

## Do Employer Pension Contributions Reflect Employee Preferences? Evidence from a Retirement Savings Reform in Denmark<sup>†</sup>

By ITZIK FADLON, JESSICA LAIRD, AND TORBEN HEIEN NIELSEN\*

*This paper studies how firms set contributions to employer provided 401(k)-type pension plans. Using a reform that decreased the subsidy to contributions to capital pension accounts for Danish workers in the top income tax bracket, we provide strong evidence that employers' contributions are based on their employees' savings preferences. We find an immediate decrease in employer contributions to capital accounts, whose magnitude increased in the share of employees directly affected by the reform. This response was large relative to average employee responses within private IRA-type plans and was accompanied by a similar magnitude shift of employer contributions to annuity accounts. (JEL D14, J26, J32)*

With the decline in the prevalence of defined-benefit pension plans, individual savings in defined-contribution accounts are becoming an increasingly important income source for post-retirement consumption. A large and growing portion of savings balances in defined-contribution accounts is within employer sponsored pension plans, such as 401(k)s.<sup>1</sup> Recent research has underlined the important role that employers' decisions play in determining employees' actual savings within employer sponsored accounts, since most workers do not actively deviate from the default options, which are set by their employer (Madrian and Shea 2001; Choi et al. 2004; Choi, Laibson, and Madrian 2007; Beshears et al. 2009; Gelber 2011). The impact of employers' decisions has also been found to translate into large effects on individuals' overall level of savings (Chetty et al. 2014). This research has led policymakers to consider introducing policies that encourage employer contributions

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<sup>1</sup>In 2014, 35 percent (\$8.3 trillion) of retirement assets in the United States were held in defined-benefit plans, while a much larger share of 58 percent (\$13.8 trillion) was held in defined-contribution accounts: 30 percent in Individual Retirement Accounts (IRAs) and 28 percent in employer sponsored plans, mostly 401(k)s (Choi 2015).

to pension accounts in order to increase individuals' retirement savings (Beshears et al. 2010).

But how effectively private firms represent their employees' savings interests remains an open question. In theory, both standard models and models of altruistic planners suggest that firms should have incentives to make efficient savings choices on their workers' behalf. For example, standard models of efficient compensation arrangements by competitive firms (as in Rosen 1974) predict that employers will provide benefits when firms can purchase goods or services more cost-effectively than employees, and will provide the optimal package that their workers will value most highly.<sup>2</sup> Similarly, models of purely paternalistic firms that incorporate individual optimization frictions predict that firms will provide their employees with optimal retirement savings plans, taking into account their employees' suboptimal behavior (Choi et al. 2003, Cremer et al. 2008, Carroll et al. 2009, Cremer and Pestieau 2011, Goda and Manchester 2013, Roeder 2014, Fadlon and Laibson 2016).

However, firms' incentives or ability to represent their employees' savings interests may be weakened for a variety of reasons. First, if employees are inattentive or "unsophisticated" (in the sense that they are not aware of their suboptimal decision making), they may fail to recognize the value of firms' choices on their behalf. This is a likely possibility given the evidence that most employees are inattentive with regards to their own savings and may have only imperfect knowledge about their employer pension plans (Mitchell 1988; Gustman, Steinmeier, and Tabatabai 2009). Second, firms' incentives may be additionally offset by the costs of efficiently managing their employees' pensions. These costs could be substantial, since managing pensions requires monitoring policy changes that alter tax incentives for contributions to retirement accounts, as well as keeping track of how these changes differentially affect the firms' heterogeneous workforce. Finally, potential mismanagement and inattention within the firm may lead to inefficient savings choices by firms themselves. Put together, these different factors imply that it is unclear whether the costs of optimally designing retirement savings plans on the workers' behalf outweigh the incentives for firms to do so.

Beyond the question of whether firms tailor pension plans to employees' saving preferences, it is important for policy design to study the nature of firm responses to changes in these preferences. The increased reliance on employer based savings as a source of consumption after retirement necessitates understanding empirically how fast and to what extent employers respond to shocks to the economic environment that can alter employees' savings incentives.

In this paper, we empirically analyze how firms set characteristics of their contributions to employer sponsored pension plans in practice.<sup>3</sup> To do so, we exploit a

<sup>2</sup>In our application, provision of pension benefits is likely less costly for the employer since there are often economies of scale with respect to the acquisition costs and managing of the pension product (e.g., in terms of average fees to the financial service provider per saver—see Danish Ministries of Business and Economics, Finance, Employment and Taxation 2003). Additionally, there is evidence that it is costly for individual households to optimally choose complex financial products due to low levels of financial literacy (Brobeck 1991; Bernheim 1998; Hilgert, Hogarth, and Beverly 2003; Lusardi and Mitchell 2007; Hastings, Madrian, and Skimmyhorn 2013).

<sup>3</sup>To our knowledge, this is the first paper that studies this specific topic. Some papers analyze firms' choice of whether to offer a pension plan (or the choice between defined-benefit or defined-contribution plans), but these papers usually focus on supply-side factors that affect firms' cost of providing the plan (Aaronson and Coronado

reform to the Danish retirement savings system. This reform differentially affected employees according to their exact location on the labor income tax schedule and differentially changed tax deductions for contributions to two types of savings accounts: “capital” savings accounts, which are paid out in full at retirement, and “annuity” savings accounts, which are paid out as an annuity. Specifically, in 1999, the Danish government decreased the subsidy to contributions to capital pension accounts for workers in the top income tax bracket, while the subsidies to capital pension contributions for workers in lower tax brackets and to annuity pension contributions remained unchanged.

We find that immediately following the reform, employers significantly decreased their annual contributions to capital pension accounts. The average decrease was on the order of 27 percent—0.76 percentage points (pp) on a baseline contribution rate of 2.81 pp. This decrease was entirely driven by firms in which some share of the workforce was directly affected by the reform, with no responses in workplaces in which all employees had earnings below the top income tax bracket. Moreover, the response strongly and continuously increased in the share of employees above the top tax threshold. We find that an additional 10 percent of workers at the top bracket led to an additional decrease of more than 0.2 pp in employer contributions, so that workplaces in which all employees were at the top bracket experienced a significant drop of more than 2 pp on a base of 3.5 pp.

