalogue these by firm and year. A more detailed explanation of this process is available in **Appendix A**.

Once we have downloaded and processed the Form 5500 attachments, we link plan data to W-2 filings from 2010 to 2016. We incorporate known parent-subsidiary relationships as

part of this linkage. This process is also described in greater detail in **Appendix A**. After matching the two data sets, we use a text-reading algorithm to identify the exact year − and often the exact date − when each company began automatically enrolling employees in their 401(k) plan (or plans). In order to ensure the accuracy of our treatment variable, we restrict our sample of firms to those that explicitly mention a start date of automatic enrollment in one of their Form 5500 attachments.

Using W-2 filings we are able to identify employees hired two years before or one year after each firm adopts automatic enrollment. Individuals hired two years before each firm adopts automatic enrollment − who must opt into a retirement plan − are designated as our "control" population, and employees who were hired one year after each firm adopts automatic enrollment − and were thus automatically enrolled in a retirement plan − are our "treated" population. To ensure sufficient within-firm variation among employees, we only include companies hiring five new employees both in the year before and the year after adopting automatic enrollment. This restriction reduces our sample considerably.[2]

In general, we try to ensure that if a firm shows up in our sample as adopting automatic enrollment in year t, that most, if not all, of the employees at that firm are eligible to enroll in the firm's 401(k) plan within three months from when we observe their contributions. We want to ensure that we do not observe low enrollment rates due to employee exclusions or long service requirements for eligibility.

In the Form 5500 attachments, firms often include details of service requirements for eligibility to participate in the company-sponsored retirement plan. Employees must often wait for a period ranging from one day to one year before they become eligible to enroll. According to the Profit Sharing/401k Council of America (PSCA), in 2010 approximately 58 percent of firms had at least a 3 month waiting period before employees became eligible to enroll in 401(k) plans, and we also observe that roughly 60 percent of eligible firms in our data have a three month minimum service requirement (Gelber, 2011; PSCA, 2010). This complicates our measurement of treatment since we do not want to identify new employees as "treated" if they have only worked at the firm a short period of time, and are not yet eligible to enroll (or be automatically enrolled) in the company's retirement plan.

Consequently, we use the details relating to employee eligibility requirements and waiting periods contained in these plan attachments to further restrict our sample to firms that have at most a six-month service requirement for participation in the firm's retirement plan. To allow for eligibility delays, we measure savings and withdrawals in the year *after* employees join each firm. We also exclude firms from our sample that do not allow all workers (both part- and full-time) to participate in their plan. Finally, if a company has more than one retirement plan, or if the company has subsidiaries with their own retirement plans, we exclude the firm if there are conflicting auto-enrollment start dates across different plan documents.

[2]We currently restrict new employees to those earning at least $7,250 in 2019 dollars, or roughly 1,000 hours at the federal minimum wage.

For sampled individuals we gather information from several tax filings. We retrieve Medicare wages and deferred compensation from Form W-2, IRA balances and contributions from Form 5498, withdrawals from retirement savings from Form 1099-R, marital status and other tax unit information from Form 1040, and age and gender from the Social Security Administration's Data Master File.[3] The advantages of these data, relative to other research on automatic enrollment, is that they allow for panel analyses even when not with the firm, contain information on other forms of saving, income beyond just those from the employer, and spousal data. However, the tax data have two important limitations in this context. First, the tax data do not contain the balances of defined contribution plans. Second, the tax data do not contain the contributions of employers.

Our full data set includes 194,362 new employees − hired either two years before or one year after each firm adopts automatic enrollment − from 751 unique firms. 59 percent of the people in our sample are "treated" employees, meaning they were hired one year after their company adopted automatic enrollment. The firms range in size from tens to tens of thousands of employees, and the median firm has roughly 275 employees. The firms represent a broad range of industries including construction, retail, wholesale trade, transportation, real estate, communications, scientific services, manufacturing, finance, insurance, professional services, technology, administrative support, education, health care, entertainment, and food services. The most common auto-enrollment default rate in our sample is three percent.

2.2 Participation, Saving, and Withdrawals

The raw data broadly indicate that automatic enrollment increases participation and contributions, something that our regression analyses mostly serve to formalize. **Figure 1** below shows the percent of newly hired employees who contributed a positive, non-zero percent of wages to their company's 401(k) plan in the years before and after each company adopted automatic enrollment. The median enrollment rate at the firm level jumps from roughly 40 percent to 90 percent after the policy changes go into effect. The distribution of enrollment rates across the full sample also changes from a slightly right-skewed distribution centered around 50 percent before auto-enrollment to a left-skewed distribution with 401(k) participation rates clustering around 90 percent after adoption of automatic enrollment.[4]

At the individual level, there are similar increases in employee contributions, although these are tempered by changes in the distribution of contribution rates among savers. **Figure 2** shows the distributions of employee saving rates before and after each firm adopts automatic enrollment, grouped by default rates from one to six percent. The figure only includes active participants in a company-sponsored retirement plan (individuals who are deferring a positive, non-zero amount of wages), but non-participants are included when calculating the

[3]We do not include rollovers when we measure withdrawals, and we remove Roth conversions.

[4]This change is among employees who work at the firm in two consecutive calendar years (i.e., receive a W-2 from the firm in two consecutive tax years).

"percent of employees." Comparing new employee participation rates before and after automatic enrollment, we can see that among savers there is bunching at the default enrollment rate set by the firm among employees hired after automatic enrollment goes into effect, but there is also a general increase at other rates.

The basic summary statistics presented in **Figures 1** and **2** illustrate the direct effects of automatic enrollment on employee participation in and contributions to employer-sponsored retirement plans. The second figure also provides strong suggestive evidence that induced participants are likely to contribute at the default rate, consistent with prior work (e.g., Choukhmane, 2019). However, as shown in the graphs below, the policy also appears to increase retirement withdrawals.

The first graph in **Figure 3** below shows the percent of employees in each group that withdraw funds from an existing savings account before and after they are hired at an auto-enrollment firm. As we can see, there is almost no difference in the two groups before hire, and in both groups, there is an increase in the percent of employees that take withdrawals after hire. However, the increase in the percent of workers taking withdrawals is much higher for individuals in the treated group relative to the control group.

The second graph in **Figure 3** shows the percent of employees in each group − treated and control − who contribute to an IRA before and after they are hired by one of the firms in our sample. There is almost no change in the percent that individuals contribute to IRAs before and after hire (for either the control or treated employees), suggesting any actions the employee (but not necessarily their spouse) takes to offset the induced increase in retirement savings is concentrated in the employer account.

When we examine changes in the level of withdrawals, we find further evidence of differences between the treated and control groups before and after being hired at an auto-enrollment firm. We see differences between the two groups in the amount that employees withdraw from retirement savings accounts, in addition to the propensity of taking a withdrawal. As shown in the first graph of **Figure 4** below, in the year before they are hired at one of the firms in our sample, employees in both the treated and control groups who withdraw funds from a retirement account withdraw roughly the same amounts. Note that the amounts are calculated as the natural log of withdrawals taken each year for purposes of graphing the distribution and highlighting differences between the two groups. There are slightly more employees in the treated group that withdraw funds from retirement accounts before hire − partially because there are slightly more employees in that group − but the distributions are almost identical on the left-hand side.

However, as we can see in the second graph, which plots log withdrawals taken after hire at one of the firms in our sample, although both groups increase their level of withdrawals, the increase in withdrawals among employees in the treated (auto-enrolled) group by far exceeds the increase in withdrawals among those in the control group. Although the median level of withdrawals is now lower for the treated group, there are a greater number of treated employees taking positive withdrawals relative to those in the control group, and withdrawals

among treated employees exceed the number of withdrawals taken by those in the control group at every level.

2.3 Summary Statistics: Spousal Saving Responses

We further examine saving responses to automatic enrollment at the household level by looking at the saving behavior of employees' spouses. In a basic neoclassical framework, married couples are jointly maximizing a single (unitary) utility function. In this setting, we would expect increased savings by the individual to be offset by other household retirement savings. This could take the form of individual savings in other accounts, individual withdrawals, spousal savings, or spousal withdrawals. However, the couple could jointly perceive the nudge of auto-enrollment as information that they should be saving more. In this case, spousal retirement savings changes could mirror those of their automatically-enrolled spouse. Alternatively, both members of the household might be "passive" savers, in which case the saving nudge to the employee will not affect the spouse because they are not active in their selection of a deferral rate (they revert to the default, which is only changing for the employee).

As shown in the **Figure 5** below, there is almost no difference in saving rates of spouses of employees in the treated and control groups. The left panel in **Figure 5** displays the distribution of savings rate (percent of the spouse's wage compensation contributed to an employer plan) by spouses the year before an employee is hired. The right panel displays spousal savings rates the year after employees are hired. Spouses of treated employees and control employees save at indistinguishable rates. We also see negligible spousal saving responses to automatic enrollment in terms of spouses' contributions to IRAs and withdrawals from retirement savings accounts, as displayed in in **Figure 16** in **Appendix D**.

Taken as a whole, these summary statistics suggest that requiring new employees to opt-out of participating in an employer saving plan, as opposed to opting-in, increases participation and savings, but only at the individual level with no effect on spouses. These effects are mitigated − although it is unclear at this point to what extent − by increases in withdrawals from employer plans. The regression analyses described in Section 3 attempts to quantify these changes, with results of the analyses reported in Sections 4 and 5.

3 Empirical Specification

Our base estimation approach in this paper is an event study design. In this setting, employees hired two years before each firm adopts automatic enrollment are the pre-event or "control" group, and employees hired the year after the policy goes into effect are the post-event or "treatment" group. We measure the inputs for our analysis (saving level, income, etc.) the year *after* the employee is hired for both the treatment and control groups ($t+2$ and $t-1$, respectively). We do this to avoid picking up partial-year responses for "treated" employees who may have to wait up to 6 months before being automatically enrolled in an employer-sponsored retirement plan. **Figure 6** summarizes the timeline of when the different

groups are flagged and measured relative to the year the firm adopts automatic enrollment. We estimate **equation 1**, below, and use robust standard errors clustered at the firm level in all regressions.

$$Y_{i,f} = \alpha + \phi T_{i,f} + \beta \mathbf{X}_{i,f} + \delta_f + \epsilon_{i,f} \tag{1}$$

The dependent variable the equation, $Y_{i,f}$, represents one of several outcomes: an indicator for an employee contributing to the employer's 401(k) plan, their contribution rate to the firm-sponsored retirement plan (measured as percent of wages), measures of withdrawals from retirement savings, and spousal equivalents of each variable. $T_{i,f}$ is a binary treatment variable that indicates whether the employee started working at the firm after it adopted automatic enrollment. We interpret the coefficient associated with the treatment, ϕ, as an average treatment effect on the treated. This interpretation requires the "unconfoundedness assumption" (Imbens, 2005), which is that the outcome of the control group is orthogonal to being treated (conditional on our matrix of control variables).

The matrix of control variables, $\mathbf{X}_{i,f}$, includes a married indicator, an indicator for being female (measured at time of birth), log wage earnings, and a quadratic age variable. We include a firm fixed effect, δ_f, which controls for variation coming from firm-level characteristics like the size of the firm, distribution of wages, and industry type. We do not include a year fixed effect because the combination of the firm fixed effect and the treatment variable perfectly predict the year of employment.

We do not include any employer matching controls because we find a very small and insignificant effect on employee participation and savings when these variables are included in our regressions. The reason for this is likely because most companies do not change their employer matching policies at the same time that they adopt automatic enrollment, thus the effect of matching policies is absorbed in the firm fixed effect. Furthermore, most companies have service requirements for employees to qualify for employer matches. Many firms require employees to be working for at least one year before they are eligible for matching contributions.

Table 2 contains the results of a comparison between the average characteristics of our treatment and control individuals and firms. We run a series of t-tests to evaluate whether the differences in each characteristic are statistically significant at the five percent level. As shown in the table, we find statistically significant differences for age and percent married, but neither of the differences are meaningful for the purposes of this analysis. When we further examine age and wage distributions between the treatment and control groups − as shown in **Figure 7** below − we find that the distributions are nearly identical. These statistics are consistent with treatment assignment being approximately random in our setting.

While our sample is more plausibly externally valid than previous research, there are two important caveats regarding external validity.[5] First, the decision of each firm to adopt

[5]We discuss these external validity issues in greater depth in **Appendix E**.

automatic enrollment is not randomly assigned. Within our sample we find that the effects of automatic enrollment vary somewhat depending on the size of the firm, the median wage level, and the industry (according to North American Industry Classification System (NAICS) codes). Second, despite beginning with the population of firms adopting automatic enrollment in this time period, we make a number of sample restrictions based on firm and plan characteristics. As a result, they are not representative of the population of U.S. firms.

Finally, it is worth pointing out that some plans may be adopting automatic enrollment as a means to mitigate the effects of nondiscrimination testing. We discuss this issue in greater detail in **Appendix F**. Briefly, tax favored benefits offered by employers must be utilized sufficiently by all employees, not just those at the top of the firm's wage distribution. Nondiscrimination testing ensures that plans meet these requirements, and if an insufficient number of non-highly compensated employees (NHCEs)are participating in the plan, then contributions made by highly compensated employees (HCEs) must be reduced or the employer has to make non-elective contributions to all NHCEs. Moreover, in 2006, the U.S. Congress passed legislation allowing for a "safe harbor" plan design (one feature of which is automatic enrollment) that eliminates the requirement for non-discrimination testing. Not all employers opt for this 2006 option because it can be expensive to the employer, but to the extent adoption of automatic enrollment is being adopted to avoid nondiscrimination testing or reduce the likelihood of failing nondiscrimination testing, it implies self-selection on the part of the employer.

4 The Effects on Employee Participation and Savings

4.1 Employee Participation in Firm-Sponsored Plans

We begin by estimating the effect of automatic enrollment on the likelihood of participating in the firm's employer-sponsored plan. We estimate **equation (1)** using an ordinary least squares (OLS) regression with robust standard errors clustered at the firm level. The dependent variable is an indicator for an employee contributing some positive amount of wages to the firm's defined contribution plan.[6] As a reminder, for both the treatment (post-automatic enrollment) and control (pre-automatic enrollment) employees, all variables in the regression are measured using data from the year *after* the employee is hired at the firm.

The results are provided in the first column of **Table 1** below. The coefficients reported in the table are marginal effects evaluated at the means. We are interested in the coefficient estimates associated with the treated term. The coefficient estimate for the "pooled" column in the table is 0.36, which we interpret as indicating that automatic enrollment increases

[6]We set a *de minimis* threshold of 1 percent of the year-specific wage threshold for inclusion in the sample ($7,250 in 2019 dollars) for our measures of participation or withdrawal (i.e., an employee must contribute/withdraw at least $72.5 in 2019 dollars in order to be flagged as participating/withdrawing). This guards, to a degree, against classifying someone who participated briefly, but opted out, as a participant/withdrawer.

employee participation in the firm's 401(k) plans by approximately 36 percentage points. This measure is very close to the effects estimated by Madrian and Shea (2001) and for federal workers by Falk and Karamcheva (2019), although lower than the effect estimated by Choi, et al, (2004).[7] The mean enrollment rate among employees in the control group is 44 percent.[8] Thus, our estimate is equivalent to an 80 percent increase in participation due to automatic enrollment.

We also decompose the pooled estimates by five age bins: ages 21-25, 26-36, 36-45, 46-55, and 56-64. We provide the coefficient estimates for this decomposition and all other categorical analyses in the full regression tables found in **Appendix B**. In the body of the paper we instead present figures displaying the coefficient estimate and 95 percent confidence intervals for the treatment variable.

As shown in the first graph in **Figure 8** the effect of automatic enrollment is slightly higher for the youngest employees (ages 21-25) at 45 percentage points, fairly uniform and close to the "pooled" estimate for those aged 26 to 55, and slightly lower for those above age 56 (at 30 percentage points). The differences between age groups are more pronounced when measuring the effect in percentage terms (rather than percentage point), as younger employees in the control group are less likely to participate relative to older employees. These results are provided in second graph in **Figure 8**. Employees between the ages of 21-25 show a 122 percent increase in participation, compared to 62 percent for those aged 55-64.

Figure 9 decomposes the estimates along two other dimensions: wage level and marital status (regression results in **Tables 7 and 8**). We separate the new employees in our sample of firms into five wage bins, one for each quintile of the new employee wage distribution (in our sample of firms). These wage quintiles (listed in 2019 dollars) are approximately: less than \$30,600, \$30,600-\$44,200, \$44,200-\$59,800, \$59,800-\$84,200 and above \$84,200. These wage bins are constructed using aggregate W-2 wages, instead of just wages at the auto-enrollment firms, to account for employees that may have second jobs, or that switch employers.

In percentage point terms, we see a pattern where the participation response gradually decreases from the first to the fifth quintile (from 47 percentage points for the lowest quintile to 22 percentage points for the highest). In percent terms, there is a much steeper decrease in the effect on participation, from a nearly 200 percent increase in participation for those in the bottom quintile to a 35 percent increase for those in the top quintile.
In a pattern that persists for the saving and withdrawal results, the marital status breakout indicates that automatic enrollment increases saving for singles more than married individuals, both in percent and percentage point terms.