In order to put the employers’ responses and their magnitude in context, the Danish setting allows us to compare contributions within employer provided 401(k)-like accounts to individual contributions within private IRA-like accounts, which were equally affected by the reform. We find that for individuals at the top bracket almost the entire change in overall capital retirement savings was attributable to employer responses. We also show that the clear gradient of changes in employer provided accounts with respect to the share of directly affected individuals in the workplace disappears in the analysis of changes in private accounts, suggesting that employer responses were not crowded out by individual responses in other closely substitutable accounts.

By changing the relative prices of contributions to capital and annuity accounts, the reform rendered contributions to annuity accounts more financially attractive through a substitution effect, but also led to an income effect that would push toward an overall decrease in pension contributions. Studying employer contributions to annuity accounts, we find that employers compensated for the decrease in capital contributions with an equally large increase in annuity contributions, with no decrease in total pension contributions.<sup>4</sup> This suggests that at the employer level the effect was driven by a substitution effect. In fact, annuity accounts serving as a close substitute is likely the reason there was such a large response in capital accounts. We

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2005, Dummann 2008, Hernæs et al. 2011). Papers that do analyze demand-side factors, relate these to the individual take-up of plans rather than to the firms’ decision to offer them (Aaronson and Coronado 2005, Dummann 2008).

<sup>4</sup>These employer responses are in contrast to individual responses in private accounts, for which Chetty et al. (2014) find a shift of 57 cents to annuity accounts for each Danish Kroner (DKr) that individuals would have contributed to capital accounts.

also show that the potential income effect of the reform had no effect on other means of employee compensation, namely, labor income.

Lastly, we provide a suggestive analysis for assessing the optimality of firms' responses to the reform from the perspective of the employees. As a benchmark for "optimal" responses, we use the actions taken by "attentive" individuals, who made changes to their self-managed IRA-like savings accounts in response to the reform. The analysis supports the notion that larger firms make more optimal decisions compared to smaller firms, and that delegating decisions to employers may be welfare increasing.

The paper proceeds as follows. In Section I, we discuss the institutional setting of the policy change and the data that we use. In Section II, we provide the empirical analysis of employers' responses to the reform and their heterogeneity with respect to workplace composition. Specifically, Section A analyzes employer responses in contributions to capital pension accounts and their timing; Section B puts the magnitude of these responses in context by comparing the changes in contributions to employer provided accounts to individuals' responses within their private accounts; Section C studies employers' shift to contributing to annuity accounts; and Section D provides a simple analysis of the optimality of the employers' responses to the reform. Section III concludes.

## I. Institutional Details and Summary of Data

### A. Institutions

This section provides the necessary background on Danish retirement institutions that is important for our empirical analysis.<sup>5</sup> In Denmark, there are two types of defined-contribution (DC) pension savings accounts similar to the United States—employer sponsored accounts, similar to 401(k)s, and private accounts, similar to IRAs. Employer sponsored and private DC accounts have equivalent tax properties but are completely independent, which makes them close substitutes. Within both the employer sponsored and the private DC pension plans, there are two types of tax-preferred accounts: capital pension accounts and annuity pension accounts. Capital pension accounts are paid out as a lump sum and taxed at 40 percent on payout, while annuity pension accounts are paid out over several years and are taxed as personal income. Balances in capital pension accounts can be converted to annuity pensions when they become liquid, but the reverse is not allowed. Contributions to both types of accounts are tax deductible at the time of contribution (as in traditional non-Roth 401(k)s and IRAs), and capital gains are taxed at 15 percent, compared to approximately 29 percent for assets in taxable accounts.

Our empirical research design exploits a 1999 tax reform, within which the Danish government aimed at reducing the generosity of capital accounts and incentivizing a shift to annuity accounts. To do so, the reform reduced the average deduction for contributions to capital pensions from 59 cents per Dkr to 45 cents per Dkr for

<sup>5</sup>For additional information see Organisation for Economic Co-operation and Development (2009) or Bingley, Gupta, and Pedersen (2007).

individuals in the top income tax bracket. The deduction for those in the lower tax bracket remained the same at 45 cents per DKr.

There were additional policy changes associated with this reform, some of which affected individuals differentially across the income distribution.<sup>6</sup> However, most importantly for our purposes, these additional changes did not affect the interaction between individual income and the tax treatment of contributions to capital savings accounts or annuity accounts. Since our research design relies on this interaction, we are confident that the results reflect responses to the reduction in the capital contributions subsidy for individuals at the top income tax bracket.<sup>7</sup>

Most jobs in Denmark (roughly 80 percent) are covered by collective bargaining agreements between worker unions and employer associations. These agreements often have a pension plan in which a fixed proportion of an individual's earnings is paid into a retirement account. For the 20 percent of jobs that are outside the common agreements, employers set contribution rates to capital and/or annuity accounts for their workers.<sup>8</sup> While individuals cannot change the total contribution rate, they can choose a different allocation across capital and annuity accounts, but only if their pension fund allows both types of accounts.

### *B. Data Sources, Sample Selection, and Variable Definitions*

We merge data from several administrative registers of the Danish population—the income tax register, the population register, and the Danish Integrated Database for Labor Market Research (IDA)—to obtain annual information on Danish employees and their matched firms from 1996 to 2001. These registers include data on taxable labor earnings, contributions to pension accounts, occupation, industry, and employees' demographics (such as age and educational attainment). All income and savings variables used in the analysis are based on third-party reports: earnings and pension contributions are reported directly by employers and pension funds to the tax authority.

Starting from the population dataset, we impose four restrictions to obtain our primary analysis sample. First, we exclude individuals under age 20 or over age 60, at which the majority of the Danish workforce is eligible for early retirement benefits and retirement savings are eligible for withdrawal (without a penalty). Second, we focus our analysis on the 20 percent of workers who are outside collective

<sup>6</sup>These changes include a reduction in the deduction value of negative capital income, a reduction in the bottom bracket tax rate, a move to equalize taxation on all liquid assets (i.e., stocks versus bonds), a decrease in the value of the Voluntary Early Retirement Plan, and the possibility to initiate a private rate pension plan (a special type of an annuity pension plan) after age 55. While the possibility to initiate a private rate pension plan may have affected the incentives for initiating annuity pension plans for older workers, effectively, we find no differential savings patterns around the age threshold of 55. Hence, this component of the reform is not affecting our results. The remaining reform elements may affect people differentially across the income distribution, but do not directly affect the demand for capital and annuity contributions.

<sup>7</sup>Nevertheless, to alleviate concerns regarding the other potential confounding policy changes, in the empirical section we include a fifth order polynomial of individual income as control variables in our regression analysis and find that our results do not change.

<sup>8</sup>The contributions rates, default portfolio allocations, and administration fees are set by bargaining between the pension fund and the employer, which is usually represented by the heads of human resources departments, chief financial officers, and pension brokers. Updates to the employees' plans, e.g., in response to taxation changes, are made by the pension fund and the employer.

bargaining agreements for which contribution rates are set by the firm (rather than within collective bargaining agreements).<sup>9</sup> To isolate the jobs that are not covered by collective bargaining, we exclude workers in the public sector or in blue-collar occupations, since they are likely covered by collective agreements.<sup>10</sup> Therefore, our analysis sample consists of workers in private firms with white-collar occupations.<sup>11</sup> Third, we exclude observations of workers with self-employment income because their “employer” contributions are not set by a firm. Finally, we exclude occupation-firm cells with fewer than five employees in order to decrease measurement error, as such small cells are unlikely to be treated as an independent unit by employers.<sup>12</sup> Overall, our sample choice allows us to study how private firms in competitive markets design their employees’ pension plans.

We run our analysis at the occupation-firm level, since firms often set contribution rates separately by occupation as the pension funds in Denmark (that the firms negotiate with when setting their retirement plans) are largely occupation based. Specifically, we differentiate occupations at the two-digit ISCO occupation code level.<sup>13</sup> We measure contribution rates to employer sponsored accounts as contribution levels divided by taxable labor income. This measure of contribution rates may vary within an occupation-firm cell since employers may set pension contributions at a finer level within the firm than the two-digit code that we use, and since individuals can choose a different distribution of contributions between capital and annuity accounts than the employer’s default when employers offer both accounts. Therefore, to identify the default contribution rates chosen by employers, we use the median contribution rate within an occupation-firm cell as our measure. In online Appendix A, we assess the sensitivity of our results to other measures of defaults (namely, modes) and find very similar results. For ease of discussion, we refer in the remainder of the paper to a two-digit occupation-firm cell as a “workplace” and to the median contribution rate within a workplace (in a given year) as the “employer contribution rate” (or the “default”).

### C. Summary Statistics

Table 1 presents summary statistics for the sample of private white-collar wage earners between ages 20–60, in workplaces with at least five employees.<sup>14</sup> Our

<sup>9</sup>While it would be interesting to additionally analyze how pension plans are designed within a collective bargaining setting, the data do not allow us to match workers to unions and firms to employer associations.

<sup>10</sup>See online Appendix E for a complete description of occupations that we define as white-collar or blue-collar.

<sup>11</sup>Still, some white-collar jobs in the private sector are covered by collective bargaining. Therefore, in online Appendix D, we assess how inadvertently including workers covered by collective agreements may affect the results and show that it likely only attenuates our estimates.

<sup>12</sup>Our results are not sensitive to this choice—see online Appendix A for analyses that vary this minimal cell-size restriction.

<sup>13</sup>Due to measurement error in many-digit occupation codes, our choice for the analysis is the two-digit code level. However, actual employer contributions may be set at a higher (or lower) digit occupation code level. This causes some measurement error in our identified decision unit. Our results stay similar if we aggregate occupations at the one-digit level, or even at the firm level.

<sup>14</sup>During our sample period, 57 percent of wage earners were in the private sector, and 70 percent had white-collar occupations.

TABLE 1—SUMMARY STATISTICS OF ANALYSIS SAMPLE

	Mean (1)	Median (2)	SD (3)
<i>Individual-level variables:</i>			
Labor earnings (DKr)	285,740	253,893	214,500
Pension contributions before the reform			
Employer sponsored accounts			
Capital contributions (DKr)	11,665	6,679	12,490
Capital contribution rate (percent)	3.6	2.8	3.8
Percent with capital contributions	66		
Annuity contributions (DKr)	12,604	5,047	17,830
Annuity contribution rate (percent)	3.7	1.8	4.5
Percent with annuity contributions	77		
Private accounts			
Capital contributions (DKr)	3,125	0	7,627
Capital contribution rate (percent)	1.1	0	2.6
Percent with capital contributions	28		
Annuity contributions (DKr)	1,470	0	5,859
Annuity contribution rate (percent)	0.4	0	1.7
Percent with annuity contributions	15		
<i>Workplace-level variables:</i>			
Percent of employees above top tax threshold	49	50	35
Number of employees	22	9	97
Number of worker year observations		2,020,705	
Number of workplace-year observations		84,764	
Number of workplaces		26,775	

*Notes:* This table presents means, medians, and standard deviations of key variables in our analysis sample of white-collar workers in private-sector firms from 1996 to 2001. The classification of white-collar occupations is described in detail in online Appendix E. All monetary values are reported in nominal Danish Kroner (DKr), where the exchange rate during this time period was approximately DKr 6.5 per US \$1. Labor income is calculated as total pre-tax wage earnings plus employer pension contributions. The values reported in the table for pension contributions before the reform are based on data from 1998. Pension contribution levels are winsorized at their 99th percentile.

sample contains 2,020,705 worker year observations from 1996–2001. These amount to 84,764 workplace-year observations with a total of 26,775 unique workplaces.

To provide an overview of contributions to retirement savings accounts in Denmark prior to the reform, Table 1 reports information on individual-level pension contributions for the year 1998. Before the reform in 1999, contributions to employer sponsored capital accounts were on average 3.6 percent of annual earnings, where 66 percent of workers had positive contributions to these accounts. The average of contributions to employer sponsored annuity accounts was similarly at 3.7 percent of labor income, where 77 percent had positive contributions to these accounts. In contrast, individual contributions to both capital and annuity private pension accounts were much lower, with average contribution rates of 1.1 percent and 0.4 percent, respectively.