[7] We place these and other results in further context of previous findings in Section 7.
[8] We calculate standard errors using a bootstrap method.

4.2 Employee Saving in Firm-Sponsored Plans

Next, we estimate the effect of automatic enrollment on employee saving rates. These estimates use the percent of annual wage earnings each employee contributes to the employer's deferred contribution plan as the dependent variable, and are estimated using an OLS regression with employer fixed effects.[9] As documented in the second column of **Table 1** above, we find that automatically enrolling employees in a 401(k) plan leads to an average increase in deferred contributions of 1.2 percentage points, equivalent to a 50 percent increase in savings. We expect that most of this increase is coming from the effect of automatic enrollment on non-savers: if the policy causes an increase in participation, as we find in the previous section, this will have a positive effect on average contributions among the treated group. In **Appendix D** we provide greater detail on differences in the effect of automatic enrollment on saving by default rate and propensity to save.

We also explore heterogeneity in the savings effect in the same manner as the previous section: by age, wage level, and marital status. These results are documented in **Figure 10**, with the regression results provided in **Appendix B**, **Tables 9, 10, and 11**. We find younger workers are disproportionately induced to save, especially in percent terms (an increase of over 90 percent), due to their lower base saving rate. The effect by wage level, in percent terms, declines monotonically, and as with participation, the differences are starker when looking at relative changes. This is consistent with the default savings rate being defined as a percent of compensation. And as in the participation case, singles appear to save more (in percent terms) as a result of automatic enrollment.

5 Withdrawals, Spousal Responses, and Net Retirement Savings

The analysis in the previous section strongly suggests automatic enrollment increases participation in employer-sponsored defined contribution plans, and contributions to these plans. In this section, we analyze spillover effects of automatic enrollment that might mitigate those savings responses. We also produce estimates of the net retirement savings effect.

5.1 Employee Withdrawals

We first examine the effects of automatic enrollment on employee withdrawals from retirement savings accounts, including from other defined contribution plans or IRAs. Higher participation and contributions to 401(k) plans may increase the likelihood of withdrawals for several reasons. First, treated individuals might have positive retirement savings balances, while their counterparts in the control group are less likely to have positive balances.

[9] If a treated employee leaves the firm at $t+2$ or a control employee leaves at $t-1$, only their wages and deferred compensation for the employer in question is included. In subsequent analyses of withdrawals and net retirement savings, contributions to and withdrawals from all retirement accounts (including IRAs) are included.

It is much easier to take a withdrawal from a positive balance than a zero balance. Second, to the extent individuals are surprised by these "nudged" contributions, they may choose to withdraw some or all of their contributions and their employer's contributions (this could include opting out, or not). Third, if employees who would not typically save part of their earnings leave a job that automatically enrolls them in a retirement account, they may withdraw the savings from that account when they leave.

Consistent with these explanations, we find automatic enrollment is in fact associated with a higher likelihood of withdrawals. Withdrawals are measured on Form 1099-R, which includes distributions from all defined contribution plan accounts or IRAs (excluding rollover distributions). We estimate **equation 1** in the same manner as the participation and savings regressions, using OLS and reporting marginal effects evaluated at the mean. We estimate the likelihood of taking a withdrawal to increase by around 4 percentage points, as shown in the third column of **Table 1**. This is consistent with the raw data in **Figure 3** in the previous section. The baseline rate of withdrawals is about 12 percent, translating to an increase of roughly 35 percent. When we decompose this estimate separately for withdrawals coming from IRAs and employer plans, and see that the result is coming entirely from employer plans. While we cannot directly link the withdrawal reporting with the employer-sponsored plan, this is evidence that withdrawals are coming largely from the plans that employees are automatically enrolled in.

We then decompose the estimated effect along the same dimensions as in the prior section − wage bins, age bins, and marital status − with the results documented in **Figure 11** and **Tables 12, 13, and 14**. We find that the effect is pronounced in the youngest age bin, those 21 to 25 years-old (around 120 percent increase in likelihood of withdrawal); the effect is smaller but still meaningful among those aged 26 to 55, and has no significant effect on those over age 56. The effect of automatic enrollment on withdrawals is monotonically decreasing in the wage distribution for this sample, with each quintile less affected by the policy in percentage point terms: the bottom quintile is 9 percentage points more likely to take a withdrawal (a 76 percent increase), compared to an increase of just one percentage point for those in the top quintile of wages.

The results by marital status mirror those for participation and savings: singles respond more (5 percentage points compared to 3), and in this case have a lower base (10 percentage points compared to 12). Younger workers are slightly more likely to take distributions as a result of automatic enrollment, increasing the likelihood of withdrawals by 6 percentage points (a larger relative increase of about 120 percent). The withdrawal effects are otherwise monotonically decreasing with age, though the baseline probability for the highest age group (26 percent) makes clear that some of these older, new employees might be part-time employees supplementing their wage income with other retirement savings.

A likely contributing factor to withdrawals are job separations, consistent with Goodman, Mackie, Mortenson, and Schramm (2021), who find that job changes are the primary observable cause of leakage. To investigate this, we repeat our base regression specification for withdrawals and include two additional variables: an indicator for whether the employee

separated from the employer in that year and an interaction between the separation indicator and the treatment variable. The estimated coefficient associated with the treatment variable − after including the separation indicator and an interaction with the treatment − is -0.019 (standard error of 0.006), the coefficient associated with the indicator for the employee separating is 0.104 (standard error of 0.015), and the coefficient associated with the interaction term is 0.029 (standard error of 0.048). This suggests job separations are driving the withdrawal effect.

Withdrawal effects are largest for younger, low wage workers, a group of workers that likely experience higher job turnover than older, high wage workers. However, younger, low wage workers also exhibit larger participation responses to automatic enrollment. The mirrored result in withdrawals and participation suggests these workers are more passive. The mechanism for passivity in participation is well-established: passive savers are defaulted into saving by automatic enrollment, and contribute more than their passive non-enrolled peers. But there is also a plan policy nudge for withdrawals. Employer-sponsored plans are allowed to force separated employees with balances below $1,000 to withdraw their balance 30 days after separation. The employee can then make an active choice to elect to rollover this amount to an IRA or other employer-sponsored account, or they can simply cash the check sent to them by their employer (GAO, 2014; Hung, et al., 2015).[10]

As shown in **Figure 12**, the percent of individuals in the treatment group who withdraw funds from their savings account after leaving their job is significantly larger for account balances under $1,000, consistent with a forced cash-out effect. Two caveats are worth noting. First, we proxy for account balance using total employee contributions. This means we are under-estimating total account balances, as employer contributions are not included. Including employer contributions would increase balances to some degree and shift the graph in **Figure 12** slightly to the right, aligning it more closely to the $1,000 cut off for forced distributions. Second, if there is a fixed cost associated with rolling over the funds − such as setting up an IRA or contacting a financial institution − it would manifest as a higher likelihood of cashing out relative to rolling over. However, these results are consistent with Hung, Luoto, and Burke (2015), who find using Vanguard administrative data that automatically enrolled employees with small balances overwhelmingly cash out upon separation.

5.2 Spousal Effects: Retirement Savings and Withdrawals

A unique advantage of the data we have compiled is the ability to observe the retirement saving patterns of spouses. In the previous sections examining retirement savings and withdrawals of employees, we consistently find smaller effects for married individuals. This is true even when accounting for the higher base rates of retirement saving by married individuals (converting the estimates to percent changes). One explanation for lower participation and savings effects is coordination by household members: if at least one of the spouses is an

[10]There is survey evidence that around 4.5 percent of those automatically cashed out fail to cash these checks.

"active" saver and the household maximizes a single utility function, married individuals will be either more likely to opt-out or more likely to have saved independently of automatic enrollment.

For the spousal analysis, we analyze three separate outcomes: the likelihood of saving, the level of saving as a percent of spousal wages, and the likelihood of taking a withdrawal. For the first two, we restrict our analysis to spouses who are employed, as those not employed cannot contribute to employer plans and can only contribute to IRAs if they have self-employment income. However, for all three measures − participation, saving as a percent of wages, and withdrawals − we measure contributions to and distributions from any tax preferred retirement savings vehicle (IRAs or defined contribution plans). The results of the regression analysis are presented in **Table 3**.

The estimation finds a statistically significant spousal reaction to participation at the five percent level, but the effect on spousal saving levels and withdrawals is not significant. Spouses are slightly more likely to make a retirement savings contribution (by 2 percentage points, or 4 percent) but there is no significant increase in contributions. These estimates also are generally not consistent with any kind of "offsetting" effect. Instead, it appears that when employees are automatically enrolled their spouses do not react to the change in policy. This is likely because the employees being affected by automatic enrollment are not active savers, and thus are simply saving at whatever default rate they are enrolled in. These employees are most likely not making saving active decisions, and thus the increase in savings does not extend to spousal saving.

5.3 Net Retirement Savings

Finally, we want to explore the degree to which the positive estimated effect of automatic enrollment on employee contributions is offset by increases in employee withdrawals from retirement accounts. The coefficient estimates displayed in **Figure 13** are in dollars of net retirement saving at the employee level, broken out by wage bin and age (also see **Tables 15 and 16** in **Appendix B**). Net retirement savings is defined as employer plan contributions and IRA contributions net of withdrawals from employer plans and IRAs. Importantly, net retirement savings can include contributions to and withdrawals from accounts and plans other than the employer-sponsored plan in question. We set the minimum amount of net retirement savings at zero. Without this restriction our measure of net retirement savings could be negative due to growth in the account or savings from prior years being included in withdrawals.

For employees in the bottom wage earnings quintile, the net effect of automatic enrollment is $274. In comparison, for high earners (those in the top quintile) the estimated increase in savings is $960. When you look at the percentage change however, employees in the lowest wage quintile increase their savings by a much higher percentage, due to their relatively low baseline saving level. Similarly, young workers (aged 21-25), whose participation and contribution effects were quite large in percent terms, are induced to save an additional $547. This

is slightly lower than the increase in savings for those aged 56-64 ($648), but in percentage terms is much larger: 54 percent versus 18 percent.

Figure 13 also displays the net retirement savings effects separately for married and single employees. As shown in the figure, the increase in net retirement savings is slightly larger for married employees, although this amounts to a lower relative increase in savings as single employees tend to save at lower levels in the absence of automatic enrollment.

6 Medium Run Effects

The final analysis in this paper is an examination of medium-run automatic enrollment responses. This analysis is more challenging than estimating short-term responses for several reasons. First, we observe a high amount of employee turnover with each passing year, and the population of employees still working for the employer that adopted automatic enrollment (generating our treatment variable) diminishes over time. Out of the employees that we observe working for the firm one year after hire ($t + 2$ for the treated), only about 60 percent are still working for the firm two years later (at time $t + 4$). Separations are almost certainly non-random, and estimates only on long-lasting employees are incomplete. Two other complications are related to measuring account balances in tax data (restricting our analysis to flows), and longer time periods causing some firms to fall out of the sample. Finally, the longer gap between the treatment and control allows for factors unrelated to automatic enrollment − real wage growth (which directly affects measures of net retirement savings) or secular increases in retirement savings prevalence − to bias estimates upward. Despite these limitations, our estimates provide insight into the medium-run effects of this plan feature.

6.1 Estimating Medium Run Effects

Our medium-run analysis requires a slightly different sample than that used in the previous sections, and a different control group. For this analysis, the control group consists of employees of auto-enrollment firms hired in year $t-4$ (where t is the year automatic enrollment is adopted), and we measure their earnings and savings in years $t - 3$, $t - 2$, and $t - 1$. We compare them with our treated group from above − hired in year $t + 1$ − in years $t + 2$, $t + 3$, and $t + 4$. We limit our sample to employees at companies that adopted automatic enrollment between 2010 and 2014, as these are the only companies for whom we observe the treated group for at least four years (our W-2 data end in 2018). The resulting sample contains around 95,000 individuals in the treated or control group across 518 companies.

Our measures of contributions, withdrawals, and wage earnings are from all employers (and IRAs) in a given year. This is analogous to the measurement/construction of withdrawals and net retirement savings in the short run section. Savings (as a percent of compensation) and participation differ from their construction in the short run analysis, in that all sources

of wage earnings and contributions to retirement accounts are included, as opposed to only wages and savings at the auto-enrollment firm. This is necessary to measure effects for individuals who leave the firm one or two years after hire.

Table 4 displays estimates of the effect of automatic enrollment on participation, savings rates, withdrawals, and net retirement savings, separately for each year after being hired.[11] When compared to the sample of employees who are hired just two years apart, the estimated responses to auto-enrollment are similar: the participation effect is 3 percentage points lower, the savings rate is 0.3 percentage points higher, and withdrawals are one percentage point lower. The only difference is that the effect on net retirement savings in the first year after hire appears twice as high in this sample. This raises two possibilities: the use of an older control group − those hired in $t-4$ instead of $t-2$ − biases upward effects, or that the subset of companies used here (518 of the original 751) generate larger responses among their employees.

As shown in **Table 4**, the estimates from our long-term analysis indicate that the effects on participation and saving for new employees four years after hire remain positive, although the effect decreases with time. The effect of automatic enrollment on participation decreases from a 33 percentage point increase in participation one year after hire to a 16 percentage point increase three years after hire. The effect on saving (as a percent of wage income) decreases from a 1.35 percentage point increase to a 0.67 percentage point increase. The effect on withdrawals remains constant over time. The effect on net retirement savings − defined here as all contributions to tax preferred retirement savings vehicles net distributions (non-rollover, non-conversion) from these vehicles − declines from $1,120 to $546.

Several factors likely explain the diminishing effect of automatic enrollment over time. First, as explored in **Section 5.1**, separating employees − perhaps especially those defaulted in − likely cash out some or all of their retirement savings in the employer plan (Hung, et al., 2015). Another explanation is that employees leave the firm at some point during the four years after being hired, and are no longer automatically enrolled in a retirement savings plan three years after hire. The sample used for this portion of the analysis only includes employees who work for an auto-enrollment firm for at least a portion of two calendar years: the year they were hired ($t-4$ for the control, $t+1$ for the treatment) and one additional year. However, even among this sub-sample, only about 60 percent of employees who are at the firm one year after being hired are still with the firm three years after being hired. Moreover, employees with shorter tenures tend to be younger and have lower wages − the same groups of employees for which automatic enrollment has the largest effect on participation and saving.

Table 5 displays estimated effects of automatic enrollment three years after being hired, separately for those who remain at the firm for all three years and for those who depart. We examine single-year flows in year $t+4$ for the treated group and $t-1$ for the control group, and include an interaction term with the treatment variable for whether the individual was

[11] Note, these are all annual flows, not cumulative amounts.

still employed with the firm in that year. We find that the effect of automatic enrollment on participation, savings rates, withdrawals, and net retirement savings for employees still working at the firm looks very similar to the overall effect in the first year after hiring, when all employees in the sample are at the firm for at least part of the year. However, when looking at employees who have left the firm in the third year after hire the effect is greatly diminished, with a participation increase of only 8 percent and a savings rate increase of 0.42 percentage points.

Surprisingly, the effect of auto-enrollment on participation, savings rates, and withdrawals remain statistically discernible from zero for the group of employees who left their auto-enroll firms. We have two explanations in mind: automatic enrollment instilled a savings habit in individuals affected by the policy, or that the larger difference in years between the treatment and control group has biased upward the effect of automatic enrollment. That is, because the treatment and control group are separated by 5 years ($t-1$ and $t+4$), the individuals may be "aging into savings" or it could be that retirement savings is simply more popular/common as times goes on.

We estimate a large, positive, and statistically significant effect on the net retirement saving behavior of these employees who remain at the firm, even three years after hire. This is evidence of the power of this default plan feature.[12] The magnitude, however, is slightly smaller than the short run effect, which we think is explained by both convergence of preferences and selection. As Choukhmane (2019) documents in the sample of firms he examines, there is conversion over time in contributions as a percent of base compensation when comparing automatically enrolled and non-automatically enrolled employees that remain at the same employer. Additionally, employees who remain at the firm are likely to be older and earn higher wages, so there is a selection issue when looking at the effect of auto-enrollment over time: those who remain are more likely to save, whether or not they are automatically enrolled.

6.2 Cumulative net retirement savings

Finally, we measure the medium-run effect of automatic enrollment on cumulative savings, breaking out estimates by wage quintile and tenure. To measure our variable of interest we calculate total contributions contributions (to both DC accounts and IRAs) less total withdrawals from retirement accounts (excluding rollovers and Roth contributions) for the entire time period following automatic enrollment, from time $t+2$ to time $t+4$. Cumulative net retirement savings are censored at zero. We estimate coefficients separately for each cluster of employees based on wage quintile and tenure. This allows us to see differences in the effect for individuals in the bottom quintile − for example − who left the firm in the second or third year of employment compared to those who are still at the firm at time $t+4$.

[12]This persistent effect could also be aided by the adoption of auto-escalation in the default enrollment rate. About one-quarter of the firms in our data have a policy of automatically escalating the default rate by 1 percent each year.