Importantly for our design, 49 percent of workers were above the top labor income tax threshold, with a sizable standard deviation of the fraction of workers above the threshold across workplaces on the order of 35 percent. Given the restriction to at least 5 workers per occupation–firm cell, the average workforce size is 22, while the median cell size is 9.

## II. Empirical Evidence

In this section, we analyze how employer contributions to pension accounts responded to the reform, namely, to the decrease in subsidies to capital pension contributions for workers with labor income in the top tax bracket. We begin by analyzing changes in employer contributions to capital accounts and their sensitivity to the share of workers who were directly affected by the reform. Then, we assess the magnitude of these responses to the reform by comparing employer responses to individual responses within private retirement accounts. We additionally explore other potential margins of firm responses, in particular, whether changes in capital contributions translate into changes in overall savings or whether firms substitute contributions to annuity accounts. Finally, we briefly discuss the optimality of the firms' responses to the reform.

### A. Employer Responses in Contributions to Capital Pension Accounts

In the years preceding the reform, employer capital contributions steadily increased, such that they were on average 2.81 percent in 1998 (see panel A of online Appendix Figure 1).<sup>15</sup> In contrast, in 1999, when the capital subsidy decreased for workers above the top threshold, the average employer capital contribution rate decreased by 0.76 pp. However, this average drop of 27 percent aggregates the responses of all the employers in our sample of private firms and white-collar occupations. Since the reform changed the savings incentives only for employees in the top labor income tax bracket, our analysis focuses on the heterogeneity of firm responses with respect to the share of the workforce that was directly affected by the reform.

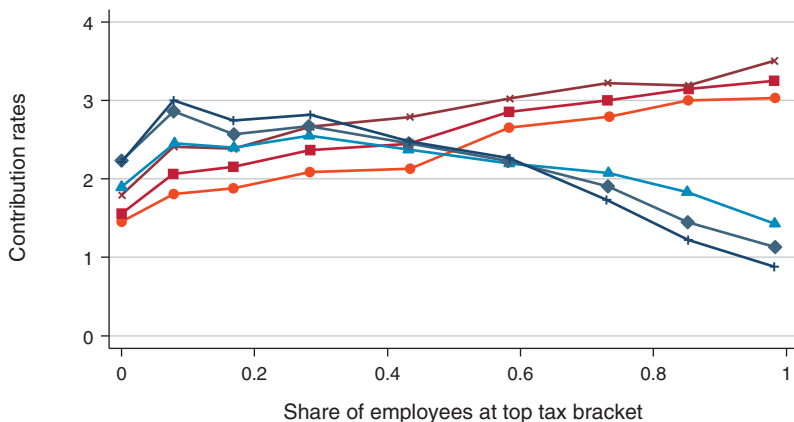
*Graphical Analysis.*—To test whether and to what extent employers' capital contribution responses to the reform increased in the share of workers above the top income threshold, we divide workplaces into equal-sized groups by the fraction of employees above the threshold within a workplace. We begin by plotting in Figure 1 the mean employer capital contribution rate against the mean fraction of employees above the top threshold for each group in years 1996–2001. Panel A shows that before the reform, employer capital contributions were increasing in the fraction of workers above the threshold and that the slopes of this relationship were similar across years.<sup>16</sup> However, immediately following the reform—which took effect in 1999—there is a significant change in this relationship, such that employer capital contribution rates became largely decreasing in the fraction of workers above the threshold. The decrease in employer capital contributions after the reform, i.e., the vertical distance between the lines of years 1998 and 1999, is noticeably larger for workplaces with a higher fraction of directly affected workers.

<sup>15</sup>Note that these are employer contributions (measured by workplace-level medians) as opposed to individual-level contributions to employer sponsored accounts that are reported in Table 1.

<sup>16</sup>This is consistent with the fact that top-bracket workers enjoyed a larger subsidy to capital contributions on the margin, but as it is a cross-sectional relationship, there is a variety of other reasons for this pattern such as different preferences for savings across individuals with different labor income levels.



Panel A. Contribution rates



Panel B. Changes in contribution rates

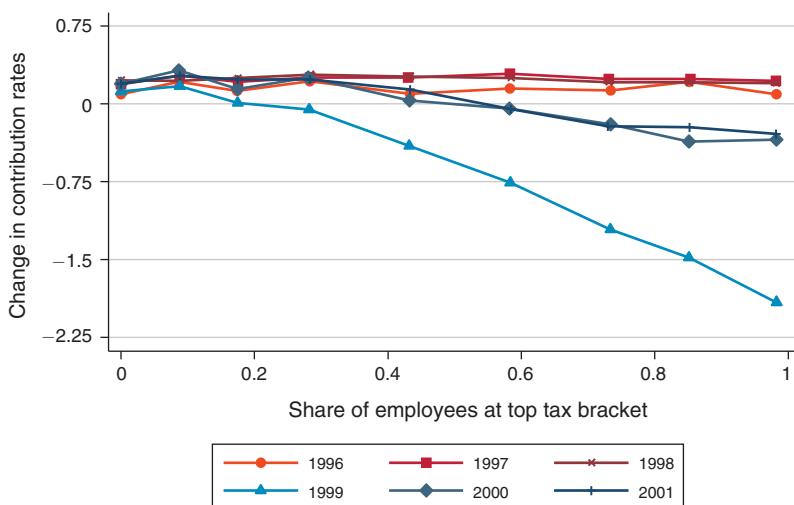


FIGURE 1. EMPLOYER CONTRIBUTIONS TO CAPITAL PENSION ACCOUNTS BY THE SHARE OF WORKERS ABOVE THE TOP TAX THRESHOLD

Notes: This figure plots employers' contributions to capital pension accounts as a function of the share of their employees whose earnings were above the top labor income tax threshold for years 1996–2001. Panel A plots employer capital contribution rates (as a fraction of labor income), and panel B plots changes in employer capital contribution rates from the previous year. The observation units are workplaces, defined as all employees with the same two-digit occupation code in the same firm, where employer contribution rates are calculated as the median annual contribution rate within each workplace in a given year. We plot these figures by dividing the sample into equal-sized groups according to the share of employees above the top tax threshold, and then plotting for each group the mean outcome (on the y-axis) against the mean share of employees above the top tax threshold (on the x-axis). The sample includes private-sector firms and white-collar occupations, and excludes self-employed individuals and workplaces with less than five employees.

To clearly see these changes, panel B of Figure 1 displays the year-to-year differences in employer capital contributions as a function of the fraction of employees above the threshold for each year from 1996 to 2001. This figure shows that annual

changes in contributions were uniform across different shares of workers above the top tax threshold in the years prior to the reform. However, between years 1998 and 1999, the year of the reform, workplaces with no affected workers did not change their contributions, while those with a larger share of affected employees decreased their contribution rates in larger magnitudes. This change continuously increased in the share of the workforce at the top bracket, with about a 1.9 pp decrease for workplaces with the highest share of affected employees. This is a large response, since completely exiting capital accounts in workplaces with the highest share of affected employees—which is an upper bound to their response—would imply a 3.5 pp reduction in contributions. In the subsequent years (2000 and 2001), there were some delayed responses to the reform, but the gradient with respect to the share of affected workers in those years is much smaller.

Overall, the graphical evidence clearly reveals that employers with a greater share of affected workers had larger capital contribution reductions in response to the reform. This suggests that employers are indeed responsive to changes in their employees' saving incentives, consistent with the hypothesis that employer provided pension plans reflect the savings preferences of their particular workforce composition.

*Regression Analysis.*—To quantify the firms' responses to the reform, we estimate regressions of the relationship between the change in employer capital contributions and the fraction of workers above the threshold. This also allows us to test the sensitivity of our results to a flexible set of controls. Our baseline estimating equation is of the form:

$$(1) \quad y_{ft} = \beta_0 + \beta_1 above_{ft} + \sum_{s=1996, s \neq 1998}^{2001} [\beta_s (I_{t=s} \times above_{ft}) + \mu_s] + X_{ft} + \varepsilon_{ft}.$$

The outcome variable  $y_{ft}$  is workplace  $f$ 's behavior in time  $t$ , i.e., annual outcomes grouped at the occupation-firm level. Our first and main outcome variable is the change in employer capital contribution rates from year  $t - 1$  to year  $t$ . The right-hand side variables include the fraction of employees above the threshold in an occupation-firm-year cell ( $above_{ft}$ ), year fixed effects ( $\mu_s$ ), and year dummies interacted with the fraction of employees above the threshold ( $I_{t=s} \times above_{ft}$ ). In this specification, we omit 1998 as the baseline year, so that all the coefficients  $\beta_s$  are estimated relative to 1998. We choose a specification linear in the fraction of affected employees, since panel B of Figure 1 revealed an approximately linear relationship between the change in employer capital contributions and the share of the workforce above the threshold. The main coefficient of interest is  $\beta_{1999}$ . This coefficient captures the relationship between the change in annual employer capital contributions and the fraction of workers above the threshold in 1999 compared to that in 1998, thus estimating the effect of the reform on this relationship. The vector  $X_{ft}$  includes various sets of controls, which we add in order to verify the robustness of the estimated effect, as the share of employees above the threshold may be correlated with other characteristics of the firm that may affect the change in contribution rates.

Panel A of Table 2 reports the coefficients on the share of employees above the threshold and the interaction of this share with indicators for years 1996 through 2001 (omitting 1998) in regressions that include various sets of controls. In all columns, we include year fixed effects and cluster standard errors at the workplace level.<sup>17</sup> We multiply the coefficients by 100 to convert them into percentage point units. Column 1 estimates the baseline regression and in columns 2 to 4 we successively add controls to the vector  $X_{it}$ . Importantly, we add high-order polynomials of the mean workplace-level income, separately for workers below and above the top tax threshold, as well as their interactions with the year dummies.<sup>18</sup> This allows us to further isolate the relationship between employer responses and whether employees are exactly above or below the threshold, by adding an underlying flexible continuous relationship between employer behavior and average labor income.<sup>19</sup> The additional controls that we include are the number of workers in a workplace and its square, as well as their interactions with year indicators, workplace (i.e., two-digit occupation firm) fixed effects, and two-digit occupation year fixed effects.

Across all specifications the results are very stable and are in accordance with the graphical results. There is no meaningful relationship between changes in employer capital contributions and the share of employees above the top threshold prior to the reform in years 1996–1998. However, the coefficient on the fraction of employees above the top threshold interacted with 1999 is approximately  $-2.2$  pp and statistically significant at any conventional significance level. Focusing on the specification of column 4 with the full set of controls, this implies that in 1999 employers in workplaces with 100 percent of employees above the top income tax threshold decreased their capital contribution rate by an average of 2.18 pp more than employers in workplaces with 0 percent of employees above the threshold. For years 2000 and 2001, the coefficients on the fraction of employees above the top threshold are  $-0.59$  and  $-0.55$ , respectively, and statistically significant. These patterns are consistent with firms responding substantially just after the reform took place, with a small degree of delayed or gradual responses by some firms.<sup>20</sup>

The stability of the estimated effect across the different regression specifications suggests that the estimated relationship is not driven by omitted variables. Still, a major possible concern is that these results are due to employee responses rather than employer responses. This concern stems from the fact that individuals whose employers contribute to both annuity and capital accounts have the ability to choose a

<sup>17</sup> Clustering at the firm level instead of the workplace level does not change the statistical significance patterns of our results.

<sup>18</sup> The reported estimates are for polynomials of degree five, but the results are robust to higher and lower degree polynomials and are available from the authors on request. The decline in the number of observations from specification (1) to (2) is due to the inclusion of controls for average income separately for employees above and below the top bracket, which excludes workplace-year observations in which all employees are either above or below the threshold.

<sup>19</sup> These controls alleviate concerns, for example, that “good” firms with higher wages may be more likely to respond to the reform and also have a higher fraction of workers above the top tax threshold. We estimated regressions that add controls for percentiles of the workplace’s distribution of employee income and found similar results. The analysis is available from the authors on request.

<sup>20</sup> We find that for workplaces with more than 50 percent of workers above the top threshold, approximately one half of the decrease in employer capital contributions after 1999 is delayed and attributable to firms that did not respond in 1999, and the other half is gradual and attributable to additional responses by firms that responded in 1999.