As shown in **Figure 14** below, the effect of auto-enrollment on cumulative net retirement savings in the medium run looks similar to the short run effects we see in **Figure 13**. The absolute (dollar) change in cumulative savings is increasing with each wage quintile, and the relative (percent) increase is generally decreasing in wage quintile due to the relatively lower base saving rates of workers at the lower end of the wage distribution. However, within each wage quintile there are differences in the effect between workers who leave the auto-enroll firm after one or two years (2- and 3-Year Tenure, respectively) compared to those who are still at the company in their third year after hire (4-Year Tenure).

For employees in the bottom quintile of wages, we see that there is a noticeable difference in the positive effect of auto-enrollment on those who are still with the firm at time $t + 4$ compared to those who left the firm after year $t + 2$ (where t is still the year in which the firm adopts auto-enrollment). In absolute terms the estimated effect is more than three times as great for those who are still with the firm in year $t + 4$. This difference between employees who left the firm versus those still with the firm is also quite large for workers in the second wage quintile. However, the difference decreases with wage level, and for those in the top wage quintile the opposite is true: the estimated effect is more than twice as large for employees with two years' tenure compared to employees still at the firm in their fourth year.

These cumulative estimates further illustrate how in the medium run (and probably in the long run), the positive effects of automatic enrollment may dissipate for several reasons. Job turnover − particularly for low-wage workers − may cause workers to stop deferring contributions (if they are no longer auto-enrolled at another firm) or cash out savings accrued as a result of the policy upon departure. For high-wage workers the effect may dissipate over time as take-up in the control group increases over time, and saving rates converge.

7 Discussion

This paper offers new evidence on automatic enrollment from a large set of private sector employers. This set of data is more plausibly externally valid than earlier studies focusing on one or more companies, though our results are very much consistent with the headline results of those findings.[13] We conduct an extensive analysis of short run retirement savings responses as well as an analysis of medium run behavior (three years after hire).

In the short run, where we measure savings in the calendar year after the employee is hired, we find that the policy has a large positive effect on the participation of employees across all age, wage level, and marital status bins. We also see that auto-enrollment disproportionately increases the relative participation and savings rates of younger, low-wage employees. These effects are particularly large when measuring relative increases (percent effects), because of the low levels of participation and savings of these employees.

[13] See **Appendix E** for a comparison of the firms in our sample with other firms by size and industry.

Low-wage individuals (in the bottom quintile of earnings) have the largest relative participation and contribution effects, and more than any other group appear to have mostly been induced to participate and contribute (nearly 80 percent increase in participation, and nearly 70 percent increase in contributions). They are also likely the most affected by the associated decrease in take-home pay. Because we measure savings the calendar year after the employee is hired, this is unlikely to reflect opt-out (though participation remorse is possible). Instead, it may be that cash-constrained individuals treat their new employer-sponsored plans as a precautionary savings vehicles, frequently withdrawing funds from retirement accounts to cover expenses.

It may also be that not opting out, and instead periodically withdrawing balances, is optimal for some individuals. Withdrawals from defined contribution accounts are generally associated with a 10 percent early withdrawal penalty for individuals younger than 59.5. However, even for withdrawals subject to the penalty, an individual whose plan includes employer matching contributions would be better off making contributions (as long as the match exceeds the penalty) and withdrawing the contributions, rather than opting-out and receiving wage income directly. As many employer match rates exceed 10 percent, this type of strategic behavior is plausible.

Separately analyzing the effect of automatic enrollment by wage levels is also important for determining whether the policy has distributional effects. This question is particularly relevant because if a retirement plan includes automatic enrollment in coordination with certain matching, default, and vesting criteria, then the plan qualifies for an exemption from nondiscrimination testing requirements (IRS, 2020). If not exempt, firms are required to test their traditional 401(k) plans each year to ensure that the contributions made by "rank-and-file" (non-highly-compensated) employees are proportional to contributions to the plan made by highly-compensated employees, including owners and managers (IRS, 2020). Our results, which demonstrate the largest net retirement saving effect (in dollars) for high income new employees, suggest firms might be adopting this policy to allow larger deferral benefits for highly-compensated employees.

Beyond savings at a given employer-sponsored plan, a primary motivation of this project is learning more about the effect of automatic enrollment on the *net* retirement savings of individuals and households. We do not find any responses in IRA contributions or withdrawals, and do not detect any spousal responses to automatic enrollment. The non-response among spouses is likely because the policy of automatic enrollment affects saving behavior overall through its effect on the behavior of passive savers, or those who remain at the default rate. If the default rate is set at zero − as it is for employees in the control group − then employees are induced to save nothing. If the default rate is positive, then they will be nudged to save at the positive default rate. Under both circumstances, the decision to save does not extend to the household level, because the nudge only affects passive employees, who are less likely to coordinate saving decisions with their spouses. These types of savers do not make active saving decisions at the household level.

When we estimate the same effects on a medium term horizon (four years), we do see that

the effect on saving and participation is persistent among employees who remain at the same firm. However, in our sample of firms − and in the wider literature − employee turnover is quite high. After one calendar year we observe that one-third of new employees are no longer working at the same firm. The significance of net retirement savings becomes very apparent at this point. When employees leave the firm where they are automatically enrolled in a retirement savings plan, they withdraw funds, possibly to cover expenses between jobs or due to rules allowing employers to involuntarily distribute small balances. This is consistent with Goodman, et al. (2021), who find that job changes are the primary reason for leakage from retirement accounts.

Finally, this paper does not engage with the literature on optimal levels of default contribution rates − including Bernheim, Fradkin, and Popov (2015) or Bubb and Warren (2020) − beyond offering evidence in **Figure 2** that default rates are common landing spots for automatically enrolled individuals. This is a known concern among economists and policymakers, and various design changes have been created to counteract this issue (e.g., annual default renewals with auto-escalating default rates). With the breadth of firms we currently analyze, and the ability to add more, it seems an estimate of this effect is worth pursuing in the future.

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Tables and Figures

Table 1: Automatic Enrollment Effect on Employee Retirement Saving

	Participation	**Savings Rate**	**Withdrawals**
Treated	0.36	1.24	0.04
	(0.02)	(0.11)	(0.00)
Female	0.04	0.30	-0.02
	(0.01)	(0.05)	(0.00)
Married	0.01	0.52	-0.00
	(0.00)	(0.04)	(0.00)
Age	-0.00	-0.09	-0.00
	(0.00)	(0.01)	(0.00)
Age Squared	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Log Wage Earnings	0.15	1.15	-0.08
	(0.01)	(0.07)	(0.01)
Firm Fixed Effect	✓	✓	✓
Mean Control	0.44	2.58	0.12
	(0.00)	(0.01)	(0.00)
Observations	131,563	131,563	131,563
Firms	751	751	751

Notes: This table displays coefficient estimates of linear regressions of three separate outcome variables − participating in the firm's defined contribution plan (binary), the percent of compensation deferred in the firm's plan (continuous, percent), and taking a withdrawal from any plan/IRA (binary) − on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The coefficient values in the participation column are in fractions (i.e., 0.36 indicates a 36 percentage point increase), in the savings rate column are in percentage points (i.e., 1.24 indicates an increase in the savings rate of 1.24 percentage points), and in the withdrawal column are fractions (i.e., 0.04 indicates a 4 percentage point increase).

Table 2: Balance Test: Control and Treated Population Differences

Individual-Level	**Mean Control**	**Mean Treated**	**95% CI**	
Wages	\$55,508	\$55,881	-\$126	\$872
Age	38.1	37.6	0.36	0.60
Percent Married	47.3%	43.9%	2.9%	4.0%
Percent Female	48.8%	48.4%	-0.1%	1.0%
Firm-Level	**Mean Control**	**Mean Treated**	**95% CI**	
New Employees	87	89	-20	17
Mean New Emp. Wages	\$54,838	\$54,012	-\$1,523	\$3,177
Median New Emp. Wages	\$46,642	\$46,178	-\$1,686	\$2,615

Notes: This table displays the result of balance tests for our sample of new employees and firms.

Table 3: Automatic Enrollment Effect on Spousal Retirement Saving

	Participation	**Saving**	**Withdrawal**
Treated	0.02	0.08	0.00
	(0.00)	(0.07)	(0.00)
Female	0.03	0.35	-0.03
	(0.00)	(0.07)	(0.00)
Age	0.00	0.11	0.00
	(0.00)	(0.01)	(0.00)
Age Squared	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
Log Wage Earnings	0.21	0.50	0.00
	(0.00)	(0.07)	(0.00)
Firm Fixed Effect	✓	✓	✓
Mean Control	0.48	3.60	0.09
	(0.00)	(0.04)	(0.00)
Observations	65,235	65,235	82,833
Firms	751	751	751

Notes: This table displays coefficient estimates of linear regressions of three separate outcome variables for spouses of employees in the treatment and control groups − making a positive contribution to an IRA or employer-sponsored plan (binary), the percent of wage compensation deferred (continuous, percent), and taking a withdrawal from any plan or IRA (binary) − on a treatment variable indicating the adoption of automatic enrollment at their spouses' employers. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for spouses of employees in the control group, with bootstrapped standard errors in parentheses. The coefficient values in the participation column are in fractions (i.e., 0.02 indicates a 2 percentage point increase), in the savings rate column are in percentage points (i.e., 0.05 indicates an increase in the savings rate of 0.05 percentage points), and in the withdrawal column are fractions (i.e., 0.04 indicates a 4 percentage point increase).

Table 4: Effects of Automatic Enrollment Over Time

	Years After Being Hired		
	One	**Two**	**Three**
Participation	0.33	0.21	0.16
	(0.03)	(0.02)	(0.01)
Savings Rate	1.35	0.75	0.67
	(0.13)	(0.09)	(0.09)
Withdrawals	0.03	0.04	0.03
	(0.00)	(0.01)	(0.00)
Net Retirement Saving	1,120	490	546
	(77)	(65)	(73)
Observations	95,710	95,710	95,710
Firms	518	518	518

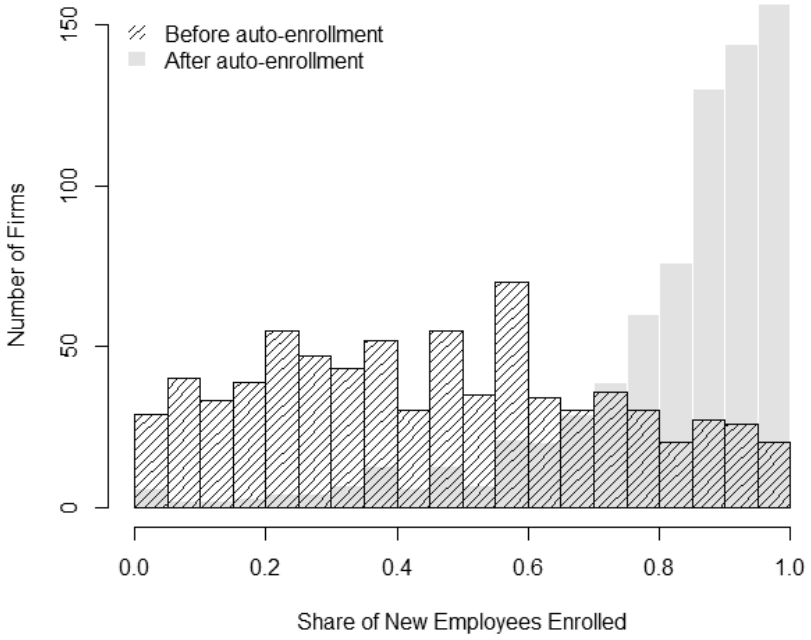
Notes: This table displays coefficient estimates of linear regressions of four separate outcome variables measured one, two, or three years after hire (not cumulative) − making a positive contribution to an employer plan or IRA (binary), the percent of wage compensation deferred in any vehicle (continuous, percent), taking a withdrawal from any plan or IRA (binary), and retirement contributions to all accounts net of withdrawals from all accounts (dollars) − on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The coefficient values in the participation row are in fractions (i.e., 0.02 indicates a 2 percentage point increase), in the savings rate row are in percentage points (i.e., 0.05 indicates an increase in the savings rate of 0.05 percentage points), in the withdrawal row are fractions (i.e., 0.03 indicates a 3 percentage point increase), and in the net retirement saving row are dollars. Each regression is run separately by years after being hired.

Table 5: Effects of Automatic Enrollment Three Years After Hire

	Still at the Firm	
	Yes	**No**
Participation	0.23	0.08
	(0.02)	(0.01)
Savings Rate	0.97	0.42
	(0.13)	(0.08)
Withdrawals	0.02	0.02
	(0.00)	(0.00)
Net Retirement Saving	599	415
	(84)	(76)
Observations	57,912	37,768
Firms	515	516

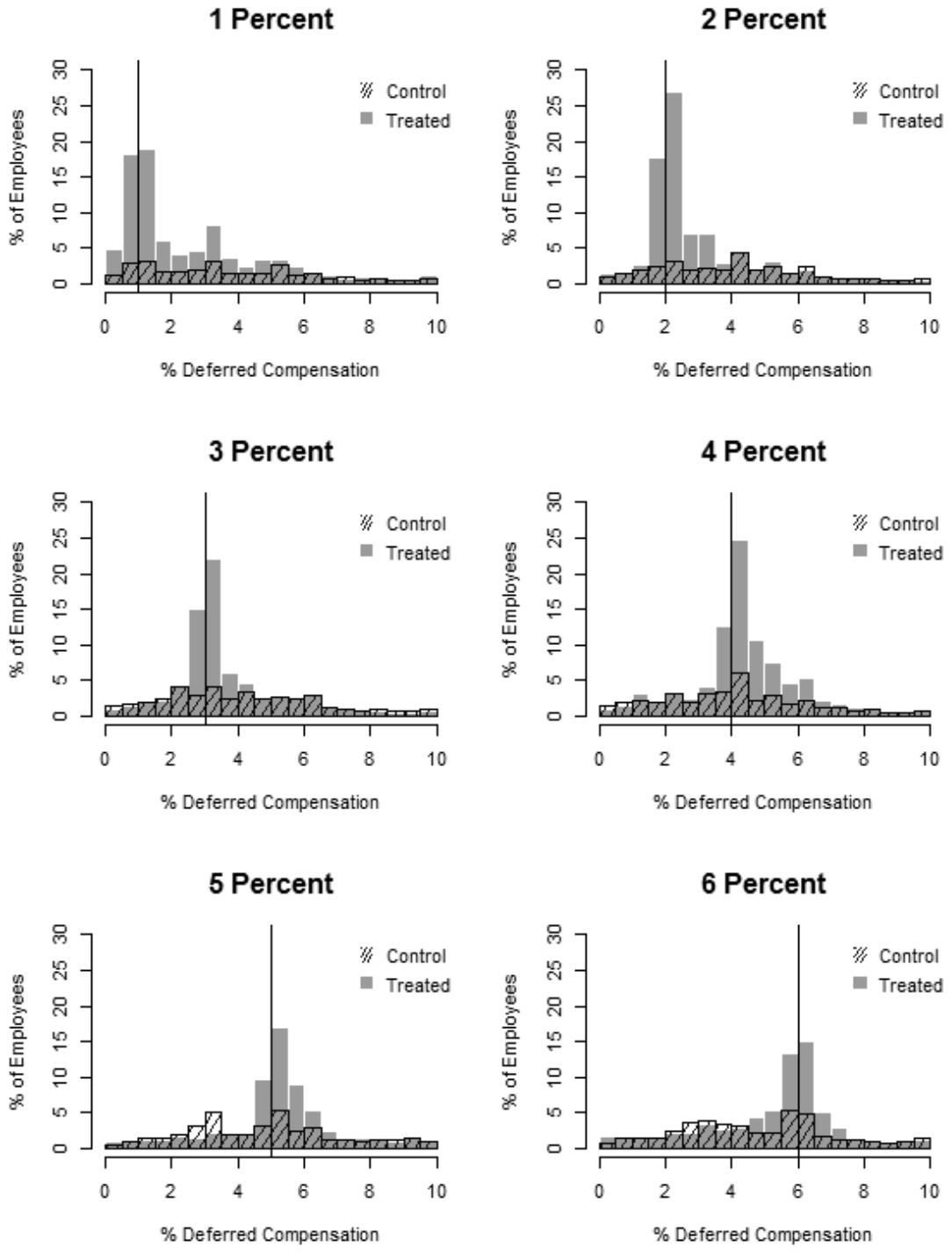
Notes: This table displays coefficient estimates of linear regressions of four separate outcome variables measured three years after hire (not cumulative) − making a positive contribution to an employer plan or IRA (binary), the percent of wage compensation deferred in any vehicle (continuous, percent), taking a withdrawal from any plan or IRA (binary), and retirement contributions to all accounts net of withdrawals from all accounts (dollars) − on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics, including an interaction variable for the incidence of still working at the firm 3 years after hire, are also included. All variables are measured three years after hire.

Figure 1: DC Plan Participation Rates Before and After Automatic Enrollment



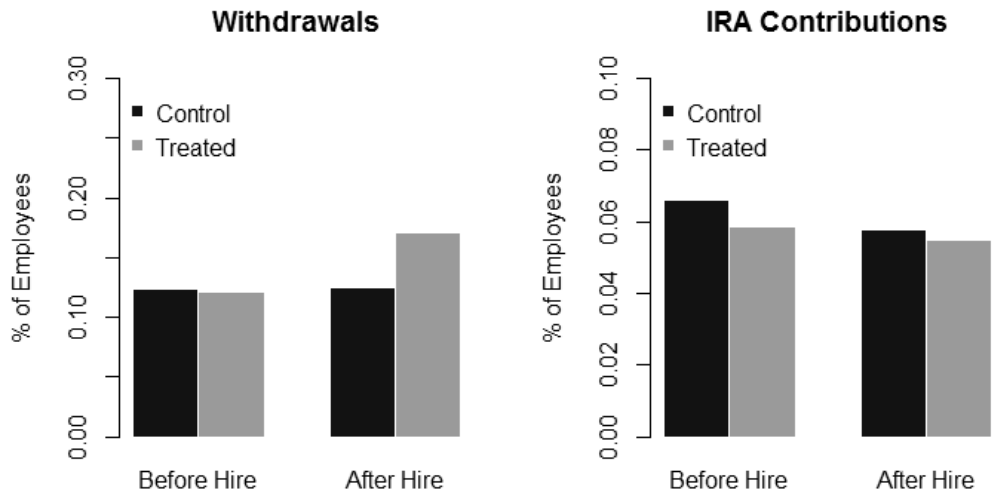
Notes: This figure displays the share of new employees that participate in their employer's defined contribution plan. The dashed bars correspond with new employees at a firm prior to the adoption of automatic enrollment. The solid bars correspond with new employees at a firm following the adoption of automatic enrollment. A unit of observation in the data underlying this figure is a firm-year pair.

Figure 2: Employee Saving Rates Before and After Automatic Enrollment



Notes: This figure displays the savings rates (contributions as a percent of compensation) for new employees at firms. Separate figures are displayed by the default saving rate specified in the plan. The dashed black and white bars correspond with new employees at a firm prior to the adoption of automatic enrollment. The solid bars correspond with new employees at a firm following the adoption of automatic enrollment.

Figure 3: Effect of Automatic Enrollment on Withdrawals and IRA Contributions

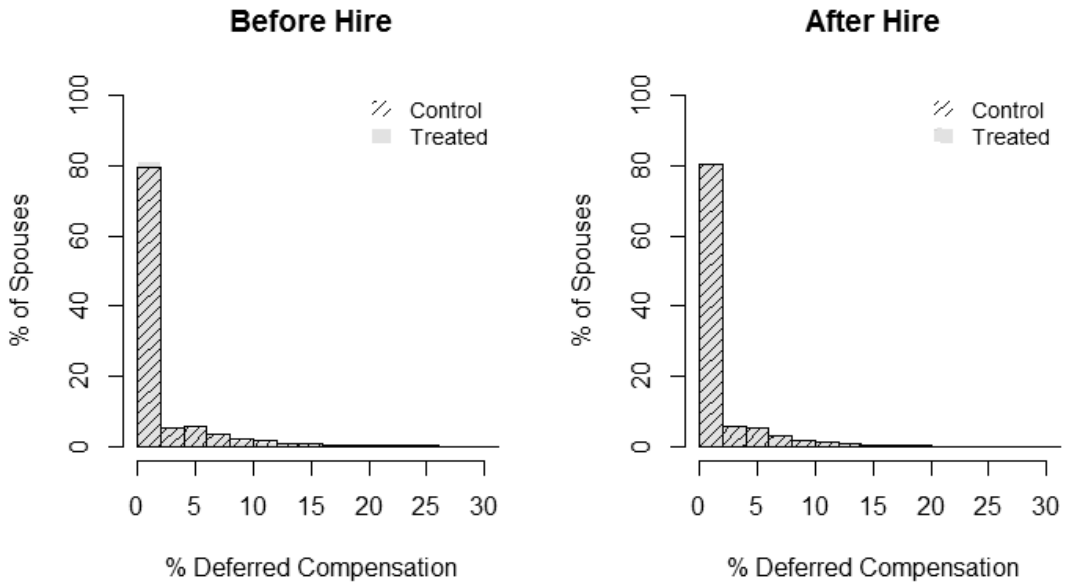


Notes: This figure displays the percent of new employees taking withdrawals from any retirement saving account (left panel), and the percent of new employees contributing to an IRA (right panel). The black bars correspond with new employees at a firm prior to the adoption of automatic enrollment (control). The gray bars correspond with new employees at a firm following the adoption of automatic enrollment (treated). The occurrence of withdrawals and IRA contributions are displayed separately for the year before and the year after employees were hired at a firm associated with treatment assignment.

Figure 4: Effect of Automatic Enrollment on Withdrawal Levels

Notes: This figure displays the level of withdrawals taken from any retirement saving account. The dashed black and white bars correspond with new employees at a firm prior to the adoption of automatic enrollment (control). The solid gray bars correspond with new employees at a firm following the adoption of automatic enrollment (treated). The level of withdrawals is displayed separately for the year before (left panel) and the year after (right) employees were hired at a firm associated with treatment assignment. Employees with zero withdrawals are excluded from the figure.

Figure 5: Effect of Automatic Enrollment on Spousal Saving Rate



Notes: This figure displays the savings rate (the percent of wage compensation deferred) by spouses of employees in the treatment and control groups. The dashed black and white bars correspond with the spouses of new employees at a firm prior to the adoption of automatic enrollment (control). The solid gray bars correspond with new employees at a firm following the adoption of automatic enrollment (treated). The level of percent of spousal wages that are contributed to employer sponsored plans is displayed separately for the year before (left panel) and the year after (right) employees were hired at a firm associated with treatment assignment.

Figure 6: Timeline: Empirical Specification

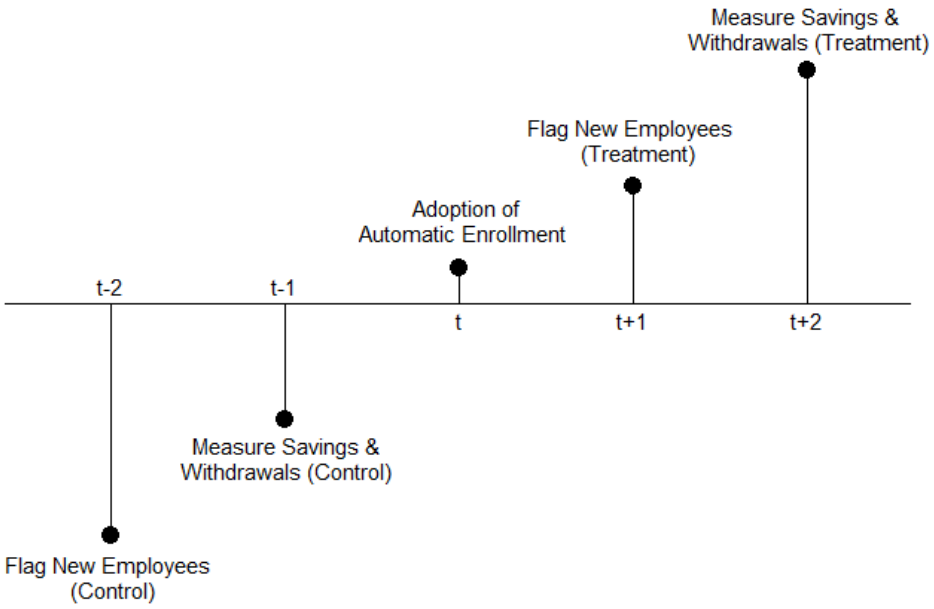
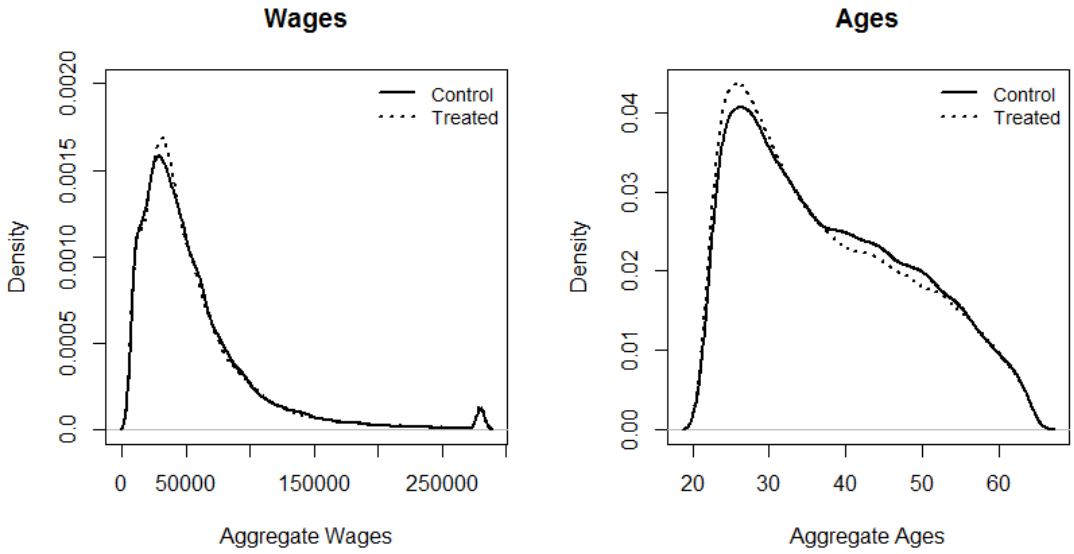
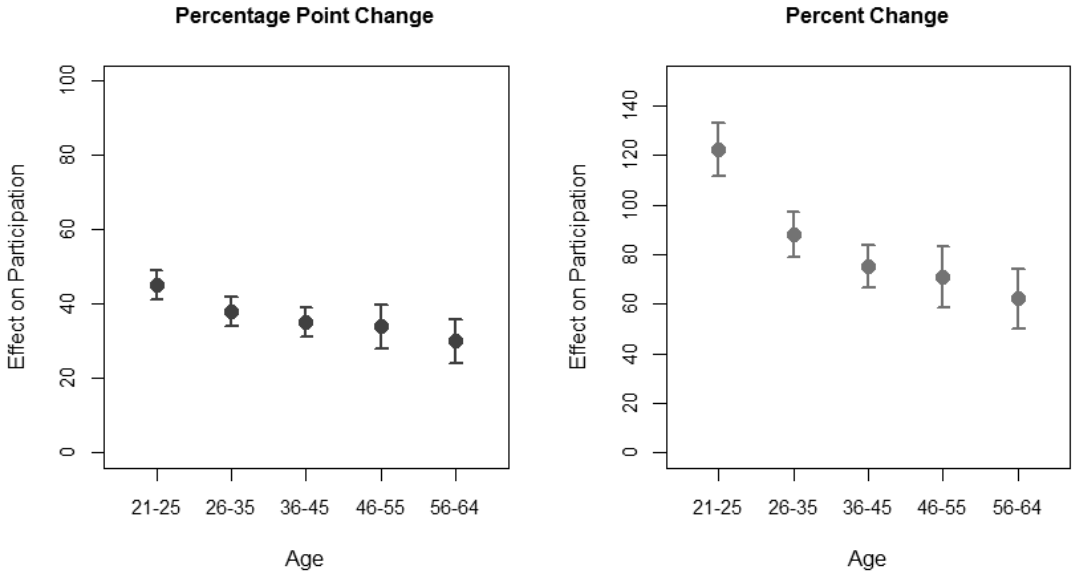


Figure 7: Employee Distributions: Treatment vs. Control



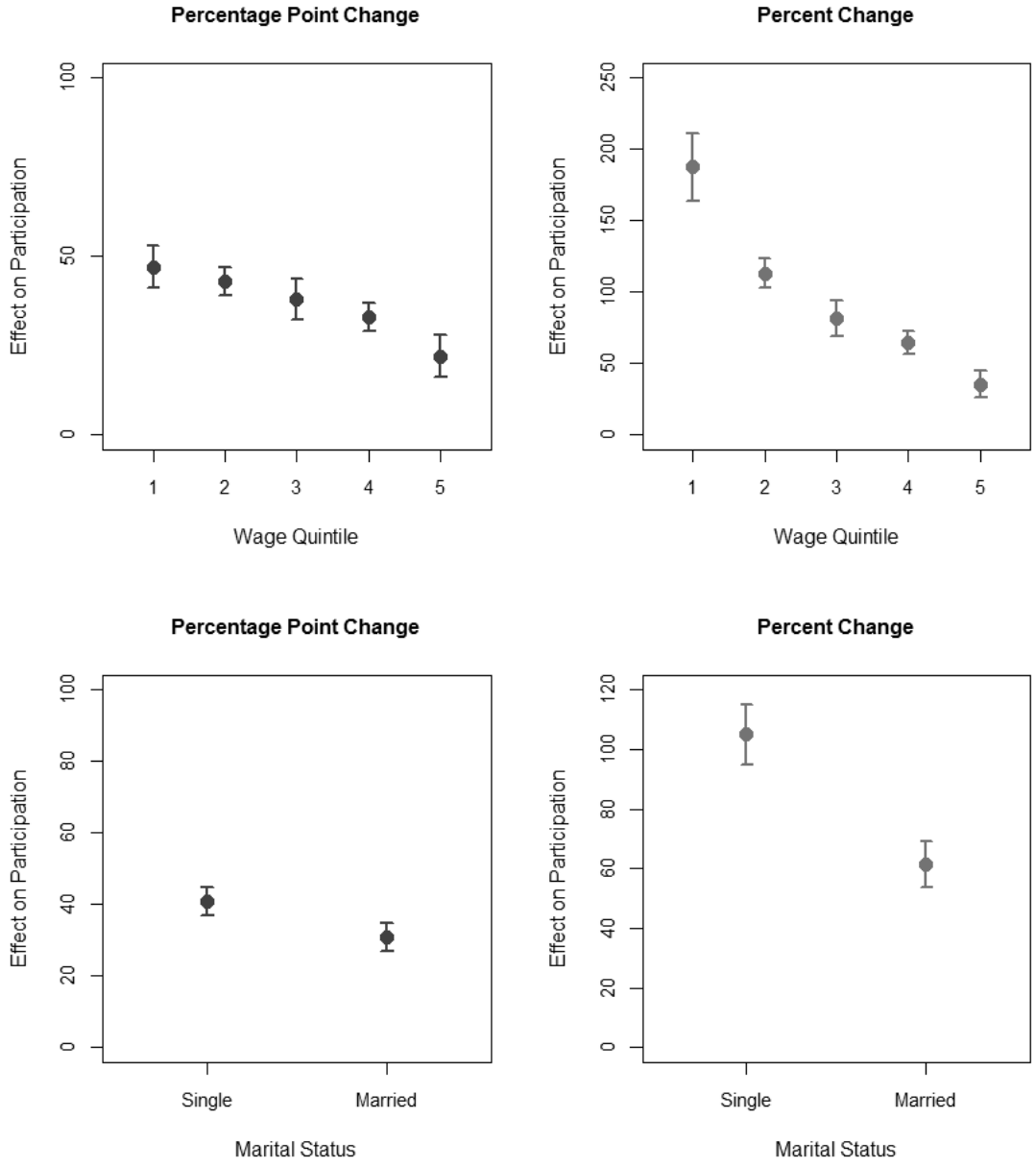
Notes: The first graph in the figure plots the distribution of annual wages for all employees in the control and treatment group where the dotted line represents the distribution for the treatment group and the solid line represents the distribution for the control group. The second graph plots the distribution of ages for all employees in the control and treatment groups (with the same dotted and solid lines for the treatment and control groups, respectively).