TABLE 2—CHANGES IN EMPLOYER CONTRIBUTION RATES TO PENSION ACCOUNTS BY THE SHARE OF WORKERS ABOVE THE TOP TAX THRESHOLD

Dependent variable:	$\Delta$ Capital contributions			
	(1)	(2)	(3)	(4)
<i>Panel A</i>				
Fraction of employees above top tax threshold (baseline year 1998)	-0.052 (0.032)	-0.113 (0.0670)	0.122 (0.137)	0.132 (0.145)
Fraction of employees above top tax threshold interacted with:				
Year 1996	0.035 (0.046)	0.101 (0.098)	0.202 (0.139)	0.273 (0.167)
Year 1997	0.061 (0.046)	0.075 (0.096)	0.071 (0.126)	0.096 (0.147)
Year 1999	-2.126 (0.061)	-2.167 (0.129)	-2.181 (0.176)	-2.182 (0.203)
Year 2000	-0.606 (0.048)	-0.569 (0.104)	-0.556 (0.149)	-0.593 (0.173)
Year 2001	-0.558 (0.046)	-0.598 (0.101)	-0.590 (0.152)	-0.553 (0.176)
Year fixed effects	X	X	X	X
Income and workforce size controls		X	X	X
Two-digit occupation-firm fixed effects			X	X
Two-digit occupation-year fixed effects				X
Observations	84,764	60,643	60,643	60,643
Number of clusters	26,775	20,642	20,642	20,642
<i>Panel B</i>				
Dependent variable:				$\Delta$ Annuity contributions
Fraction of employees above top tax threshold interacted with year 1999				1.962 (0.195)
<i>Panel C</i>				
Dependent variable:				$\Delta$ Overall employer contributions
Fraction of employees above top tax threshold interacted with year 1999				-0.220 (0.217)

*Notes:* This table reports estimates of employers' responses to the reform as a function of the share of their employees whose earnings were above the top labor income tax threshold (equation (1)). In panel A, the outcome variable is the change in employer capital contribution rates from the previous year. We regress this outcome on the fraction of workers above the top tax threshold, year fixed effects, the fraction of workers above the top tax threshold interacted with year fixed effects, and different sets of controls as indicated in the table. The baseline year is 1998, so that the coefficient on the fraction of employees above the top tax threshold refers to that year. The coefficient on the fraction of employees above the top tax threshold interacted with other year indicators estimates this relationship relative to the relationship in the baseline year. Income controls include a fifth-order polynomial of the mean workplace-level labor income, separately for workers above and below the top tax threshold, as well as their interactions with year indicators. Workforce size controls include the number of workers in a workplace and its square, as well as their interactions with year indicators. In panels B and C, we replicate the specification with the full set of controls from column 4 of panel A, but where the outcome variables are changes in employer annuity contribution rates and changes in overall employer contribution rates to both capital and annuity accounts, respectively. In all regressions the observation units are workplaces, defined as all employees with the same two-digit occupation code in the same firm, where employer contribution rates are calculated as the median annual contribution rate within each workplace in a given year. The sample includes private-sector firms and white-collar occupations, and excludes self-employed individuals and workplaces with less than five employees. Standard errors are clustered at the workplace level. Coefficients are multiplied by 100 so that they are converted to percentage point units.

different distribution between capital and annuity contributions than the default set by the employer. In order to address this concern, we conduct a variety of tests detailed in online Appendix A. First, instead of workplace-level medians, we calculate workplace-level modes, which are not affected by specific individuals, to identify employer contributions rates and find very similar results. Second, we plot the distribution of the distance between employee-level capital contribution rates and the workplace-level aggregates and find that most employee contributions bunch exactly at these aggregates, supporting our method for identifying employer behavior. Third, we find similar results when we focus on the sample of workplaces whose default annuity contribution rate in the years prior to the reform was zero, and whose employees, therefore, did not have discretion in allocating contributions across different types of employer sponsored accounts. Fourth, since medians more accurately identify default contribution rates in large workplaces and since, conceptually, firms are probably more likely to tailor defaults to groups of employees of similar occupations in larger workplaces, we study the robustness of the results to varying the minimal size of workplaces that we include in the analysis. Again, we show that the findings remain qualitatively similar. Overall, the analysis in online Appendix A supports our conclusion that the results are driven by firm responses rather than by individual responses.

In addition, in online Appendix C we demonstrate that the employer responses in contribution rates were attributable to changes in capital contributions (that is, the numerator) rather than changes in labor income (the denominator). Finally, in online Appendix D, we show that inadvertently including workers who were covered by collective bargaining likely only attenuates our results.

In sum, our analysis is consistent with the notion that employers design pension plans to reflect the savings preferences of their workforce, and that they respond immediately to changes in their employees' incentives. In the next section, we gauge the magnitude of the employer responses that we estimated.

### *B. Employer versus Individual Responses*

In the analysis above, we showed that the average response of employers was large relative to their baseline contribution rates to capital accounts. In this section we assess the magnitudes of the employer responses to the reform by comparing them to the responses of individuals within their private accounts.

The ideal experiment that compares individuals' savings behavior and employers' savings behavior on the individuals' behalf would randomly assign savings decisions to either individuals or their respective employers. To mimic this experiment, we exploit the Danish setting that provides us with administrative records of employee-level savings contributions to both employer sponsored 401(k)-like accounts and private IRA-like accounts that are managed by the individuals themselves. We focus the analysis only on those who were directly affected by the reform—that is, employees at the top bracket of the labor income tax schedule—and compare their responses in private accounts to those of their employers in their employer sponsored accounts.

In Figure 2, we divide the sample of affected workers into equal-sized groups according to the share of workers above the top threshold in their workplace.