Figure 8: Participation Effect by Age



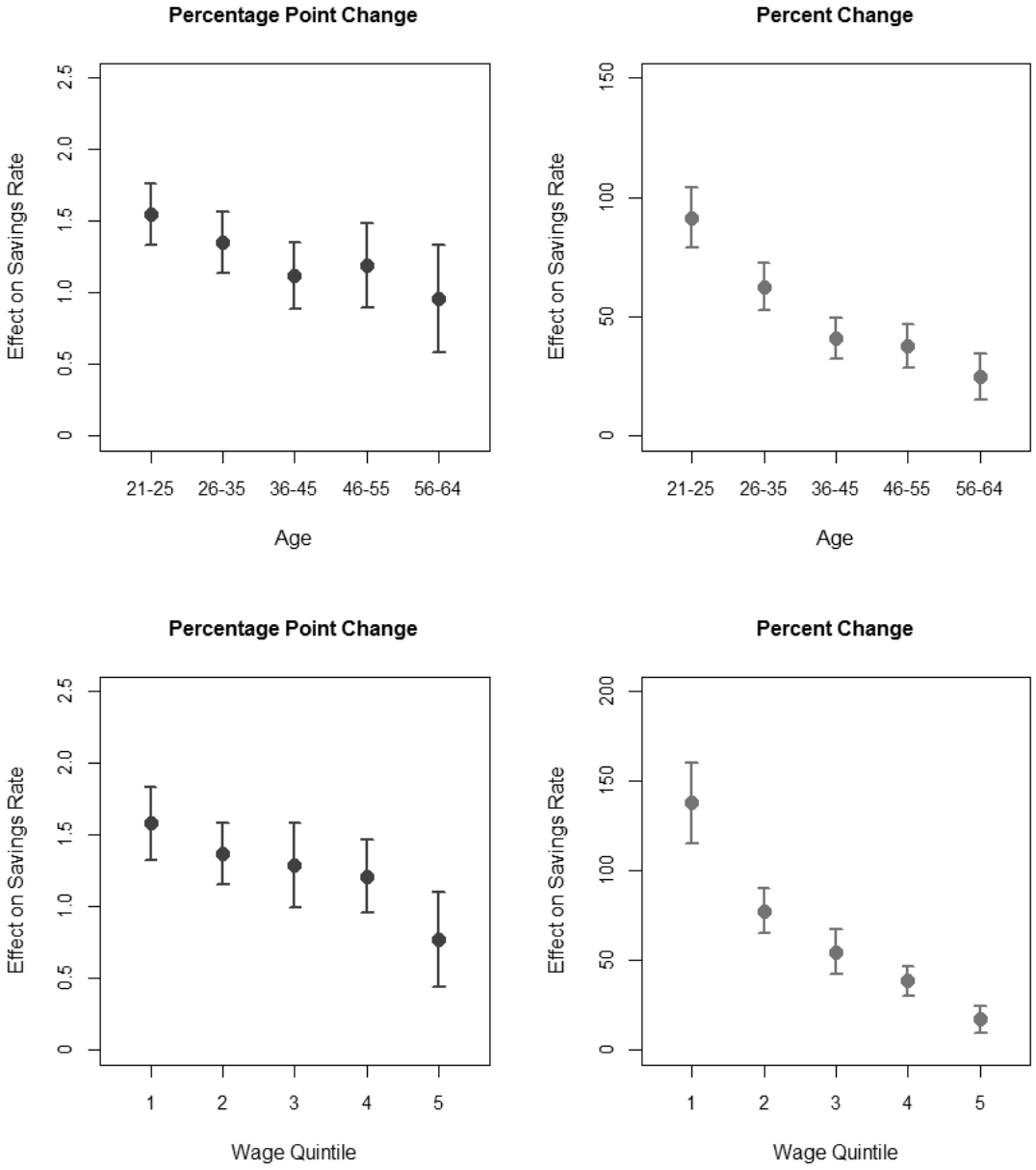
Notes: This figure displays coefficient estimates of linear regressions of making a positive contribution to the firm's employer-sponsored defined contribution plan on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The coefficients displayed (the shaded dots) are associated with the treatment variable, and 95 percent confidence intervals − estimated using bootstraps − surround the point estimates. Regressions are estimated separately for different age bins. The point estimates displayed in the left panel are in percentage points. The point estimates displayed in the right panel have been converted to percent changes using the mean amounts for corresponding control groups (standard errors again bootstrapped).

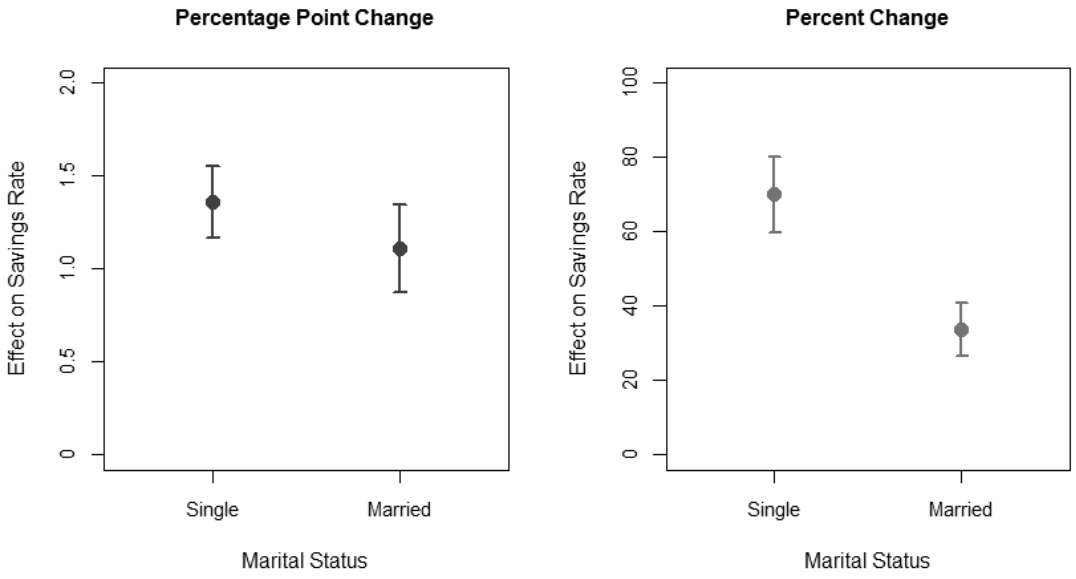
Figure 9: Effect on Employee Participation by Wage Earnings and Marital Status



Notes: This figure displays coefficient estimates of linear regressions of making a positive contribution to the firm's employer-sponsored defined contribution plan on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The coefficients displayed (the shaded dots) are associated with the treatment variable, and 95 percent confidence intervals − estimated using bootstraps − surround the point estimates. Regressions are estimated separately for wage earning quintiles (top panels) and marital status (bottom panels). The point estimates displayed in the left panels are in percentage points. The point estimates displayed in the second panel have been converted to percent changes using the mean amounts for corresponding control groups (bootstrapped standard errors).

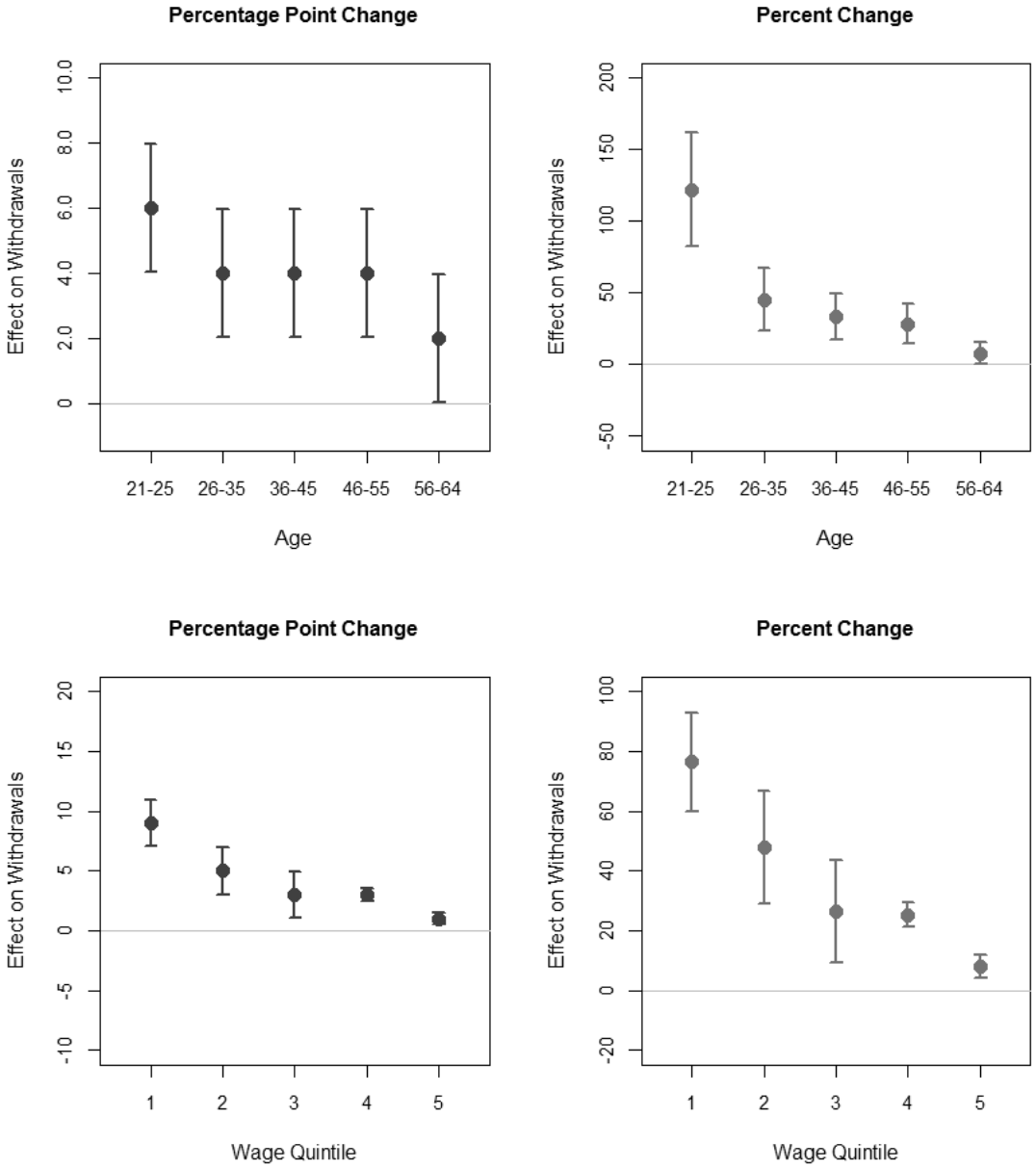
Figure 10: Effect on Savings Rate by Age, Wages, and Marital Status

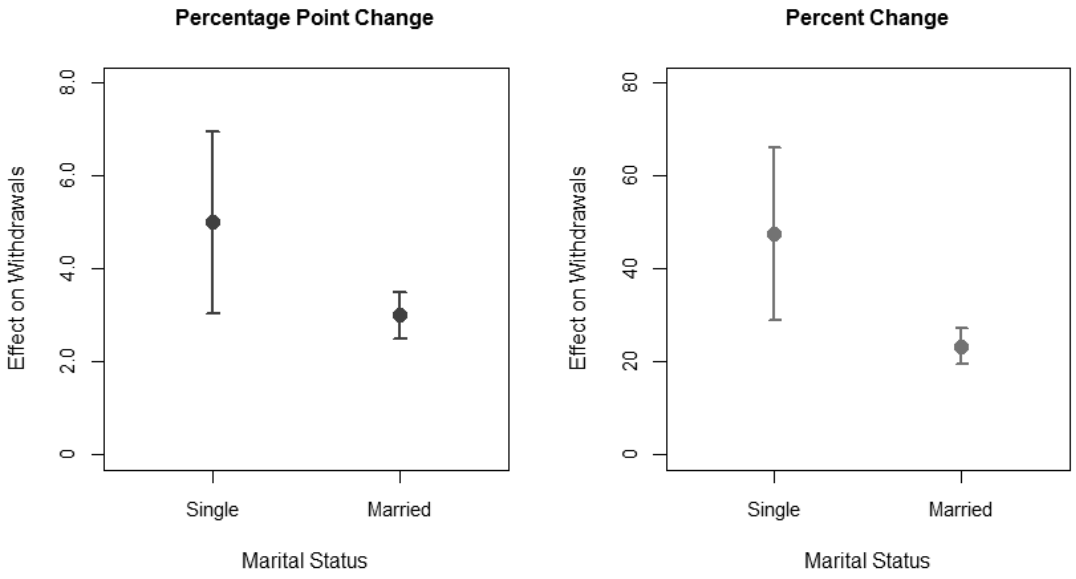




Notes: This figure displays coefficient estimates of linear regressions of contributions to the firm's retirement savings plan (as a percentage of compensation) on a treatment variable indicating the adoption of automatic enrollment. The coefficients displayed (the shaded dots) are associated with the treatment variable, and 95 percent confidence intervals − estimated using bootstraps − surround the point estimates. Regressions are estimated separately for age bins (top panels), wage earning quintiles (middle panels) and marital status (bottom panels). The point estimates displayed in the left panels are in percentage points. The point estimates displayed in the second panel have been converted to percent changes using the mean amounts for corresponding control groups (standard errors again bootstrapped).

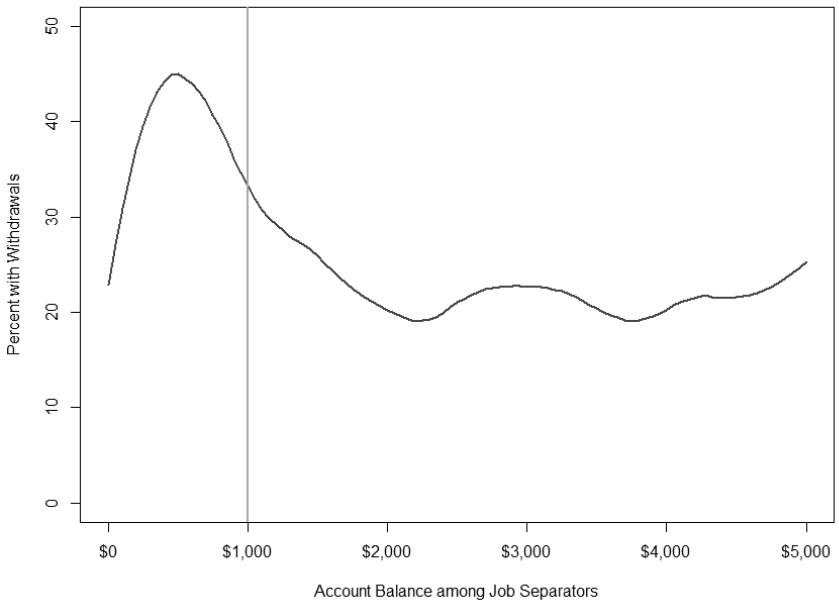
Figure 11: Effect of Automatic Enrollment on Withdrawals





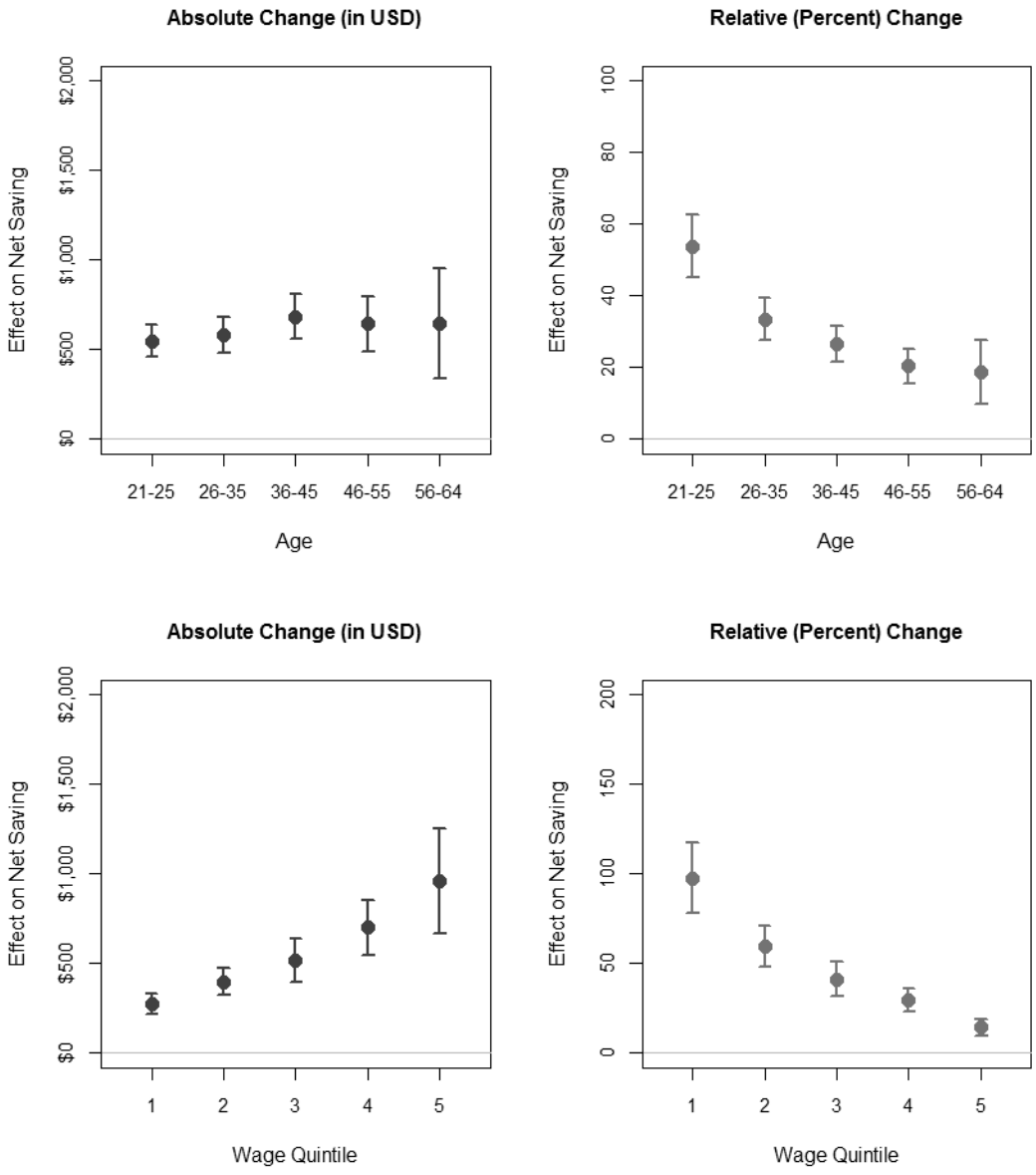
Notes: This figure displays coefficient estimates of linear regressions of withdrawals from employer-sponsored retirement savings accounts or IRAs on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The coefficients displayed (the shaded dots) are associated with the treatment variable, and 95 percent confidence intervals − estimated using bootstraps − surround the point estimates. Regressions are estimated separately for age bins (top panels), wage earning quintiles (middle panels) and marital status (bottom panels). The point estimates displayed in the left panels are in percentage points. The point estimates displayed in the second panel have been converted to percent changes using the mean amounts for corresponding control groups (standard errors bootstrapped).

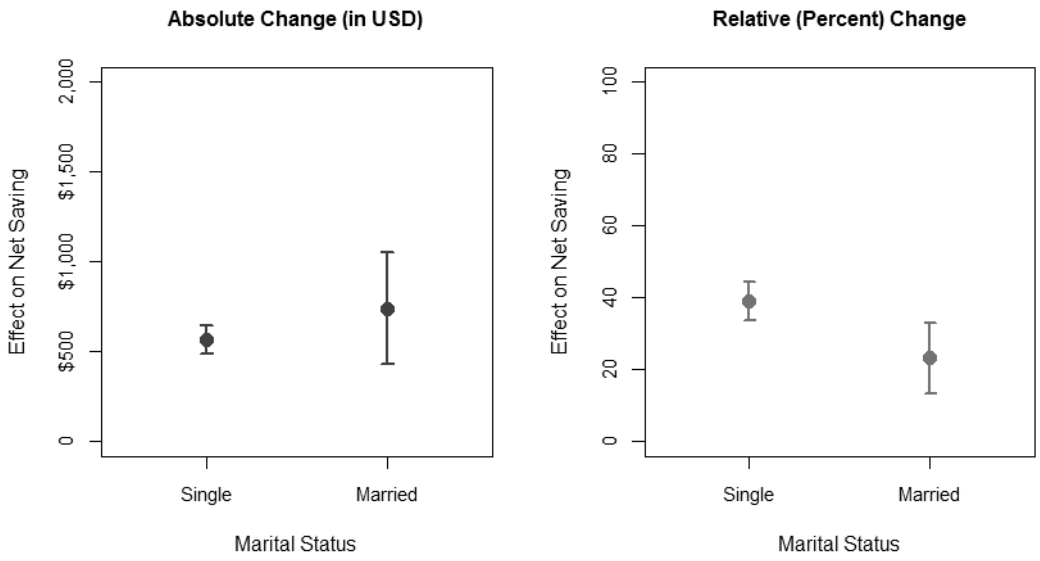
Figure 12: Savings Account Withdrawals by Balance Upon Departure from Firm



Notes: This figure displays the fraction of job separators that take a non-rollover withdrawal by account balance. Dollar amounts are adjusted to 2019 price levels and are rounded to the nearest $200.

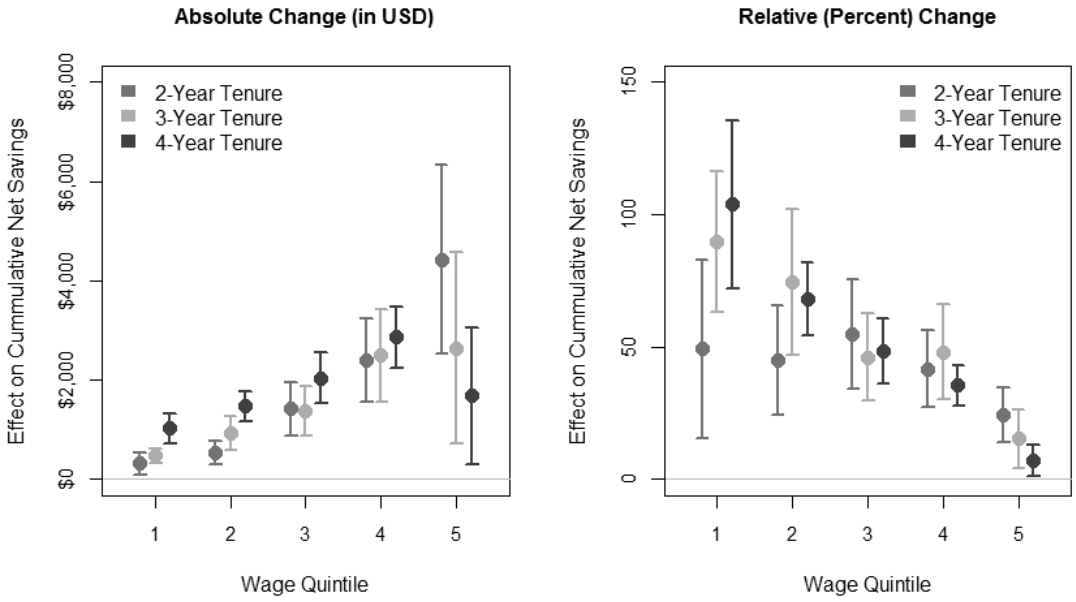
Figure 13: Effect on Net Retirement Savings by Age, Wage Level, and Marital Status





Notes: This figure displays coefficient estimates of linear regressions of net contributions to retirement savings accounts on a treatment variable indicating the adoption of automatic enrollment. Contributions include contributions to the firm's plan, another employer-sponsored plan, or an IRA. Net contributions are contributions less withdrawals from the firm's plan, another employer-sponsored plan, or an IRA. Firm fixed effects and a matrix of individual characteristics are also included. The coefficients displayed (the shaded dots) are associated with the treatment variable, and 95 percent confidence intervals − estimated using bootstraps − surround the point estimates. Regressions are estimated separately for age bins (top panels), wage earning quintiles (middle panels) and marital status (bottom panels). The point estimates displayed in the left panels are in percentage points. The point estimates displayed in the second panel have been converted to percent changes using the mean amounts for corresponding control groups (standard errors again bootstrapped).

Figure 14: Effect of Automatic Enrollment on Cumulative Net Retirement Savings



Notes: This figure displays coefficient estimates of linear regressions of cumulative contributions to retirement savings accounts net withdrawals on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are included in the regressions. The coefficients displayed (the shaded dots) are associated with the treatment variable and 95 percent confidence intervals − estimated using bootstraps − surround the point estimates. The estimates are broken out by wage quintile and by tenure at time $t + 4$. The point estimates displayed in the left panels are in percentage points. The point estimates displayed in the second panel have been converted to percent changes using the mean amounts for corresponding control groups (standard errors bootstrapped)

Appendix A: Data Construction

This appendix describes the process used to construct the tax data and pension data underlying our analyses.

Tax Data: Form W-2

The employee-level wage and retirement contribution data used in this paper are drawn from the population of Form W-2 filings from 2007 to 2018. The process of extracting these data involves three steps. First, each EIN is classified as belonging to a partnership, corporation, non-profit, government, sole proprietor, or some other type of organization. For this project, we are only interested in private entities, and drop W-2 EINs belonging to state, local, or federal governments. If the EIN belongs to an overarching "parent" company, the EIN of the parent company is also recorded. Second, all W-2s that are not deemed to belong to a government are aggregated by W-2 EIN. As part of the aggregation, we count the number of W-2s, the number of W-2s with deferred compensation, and the amount of Medicare wages. To limit the effect of part time workers in our sum total, we drop all W-2s with less than $7,250 in wages (in 2019 dollars). To ensure sufficient firm-level variation, we drop all firms with fewer than 10 W-2s. The final step is to further aggregate the data by parent EIN and year, again counting the number of W-2s, the share with deferred compensation, and the amount of wages.

Pension Data: Form 5500

The plan-level information on pension details used in this paper are drawn from the population of Form 5500 filings from 2010 to 2016. We use the Department of Labor's (DOL) "Bulletin" files, which are cleaned by DOL (2018). We limit our data to single employer defined contribution plan filings with the latest plan year ending date. We do not include plans for which the accrual of benefits has been suspended or plans that have zero participants at the start of the year. We then cross reference this list of filings with the Form 5500 Annual Report from the Department of Labor's Employee Benefits Security Administration. The reports are a set of indices used for bulk downloading of Form 5500 images and attachments in PDF format. Since we are ultimately interested in using Form 5500 attachments to identify details about the plans' auto-enrollment policies, we limit the list of plans to those that have attachments available for download.

Linking Wage and Pension Data

After gathering the W-2 data and augmented Form 5500 data, we merge the two sets. First, we aggregate all W-2 data − the number of employees, the number of employees with deferred compensation, total compensation, and total deferred compensation − at the parent EIN level. Then we merge the two data sets by parent company EIN, and tax year.

Identifying Adoption of Auto-Enrollment in Pension Plans

After merging the W-2 data with the augmented Form 5500 data and excluding plans that do not have attachments available for download, we identify companies that adopted auto-enrollment using the following procedure.

First, we use data from the Form 5500 Bulletin files to create an "auto-enrollment flag" for each year from 2010 to 2016. All plans in the Form 5500 data that have a type pension benefit code containing the character string "2S" are flagged as having auto-enrollment. Although this flag is not very accurate when it comes to identifying the exact year in which a company adopted auto-enrollment, it is accurate at identifying companies that adopted automatic enrollment *at some point* between 2010 and 2016. If the company is flagged as having auto-enrollment in one of these seven years we include it in our initial sample.

Second, we use Form 5500 attachments, downloaded from the Bulk Form 5500 Image/Attachments Requests site, to identify the exact year in which each plan/company adopted auto-enrollment. We use a text-reading algorithm that searches each attachment for specific key words and phrases related to auto-enrollment, and once we have identified whether each plan mentions auto-enrollment, we compare the results to the flag we created using the F5500 Bulletin files. There is about a 65% match rate between the auto-enrollment flag produced by the text-reading algorithm and the auto-enrollment flag provided in the Bulletin files. In total, we analyze 143,104 plan attachments for 21,016 firms that have automatic enrollment between 2010 and 2016.

In order to identify the exact year in which each company adopts auto-enrollment, we again use a text reading algorithm to identify words or phrases surrounding explanation of a start date for the policy. We go through the text of these plans one by one to pull out start dates for each of them. In total, 13,292 companies mention the specific date of auto-enrollment in one of their plan attachments. Many of the firms that we pick up in the initial sample already have an auto-enrollment policy in place starting in 2010 and others do not explicitly mention a start date for the policy in their plan documents, which explains why we see a large drop in the number of firms at this step. Some of the firms actually mention start dates in these documents as early as 2000, and as late as 2017.

Due to data limitations, we then further limit our sample to firms that have an explicitly mentioned start year between 2010 and 2016. We also limit our sample to firms that hire five new employees in the years before and after the companies adopted automatic enrollment in order to ensure that we are selecting firms with large enough sample sizes to estimate the effects of the policy. We also eliminate firms that do not report any contributions to DC plans in the five-year window surrounding the year that they adopt automatic enrollment (time $t-2$ to time $t+2$).

Additionally, we read through the plan documents for each of the remaining firms to eliminate companies that have certain policies or data irregularities. In particular, we remove from our sample any firms that have more than a six month waiting period for new employ-

ees to become eligible to enroll (or be automatically enrolled) in a company-sponsored plan. If we see that a firm adopted automatic enrollment during a period of excessive growth − defined as a growth rate in employment that is a statistical outlier among the firms in our analysis − then we drop that firm as well.

We also exclude firms that have data irregularities. For example, firms may have one plan document stating automatic enrollment was adopted in 2013, but a plan document for 2010 mentions the policy. Alternatively, parent companies with multiple plans might have conflicting automatic enrollment adoption dates, which leads to all plans associated with the company being excluded. Firms that have restrictions on which types of employees qualify for the policy − for example, some plans are only applicable to employees who are also members of a labor union − are also excluded.

Finally, we drop all plans affiliated with a given parent company if one or more of the company's plans had the following characteristics: collective bargaining employees or leased employees, Puerto Rican plan, self-employed plan, any form of an ESOP plan, or a non-qualified plan. For plans that remained, we searched the 5500 Main form and Small Filer form filings for years 2010 through 2016 for other plans the sponsor might offer two years before and two after the sample plan indicated it initiated automatic enrollment. We then checked the expanded collection of plans for the above characteristics, and again, dropped the employer from the sample if any of the characteristics were positive.

Appendix B: Regression Tables Underlying Figures

Tables for Figure 9 from Section 4

Table 6: Automatic Enrollment Effect on Likelihood of Participating by Age

		Age Bins				
	Pooled	**21-25**	**26-35**	**36-45**	**46-55**	**56-64**
Treated	0.36	0.45	0.38	0.35	0.34	0.30
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Female	0.04	0.03	0.04	0.04	0.05	0.05
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Married	0.01	-0.01	0.00	0.02	0.03	0.03
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	-0.00	0.08	-0.02	0.02	0.05	0.06
	(0.00)	(0.16)	(0.02)	(0.02)	(0.03)	(0.09)
Age Squared	0.00	-0.00	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Wage Earnings	0.15	0.13	0.13	0.14	0.15	0.15
Firm Fixed Effect	✓	✓	✓	✓	✓	✓
Mean Control	0.44	0.37	0.43	0.47	0.48	0.48
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Observations	131,563	26,255	26,285	26,297	26,286	26,259
Firms	751	661	704	728	710	647

Notes: This table displays coefficient estimates of linear regressions of an indicator on participation in an employer-sponsored deferred compensation plan on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group. The other columns labels correspond with estimates for different age bins.

Table 7: Automatic Enrollment Effect on Likelihood of Participating by Wages Earnings

		Wage Earnings Quintile				
	Pooled	**1**	**2**	**3**	**4**	**5**
Treated	0.36	0.47	0.43	0.38	0.33	0.22
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
Female	0.04	0.01	0.03	0.04	0.04	0.05
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Married	0.01	0.01	0.02	0.01	0.03	0.01
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	-0.00	0.00	-0.00	-0.00	-0.01	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age Squared	0.00	-0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Wage Earnings	0.15	0.10	0.14	0.15	0.15	0.17
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.02)
Firm Fixed Effect	✓	✓	✓	✓	✓	✓
Mean Control	0.44	0.25	0.38	0.47	0.51	0.62
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Observations	131,563	26,255	26,285	26,297	26,286	26,259
Firms	751	661	704	728	710	647

Notes: This table displays coefficient estimates of linear regressions of an indicator on participation in an employer-sponsored deferred compensation plan on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group. The columns labeled "1" through "5" are separate regressions for each wage earnings quintile. The wage earnings quintiles (listed in 2019 dollars) are approximately: less than $30,600, $30,600-$44,200, $44,200-$59,800, $59,800-$84,200 and above $84,200.

Table 8: Automatic Enrollment Effect on Likelihood of Participating by Marital Status

		Marital Status	
	Pooled	**Single**	**Married**
Treated	0.36	0.41	0.31
	(0.02)	(0.02)	(0.02)
Female	0.04	0.04	0.04
	(0.01)	(0.01)	(0.01)
Married	0.01		
	(0.00)		
Age	-0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)
Age Squared	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)
Log Wage Earnings	0.15	0.14	0.15
	(0.01)	(0.01)	(0.01)
Firm Fixed Effect	✓	✓	✓
Mean Control	0.44	0.39	0.50
	(0.00)	(0.00)	(0.00)
Observations	131,563	71,627	59,936
Firms	751	751	751

Notes: This table displays coefficient estimates of linear regressions of making a positive contribution to an employer-sponsored defined contribution account on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group, the "single" column limits estimates to non-married individuals, and the "married" column limits estimates to married individuals.

Tables for Figure 10 from Section 4

Table 9: Automatic Enrollment Effect on Savings Rate by Age

		Age Bins				
	Pooled	**21-25**	**26-35**	**36-45**	**46-55**	**56-64**
Treated	1.24	1.55	1.35	1.12	1.19	0.96
	(0.11)	(0.11)	(0.11)	(0.12)	(0.15)	(0.19)
Female	0.30	0.05	0.24	0.32	0.48	0.50
	(0.05)	(0.05)	(0.07)	(0.07)	(0.08)	(0.12)
Married	0.52	-0.02	0.36	0.61	0.69	0.95
	(0.04)	(0.07)	(0.05)	(0.05)	(0.07)	(0.13)
Age	-0.09	3.08	0.07	0.36	0.30	-2.36
	(0.01)	(1.18)	(0.16)	(0.21)	(0.38)	(1.06)
Age Squared	0.00	-0.06	-0.00	-0.00	-0.00	0.02
	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)	(0.01)
Log Wage Earnings	1.15	0.94	0.97	1.02	1.26	1.49
	(0.07)	(0.08)	(0.07)	(0.06)	(0.10)	(0.13)
Firm Fixed Effect	✓	✓	✓	✓	✓	✓
Mean Control	2.58	1.69	2.16	2.72	3.16	3.87
	(0.02)	(0.04)	(0.03)	(0.04)	(0.05)	(0.09)
Observations	131,563	18,051	46,490	31,402	24,216	11,281
Firms	751	697	749	744	733	653

Notes: This table displays coefficient estimates of linear regressions of contributions to retirement savings accounts (as a percent of wage compensation) on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group. The other columns labels correspond with estimates for different age bins.