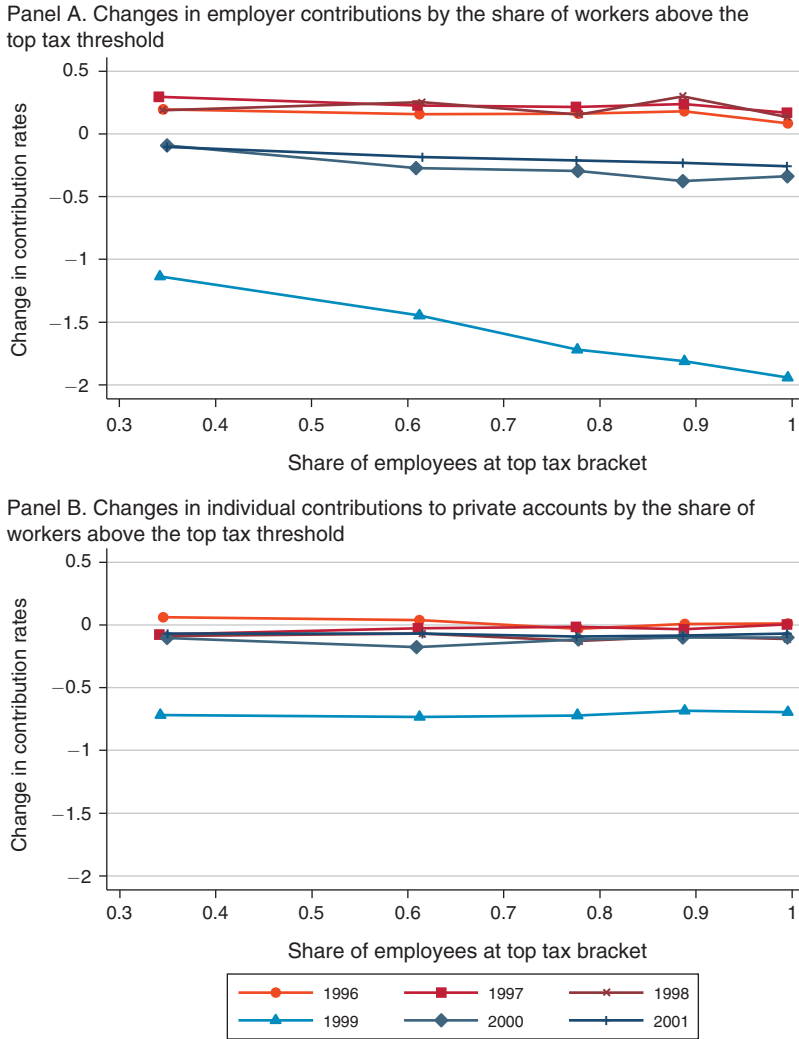


FIGURE 2. EMPLOYER VERSUS INDIVIDUAL CONTRIBUTIONS TO CAPITAL PENSION ACCOUNTS OF WORKERS ABOVE THE TOP TAX THRESHOLD

Notes: These figures plot changes in workplace-level contribution rates to capital pension accounts, only for employees with labor income at the top tax bracket, as a function of the workplace’s share of employees above the top tax threshold for years 1996–2001. Panel A plots changes in median capital contribution rates to employer-sponsored (401(k)-like) accounts, and panel B plots changes in average capital contribution rates to private (IRA-like) accounts. The observation units are workplaces, defined as employees with the same two-digit occupation code in the same firm. We plot these figures by dividing the sample into equal-sized groups according to the share of employees in the workplace above the top tax threshold, and plotting for each group the mean outcome (on the y-axis) against the mean share of employees above the top tax threshold (on the x-axis). The sample includes private-sector firms and white-collar occupations, and excludes self-employed individuals, workplaces with less than five employees, and employees with earnings below the top tax threshold.

Panel A plots the change in the default contribution rate to employer sponsored capital accounts (defined only for workers affected by the reform), while panel B plots the change in the average contribution rate to private capital accounts.

One key difference between employer and individual responses is that for any fraction of employees at the top bracket, the decrease in employer contributions to capital accounts was larger than the individuals' responses. The latter is at most a decrease of 0.75 pp, while the smallest decrease in employer contributions is more than 1 pp. This suggests that most of the overall decrease in capital contributions due to the reform was attributable to employer, rather than individual, responses. It is, in part, due to the fact that baseline contributions to capital accounts in the years prior to the reform were much smaller in individual accounts compared to employer sponsored accounts (see Table 1). Another noticeable difference between the two panels of Figure 2 is that there is no gradient in private accounts with respect to the share of employees above the top threshold, while there is a pronounced gradient in employer sponsored accounts. This suggests that the response of employers in capital pension plans was not crowded out by individual responses in private plans.

To account for differential baseline contribution rates to private versus employer sponsored accounts and to understand better what underlies the aggregate responses, we analyze in online Appendix B the changes in the two types of accounts at the employee level by studying their respective distributions.

Altogether, the comparison of responses between employer sponsored accounts and private accounts reveals that, at the aggregate, the effect of the reform on capital contributions was mostly driven by employers. This underlines the large relative role of employers in individuals' overall savings for retirement. Next, we study whether the decrease in employer contributions to capital accounts translated into a decline in overall savings or into increased contributions to other substitutable accounts.

### *C. Substitution into Annuity Accounts*

The empirical analysis of employer responses to the reform has focused so far on capital contributions. To understand the effects of the reform on the overall employer sponsored savings portfolios of employees, we proceed by analyzing how employer contributions to annuity accounts may have changed.

The reform's decrease in subsidies to contributions to capital accounts had two main effects on employees' savings incentives for workers in the top income tax bracket. As it made contributions to savings accounts less attractive, the reform caused a negative income effect that pushed toward lower levels of total pension savings. At the same time, the reform created a substitution effect due to the decrease in the relative price of contributions to annuity accounts. The relative forces of these two effects determine whether and to what extent employers responded in their contributions to annuity accounts and in their employees' total compensation.