Table 10: Automatic Enrollment Effect on Savings Rate by Wage Earnings Quintile

		Wage Earnings Quintile				
	Pooled	**1**	**2**	**3**	**4**	**5**
Treated	1.24	1.58	1.37	1.29	1.21	0.77
	(0.11)	(0.13)	(0.11)	(0.15)	(0.13)	(0.17)
Female	0.30	0.09	0.16	0.21	0.35	0.79
	(0.05)	(0.05)	(0.05)	(0.06)	(0.08)	(0.08)
Married	0.52	0.44	0.43	0.45	0.68	0.48
	(0.04)	(0.07)	(0.05)	(0.05)	(0.07)	(0.08)
Age	-0.09	-0.00	-0.03	-0.07	-0.19	-0.16
	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Age Squared	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Wage Earnings	1.15	0.39	0.66	0.85	0.93	1.09
	(0.07)	(0.08)	(0.12)	(0.12)	(0.16)	(0.18)
Firm Fixed Effect	✓	✓	✓	✓	✓	✓
Mean Control	2.58	1.15	1.76	2.35	3.14	4.50
	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Observations	131,563	26,255	26,285	26,297	26,286	26,259
Firms	751	661	704	728	710	647

Notes: This table displays coefficient estimates of linear regressions of contributions to retirement savings accounts (as a percent of wage compensation) on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group. The columns labeled "1" through "5" are separate regressions for each wage earnings quintile. The wage earnings quintiles (listed in 2019 dollars) are approximately: less than $30,600, $30,600-$44,200, $44,200-$59,800, $59,800-$84,200 and above $84,200.

Table 11: Automatic Enrollment Effect on Savings Rate by Marital Status

		Marital Status	
	Pooled	**Single**	**Married**
Treated	1.24	1.36	1.11
	(0.11)	(0.10)	(0.12)
Female	0.30	0.08	0.62
	(0.05)	(0.05)	(0.06)
Married	0.52		
	(0.04)		
Age	-0.09	-0.08	-0.05
	(0.01)	(0.02)	(0.02)
Age Squared	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Log Wage Earnings	1.15	1.07	1.21
	(0.07)	(0.06)	(0.09)
Firm Fixed Effect	✓	✓	✓
Mean Control	2.58	1.94	3.28
	(0.02)	(0.02)	(0.03)
Observations	131,563	71,627	59,936
Firms	751	751	751

Notes: This table displays coefficient estimates of linear regressions of contributions to retirement savings accounts (as a percentage of compensation) on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group, the "single" column limits estimates to non-married individuals, and the "married" column limits estimates to married individuals.

Tables for Figure 11 from Section 5

Table 12: Automatic Enrollment Effect on Withdrawals by Age

		Age Bins				
	Pooled	**21-25**	**26-35**	**36-45**	**46-55**	**56-64**
Treated 0.04	0.06	0.04	0.04	0.04	0.02	
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Female	-0.02	-0.01	-0.02	-0.02	-0.03	-0.04
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Married	-0.00	0.01	0.00	-0.02	-0.02	0.00
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)
Age	-0.00	0.13	0.03	-0.00	0.01	0.03
	(0.00)	(0.10)	(0.01)	(0.02)	(0.03)	(0.09)
Age Squared	0.00	-0.00	-0.00	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Wage Earnings	-0.08	-0.14	-0.10	-0.07	-0.07	-0.07
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Firm Fixed Effect	✓	✓	✓	✓	✓	✓
Mean Control	0.12	0.05	0.09	0.12	0.14	0.26
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Observations	131,563	18,051	46,490	31,402	24,216	11,281
Firms	751	697	749	744	733	653

Notes: This table displays coefficient estimates of linear regressions of an indicator for a withdrawal being taken from a retirement savings account on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group. The other columns labels correspond with estimates for different age bins.

Table 13: Automatic Enrollment Effect on Withdrawals by Wage Earnings Quintile

		Wage Quintile				
	Pooled	**1**	**2**	**3**	**4**	**5**
Treated	0.04	0.09	0.05	0.03	0.03	0.01
	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
Female	-0.02	-0.03	-0.01	-0.02	-0.01	-0.02
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Married	-0.00	-0.00	-0.01	-0.00	-0.00	-0.01
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)
Age	-0.00	-0.00	-0.00	0.00	-0.00	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age Sqared	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Wage Earnings	-0.08	-0.20	-0.23	-0.15	-0.10	-0.05
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Firm Fixed Effect	✓	✓	✓	✓	✓	✓
Mean Control	0.12	0.12	0.11	0.11	0.12	0.13
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	131,563	26,255	26,285	26,297	26,286	26,259
Firms	751	661	704	728	710	647

Notes: This table displays coefficient estimates of linear regressions of an indicator for a withdrawal being taken from a retirement savings account on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group. The columns labeled "1" through "5" are separate regressions for each wage earnings quintile. The wage earnings quintiles (listed in 2019 dollars) are approximately: less than $30,600, $30,600-$44,200, $44,200-$59,800, $59,800-$84,200 and above $84,200.

Table 14: Automatic Enrollment Effect on Withdrawals by Marital Status

		Marital Status	
	Pooled	**Single**	**Married**
Treated	0.03	0.04	0.02
	(0.01)	(0.01)	(0.00)
Female	-0.02	0.00	-0.04
	(0.00)	(0.01)	(0.01)
Married	-0.01		
	(0.01)		
Age	0.00	0.01	-0.01
	(0.00)	(0.00)	(0.00)
Age Squared	0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)
Log Wage Earnings	-0.08	-0.10	-0.06
	(0.00)	(0.00)	(0.00)
Firm Fixed Effect	✓	✓	✓
Mean Control	0.13	0.13	0.14
	(0.00)	(0.00)	(0.00)
Observations	194,362	104,835	89,527
Firms	751	751	751

Notes: This table displays coefficient estimates of linear regressions of withdrawals from retirement savings accounts on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group, the "single" column limits estimates to non-married individuals, and the "married" column limits estimates to married individuals.

Tables for Figure 13 from Section 5.3

Table 15: Automatic Enrollment Effect on Net Retirement Saving by Age

		Age Bins				
	Pooled	**21-25**	**26-35**	**36-45**	**46-55**	**55-64**
Treated	603	547	580	682	643	648
	(48)	(45)	(52)	(64)	(79)	(157)
Female	-73	-129	40	-58	-41	-9
	(49)	(44)	(64)	(75)	(100)	(133)
Married	601	-95	413	703	747	855
	(50)	(42)	(62)	(66)	(72)	(115)
Age	-43	983	-7	-15	487	-1,986
	(17)	(688)	(155)	(240)	(462)	(1,262)
Age Squared	1	-20	1	0	-4	16
	(0)	(15)	(3)	(3)	(5)	(11)
Log Wage Earnings	2,767	1,459	2,092	2,784	3,406	3,836
	(140)	(100)	(149)	(171)	(165)	(223)
Firm Fixed Effect	✓	✓	✓	✓	✓	✓
Mean Control	2,263	1,015	1,733	2,566	3,162	3,456
	(18)	(24)	(22)	(40)	(54)	(84)
Observations	131,563	18,051	46,490	31,402	24,216	11,281
Firms	751	697	749	744	733	653

Notes: This table displays coefficient estimates of linear regressions of net contributions to retirement savings accounts on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group. The other columns labels correspond with estimates for different age bins.

Table 16: Automatic Enrollment Effect on Net Retirement Saving by Wage Earnings Quintile

		Wage Earnings Quintile				
	Pooled	**1**	**2**	**3**	**4**	**5**
Treated	603	274	397	519	701	960
	(48)	(28)	(38)	(62)	(79)	(149)
Female	-73	42	56	88	228	539
	(49)	(14)	(20)	(38)	(62)	(167)
Married	601	148	189	282	532	1,026
	(50)	(19)	(22)	(33)	(49)	(156)
Age	-43	-1	-17	-62	-181	34
	(17)	(5)	(7)	(13)	(21)	(59)
Age Squared	1	0	0	1	2	1
	(0)	(0)	(0)	(0)	(0)	(1)
Log Wage Earnings	2,767	365	572	713	985	3,243
	(140)	(25)	(35)	(50)	(93)	(377)
Firm Fixed Effect	✓	✓	✓	✓	✓	✓
Mean Control	2,263	281	667	1,256	2,396	6,750
	(18)	(9)	(14)	(20)	(32)	(69)
Observations	131,563	26,255	26,285	26,297	26,286	26,259
Firms	751	661	704	728	710	647

Notes: This table displays coefficient estimates of linear regressions of net contributions to retirement savings accounts on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group. The columns labeled "1" through "5" are separate regressions for each wage earnings quintile. The wage earnings quintiles (listed in 2019 dollars) are approximately: less than $30,600, $30,600-$44,200, $44,200-$59,800, $59,800-$84,200 and above $84,200.

Table 17: Automatic Enrollment Effect on Net Retirement Savings by Marital Status

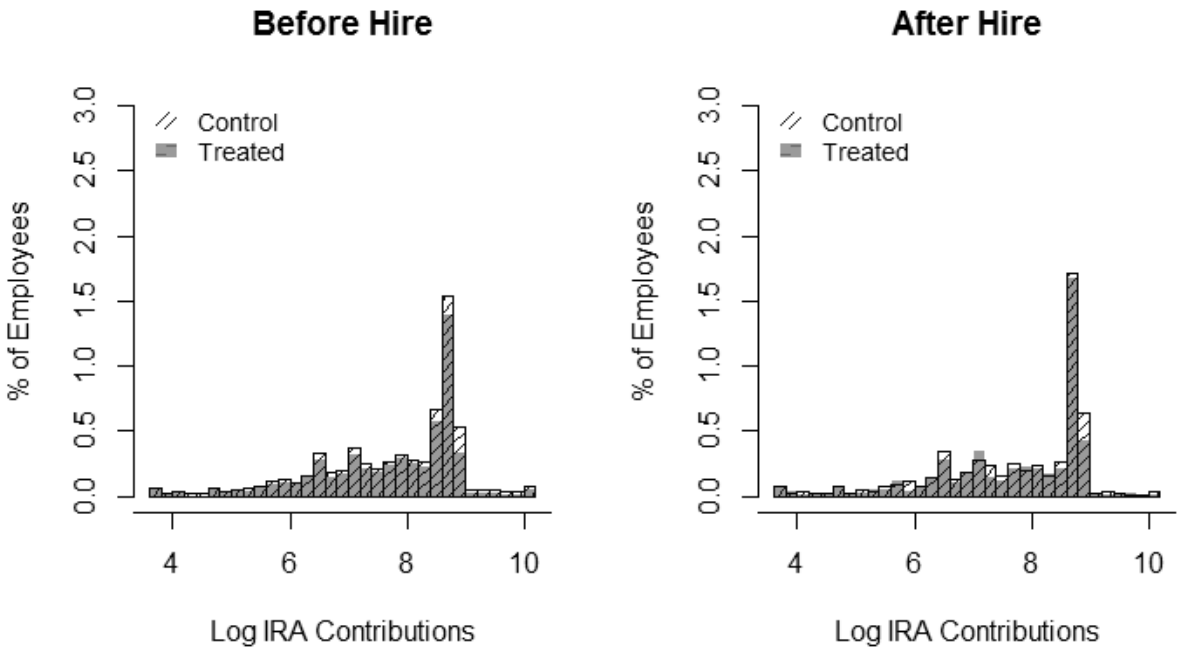
		Marital Status	
	Pooled	**Single**	**Married**
Treated	603	565	653
	(48)	(40)	(70)
Female	-73	-104	119
	(49)	(38)	(78)
Married	601		
	(50)		
Age	-43	-43	28
	(17)	(12)	(28)
Age Squared	1	1	0
	(0)	(0)	(0)
Log Wage Earnings	2,767	2,129	3,294
Firm Fixed Effect	✓	✓	✓
Mean Control	2,263	1,443	3,178
	(18)	(20)	(31)
Observations	131,563	71,627	59,936
Firms	751	751	751

Notes: This table displays coefficient estimates of linear regressions of net contributions to retirement savings accounts on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The "Mean Control" row is the mean of the dependent variable for the control group, with bootstrapped standard errors in parentheses. The "pooled" column displays coefficient estimates for all new employees in the treatment and control group, the "single" column limits estimates to non-married individuals, and the "married" column limits estimates to married individuals.

Appendix C: Other Figures

When we graph IRA contributions made by employees in the treated and control groups − provided in **Figure 15** below − we do not see a meaningful difference in the change in IRA contributions between the two groups before and after hire. The histograms for each group in the first and second graph are almost identical, with a slight increase in IRA contributions for the treated group. Here again, we see that employees in the treated group are slightly over-represented, so their IRA contributions are higher across the board.

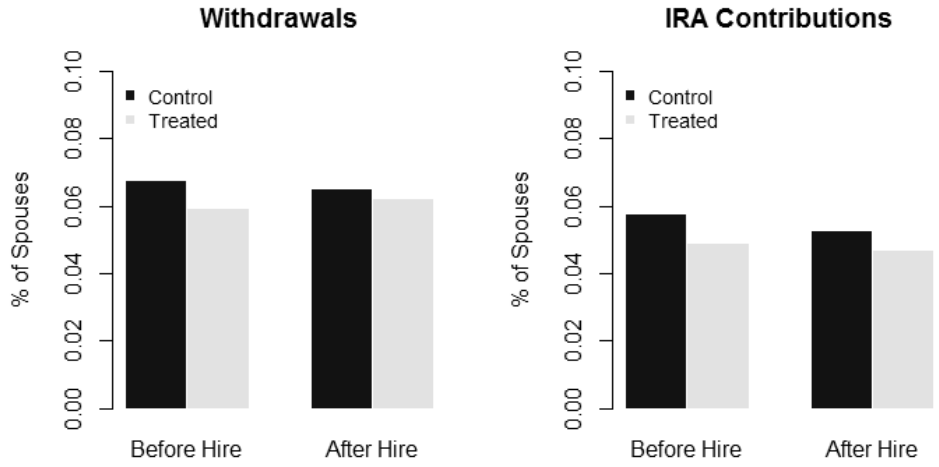
Figure 15: Effect of Automatic Enrollment on IRA Contribution Levels



Notes: This figure displays contributions to IRAs for treated and control employees before and after being hired at the firm associated with the treatment assignment. The spike at around 9 log points is the maximum contribution limit.

The pattern is similar when examining the levels of savings by spouses. The distribution of spousal withdrawals from retirement accounts − shown in **Figure 17** below − reveal only minor changes between the two groups before and after hire. It does appear that there is a slight increase in spousal withdrawals from existing accounts in both groups, and that there may be a slightly larger increase for spouses of employees in the treated group, but these differences are quite small relative to what we see when graphing employee withdrawals.

Figure 16: Effect of Automatic Enrollment on Spousal Withdrawals and IRA Contributions



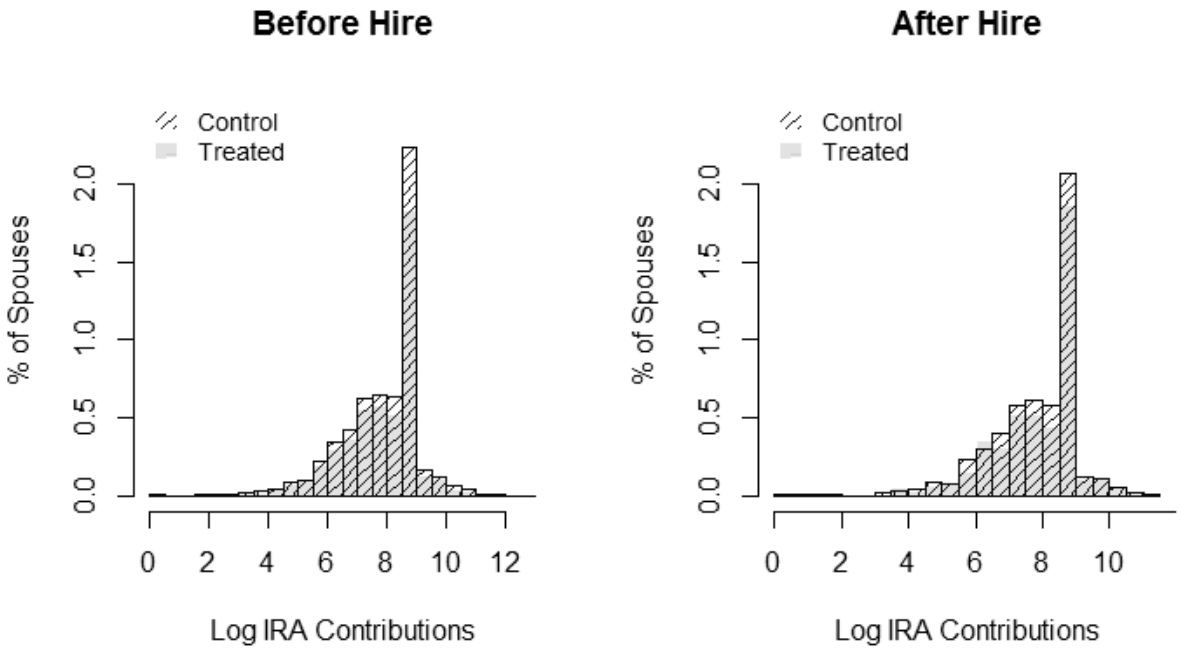
Notes: This figure displays the percent of spouses (of treated and control employees) making contributions to IRAs and the percent taking withdrawals from any retirement saving account. Both the occurrence of contributions and withdrawals are displayed separately for the year before and the year after their spouse was hired at a firm associated with treatment assignment.

When we look at the level of IRA contributions of employees' spouses before and after employees are hired at auto-enrollment firms, we see that automatic enrollment appears to have a small but positive effect on spousal contributions. As shown in the first graph of **Figure 18** below, spouses in the treatment group contribute slightly more to begin with (although this can be explained by the slight over-representation of employees in the treated group), but the distributions are largely overlapping. However, in the year after hire there is a small increase in the IRA contributions of spouses in the treated group relative to those in the control group, particularly around the median.

Figure 17: Effect of Automatic Enrollment on Spousal Withdrawal Levels

Notes: This figure displays the levels of withdrawals from any retirement saving account for the spouses of treated and control employees. Withdrawals are displayed separately for the year before and the year after their spouse was hired at a firm associated with treatment assignment. Spouses not taking a withdrawal are excluded.

Figure 18: Effect of Automatic Enrollment on Spousal IRA Contribution Levels



Notes: This figure displays the levels of contributions to IRAs for the spouses of treated and control employees. Contributions are displayed separately for the year before and the year after their spouse was hired at a firm associated with treatment assignment. Spouses not contributing are excluded. The spike at around 9 log points is the maximum contribution limit.

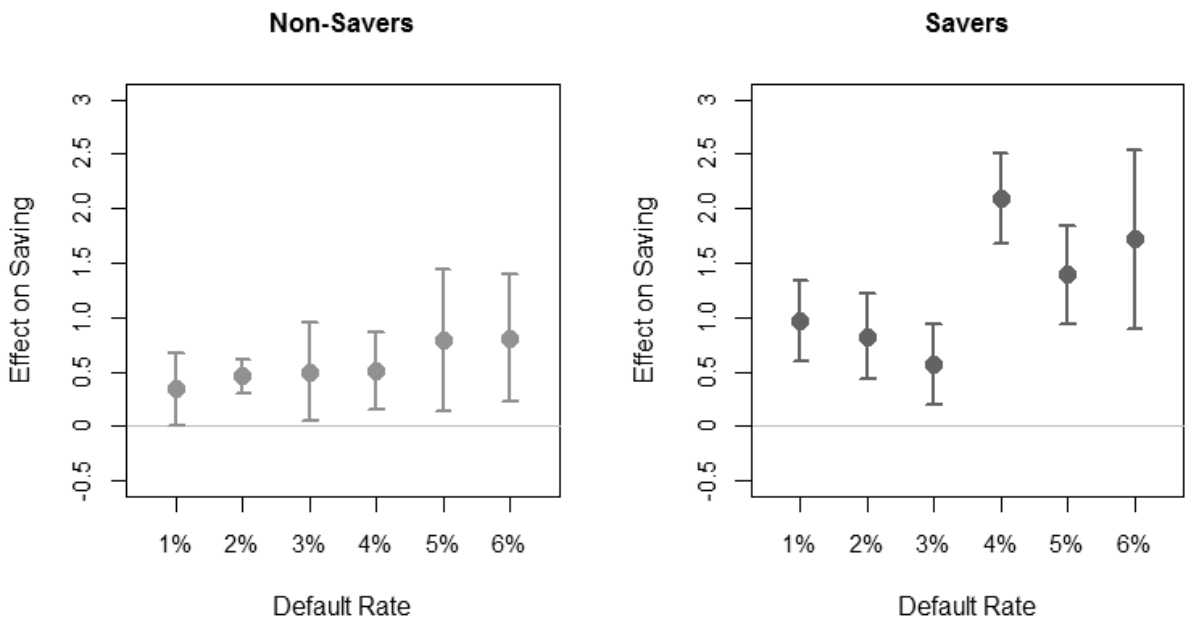
Appendix D: Saving Effects by Default Rate

We analyze the effects of automatic enrollment on saving more closely by dividing our population in two ways: by the automatic enrollment rate that their firm chooses (either before or after each person is hired, depending on whether they are in the control or treated group), and by whether the person was a "saver" at their previous job. "Savers" are identified as individuals who contributed some positive percent of earnings to a retirement plan before they were hired at an auto-enrollment firm.

As shown in **Figure 19** below, there are significant differences by auto-enroll rate when comparing "non-savers" to "savers". The effect on the saving rates of "non-savers" appears to be monotonically increasing in the default rate, which is not surprising if we think that these individuals are not active savers, and thus might either remain enrolled at the default, or opt out of the plan entirely. In comparison, the effect of automatic enrollment on "savers" − while still positive − appears to be far lower for those enrolled at one to three percent than for individuals enrolled at four to six percent. It seems that being enrolled at a higher rate leads to a larger increase in savings for individuals who were already prone to save.

A major caveat to keep in mind when considering the results of this analysis − and the reason this section is in the appendix, instead of the body − is that each firm's choice of default rate is endogenous to the characteristics of its workforce. If firms generally determine that their workers prefer high savings, they will likely choose higher default rates.

Figure 19: Effect of Automatic Enrollment by Default Rate: Non-Savers and Savers



Notes: This figure displays coefficient estimates of linear regressions of contributions to retirement savings accounts (as a percent of wage compensation) on a treatment variable indicating the adoption of automatic enrollment. Firm fixed effects and a matrix of individual characteristics are also included. The coefficients displayed (the shaded dots) are associated with the treatment variable, and 95 percent confidence intervals surround the point estimates. Regressions are estimated separately for different default savings rates specified in the firm's deferred compensation plan. The regressions in the first panel are limited to those individuals that did *not* save in the year prior to joining the firm. The regressions in the second panel are limited to those individuals that *did* save in the year prior to joining the firm.

Appendix E: External Validity to U.S. Employers

Although we use a large sample of firms and employees in our estimates, one important caveat to our findings is that the firms in our data are not randomly sampled, and are not representative of the U.S. population of employers. Our estimation strategy relies on identifying companies that have at least five new employees in the years before and after adoption of automatic enrollment, which largely drops small firms. The smallest firm in our sample has 78 employees and only one percent of the firms have under 100 employees. We also drop fast-growing firms and firms with multiple plans, which likely eliminates some of the largest companies adopting automatic enrollment between 2010 and 2016.

To get a sense of external validity, we compare our sample of firms with aggregates estimated using the Census' Statistics of U.S. Businesses (SUSB). Our data does not include small employers, and approximately 98 percent of firms in the United States have fewer than 100 employees (Census SUSB, 2016). These small firms employ around one-third of all people in the labor market. Our sample of employees is instead drawn disproportionately from large firms with 500 or more employees. About 87 percent of the employees in our sample are employed by these types of firms, compared to about 53 percent of the total working population. In addition, about 12 percent of the employees in our data come from medium-sized firms of about 100 to 500 employees, compared to 30 percent of the national labor market.

The average earnings of individuals in our sample is similar to national averages. The mean earnings of our treated and control populations (in 2019 dollars) are about $54,500, which is only slightly higher than the average wage among all employees in the United States, which was about $53,800 in 2016 (Census SUSB, 2016). Total payroll at the firms in our sample is of course much higher than average, given that our data consists mainly of employees at large- and medium-sized firms.

We also see that certain industries are over-represented in our sample, relative to the broader economy. **Figure 20** below graphs the percent of firms in our sample and among all US firms that are classified under each 2-digit North American Industry Classification System (NAICS) code. As shown in the figure, our sample includes a disproportionate percent of firms classified as "Utilities" or "Administrative and Support and Waste Management" firms. Our data also under-represents firms in several industries including "Wholesale Trade", "Transportation", "Finance and Insurance", "Professional, Scientific, and Technical Services", and "Health Care". We also have a much larger percent of firms that are missing a NAICS classification ("Unknown"), which could help explain some − although not all − of these discrepancies.

Finally, we compare our sample to pooled years of the Statistics of Income (SOI) Individual cross section.[14] We include the years 2010 through 2016 and index all dollar values to 2019 to be as comparable as possible to our sample. Total mean wages for individuals 21 years

[14]The SOI cross section is an income-stratified random sample of individual tax returns that are representative of the U.S. tax filing population (SOI, 2018).

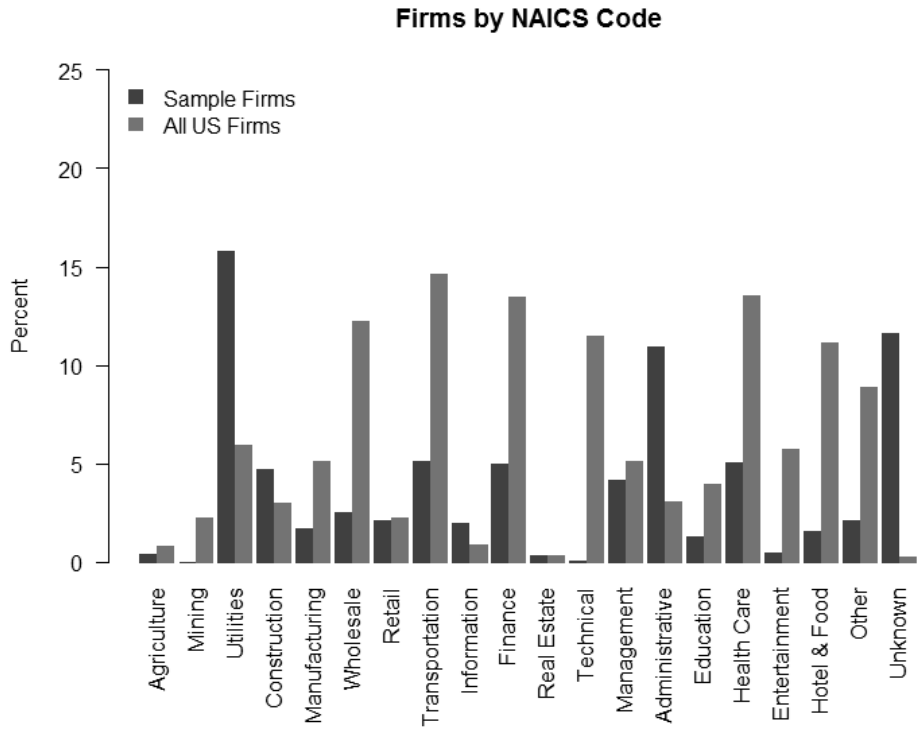
or older with Medicare wages in excess of $7,250 is $61,556 (compared to $54,500 in our combined treatment and control groups); however, this group is likely dominated by non-job changers. To get a better sense of the job changing population, we look at individuals with more than one but less than five W2 information returns. Mean wages for this group is $54,902, which is very close to our sample.

It is worth mentioning, however, that there is no explicit mapping of U.S. firms to retirement plans. Employers provide retirement savings arrangements as a benefit to their employees. Broadly speaking, there are defined benefit plans and defined contribution plans, but within each of these categories there can be a wide degree of differentiation. Moreover, employee associations like unions provide retirement savings for their members. A firm can provide one of these types of plans, defined benefit or defined contribution, or both of these types. Large multinational corporations can provide several of each type in addition to utilizing union employees and contributing to union plans. Parent companies might permit subsidiaries to participate in the parent plan. Some firms may not offer retirement benefits at all.

Consequently, there does not exist high-quality national data relating to the distribution of firms with certain retirement plans by employee size. For 2010, the starting year of our sample, Form 5500 data indicate there are approximately 610,000 non-unionized, private sector defined contribution plans (or 91 percent of all defined contribution plans across both the main 5500 form and short form) with 100 or fewer active participants. However, these plans in total comprise only 20 percent of total active defined contribution plan participants. The remaining ten percent of plans, those with more than 100 active participants comprise nearly 80 percent of total private sector DC plan participants.

We ultimately view our findings as being representative of a large sub-section of the US economy, and the behavioral effects measured at larger firms provide valuable insight into how employees generally respond to automatic enrollment. The restrictions we make to our sample are done with goal of isolating the effect of automatic enrollment on the margins we examine. In addition, we are limited to estimating the effect at firms that adopt automatic enrollment during the years for which we can access search-able Form 5500 attachments (2010 and later).

Figure 20: Comparison of Sample Firms to National Level based on NAICS Code



Appendix F: Employer Contributions and Nondiscrimination Testing

In our broader discussion of automatic enrollment, it is important to consider the possible effects of the policy on employer contributions and nondiscrimination testing. Employers generally contribute to DC plans in three ways: through employer matching contributions, which are conditional upon a participant contributing to the plan, profit sharing contributions or non-elective contributions, which are contributions made by the employer irrespective of whether a participant contributes, and safe harbor contributions, which are contributions made by the employer to satisfy nondiscrimination testing. Plan adoption of automatic enrollment can reduce or even eliminate safe harbor contributions and thereby reduce benefit costs for the employer.

When an employer decides to offer a benefit with tax-advantaged attributes, such as a defined contribution plan, the employer must ensure sufficient participation among all eligible employees or else the benefit must be limited. To put this another way, the benefit cannot discriminate in favor of highly compensated employees. As a result, employers must annually subject their retirement plan to nondiscrimination testing. This testing is described in sections 401(a)(4) and 414(q) of the Internal Revenue Code.

The test directly compares deferrals of non-highly compensated to highly compensated employees. The Code defines highly compensated employees (HCEs) as: a five percent or more owner, directly or by family attribution, an employee earning more than $130,000 (in 2021) and, at the discretion of the employer: any employee whose salary is in the top 20 percent of all employees. A successful plan can exhibit no more than a two percent differential between the ratios of total salary deferrals (traditional plus Roth deferrals) divided by total compensation of the two groups (IRS, 2021b). For example, if the average deferral rate came to seven percent for the HCEs and three percent for the NHCEs, the test would fail (four percent is greater than two percent), and the plan would have to take steps to correct the differential. Similar tests examine employer matches and asset holdings, which we will omit here for simplicity.

Options to correct for test failure include limiting contributions made by the HCEs, increasing employer contributions to NHCEs or some combination of the two. HCE contributions can be limited either at year end, where one or more HCEs will have to receive a plan distribution consisting of their excess contributions, or a plan design can limit HCE contributions beforehand using a variety of methods, including limiting the amount of compensation allowable for HCE deferrals.

Additionally, IRS provides two standard safe harbor plan designs, which confer passage of nondiscrimination testing, if adopted (IRS, 2021a). The first option provides for a non-elective safe harbor contribution made by the employer equal to three percent of compensation on behalf of all defined NHCEs. The second option provides for a matching contribution equal to 100 percent of the first three percent of NHCE elective contributions and 50 percent

matching contribution of NHCE contributions greater than three percent and not exceeding five percent. These safe harbor employer contributions must vest immediately.

The advent of automatic enrollment and its touted successes has led many plans to adopt this feature as part of a plan design to help boost NHCE participation. In 2006 (and updated in 2020), Congress passed legislation defining additional plan safe harbors based on the adoption of auto-enrollment. These safe harbor options include two standard options: the first is an across-the-board three percent non-elective contribution made by the employer on behalf of all NHCEs; the second is a 100 percent matching contribution for the first one percent of compensation deferred and a 50 percent match up to six percent of compensation (IRS, 2021a). Importantly, employer safe harbor contributions made under a qualified automatic deferral arrangement are not required to immediately vest. A plan may instead require up to two years of vesting service.

Consequently, adoption of automatic enrollment by plans may generate distributional changes in employer contributions across different groups of employees as well as distributional changes in total elective deferrals made by highly compensated employees. Consider a plan that failed nondiscrimination testing and required HCEs to limit their contributions. Including automatic enrollment in plan design might increase NHCE deferrals sufficiently to move the plan over to the passing side and even enable increased contributions on behalf of HCEs.

Note also that safe harbor contributions are designed to go to non-highly compensated employees (NHCEs). Overall, safe harbor matching contributions are slightly lower under a qualified automatic enrollment arrangement (3.5 percent) compared to one that does not have automatic enrollment (four percent). But even across the board non-elective contributions to NHCEs can be reduced or eliminated if participation at the lower end increases sufficiently upon adopting automatic enrollment. Different vesting requirements between non-automatic enrollment safe harbors and automatic enrollment safe harbors can enable employers to more precisely target a "core" group of employees, by moving employer contributions away from short-term participants more likely to leave within a year or so, to employees who stay longer. In short, while employees in the middle of the compensation distribution may be only mildly affected by these changes in plan design, employees at extreme ends of the compensation spectrum may be much more affected, some for the worse, some for the better.