Figure 3 plots changes in employers' contributions to annuity accounts. We begin with panel A, which plots changes in employer contribution rates to annuity versus capital accounts by year. This graph shows that the time series of changes in employer contributions to annuity accounts essentially mirrored the changes in capital contributions. Moreover, panel B of Figure 3, which replicates panel B of Figure 1 but with changes in employer annuity contributions as the outcome variable, reveals that employer responses in annuity accounts also mirrored the responses in capital accounts as a function of the share of employees above the top

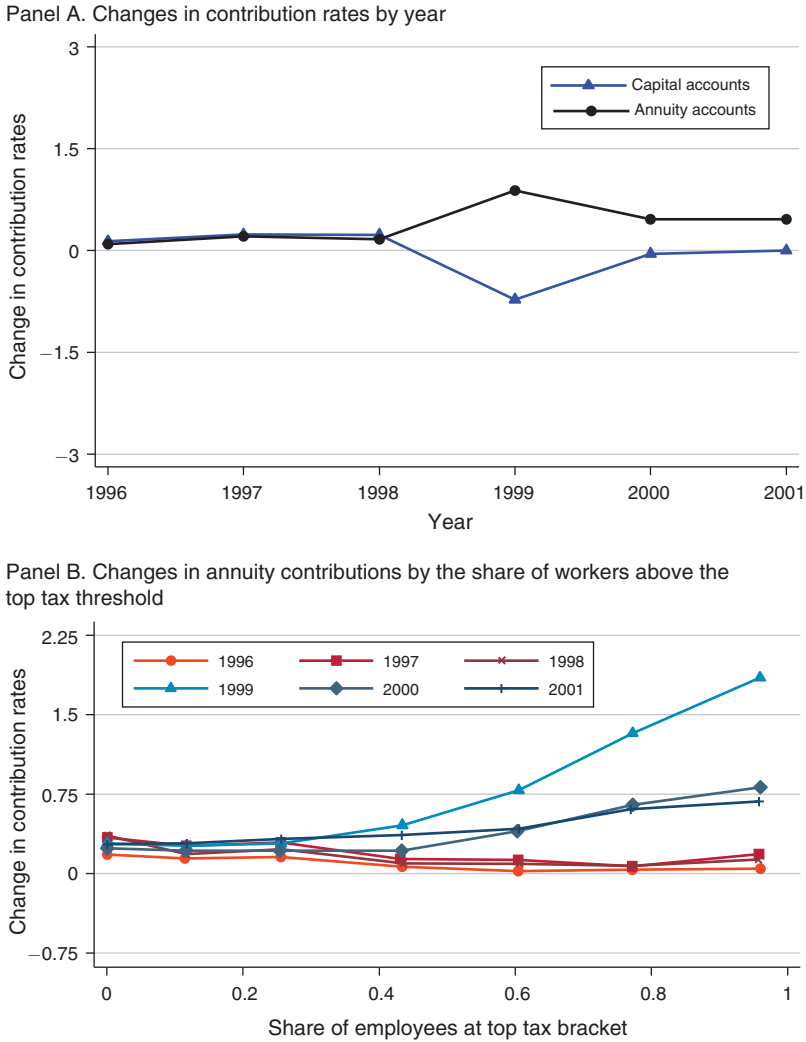


FIGURE 3. EMPLOYER CONTRIBUTIONS TO ANNUITY PENSION ACCOUNTS

*Notes:* These figures plot changes in employers’ contributions to annuity pension accounts, for years 1996–2001. Panel A plots changes in employer contributions by year, comparing annuity contributions (in circles) to capital contributions (in triangles). Panel B plots changes in employers’ contribution rates to annuity pension accounts as a function of the share of their employees whose earnings were above the top labor income tax threshold for years 1996–2001. The observation units are workplaces, defined as all employees with the same two-digit occupation code in the same firm, where employer contribution rates are calculated as the median annual contribution rate within each workplace in a given year. We plot these figures by dividing the sample into equal-sized groups according to the share of employees above the top tax threshold, and plotting for each group the mean outcome (on the y-axis) against the mean share of employees above the top tax threshold (on the x-axis). The sample includes private-sector firms and white-collar occupations, and excludes self-employed individuals and workplaces with less than five employees.

threshold. Before the reform, annual changes in both annuity and capital accounts were uniform across workplaces with different fractions of workers above the top tax threshold. In 1999, in response to the reform, employers decreased their capital contributions and increased their annuity contributions as a function of the share of



their affected employees and in similar magnitudes. Panel B of Table 2 estimates equation (1) with a full set of controls and with changes in employer annuity contributions as the outcome variable. We find that in 1999 employers in workplaces with 100 percent of employees above the top income tax threshold increased their annuity contribution rate by an average of 1.96 pp more than employers in workplaces with 0 percent of employees above the threshold, alongside the decrease of 2.18 pp in capital contributions. In fact, studying the sum of these responses in panel C of Table 2, the evidence is consistent with full compensation of the decrease in capital contributions by an increase in annuity contributions, so that the change in overall employer contributions is not statistically different from zero.

In sum, the results suggest that the response at the employer level was driven by a substitution effect, so that the decrease in capital contributions was almost fully compensated for by an increase in annuity contributions, with no statistically significant effect on overall employer contributions. These employer responses are in contrast to individual responses in private accounts, for which Chetty et al. (2014) find a shift of 57 cents to annuity accounts for each DKr that individuals would have contributed to capital accounts. In online Appendix C, we additionally show that there was no average effect on labor income, so that we do not find evidence that the potential income effect of the reform was offset by higher wages.

#### *D. Optimality of Firm Responses*

A comprehensive analysis of the optimality of firms' responses would require estimating workers' preferences, modeling their lifetime budget constraint, and characterizing their optimal allocations, which is beyond the scope of this paper. In this section we attempt to provide a back-of-the-envelope assessment of how close firms' responses were to "optimal" from the perspective of the employees. Therefore, it is necessary to hypothesize or impute how optimizing individuals would respond to the reform absent any adjustment or information costs. To do so, we choose the actions taken by "attentive" affected individuals, who made changes to their self-managed IRA-like savings accounts in response to the reform, as a baseline benchmark for employee-level optimal response. We choose the response of attentive individuals rather than all individuals since most individuals are passive in their savings behavior, likely due to re-optimization costs (Chetty et al. 2014).<sup>21</sup>

Consider individuals at the top income tax bracket who were directly affected by the reform. In the year of the reform, almost all individuals among this group, who had positive individual capital contributions in the previous year and actively changed their contribution levels, chose to completely exit their individual capital accounts (see Chetty et al. 2014 and online Appendix B). To the extent that their attentiveness is not systematically correlated with their underlying ranking of saving choices, their actions may be viewed as a crude benchmark for optimal responses of

<sup>21</sup>This is in the spirit of Bernheim and Rangel's (2009) choice-based approach to welfare and its application by Chetty, Looney, and Kroft (2009), who assume that optimal responses to changes in tax rates in the presence of optimization frictions can be recovered by choices when taxes are salient.

workers above the threshold.<sup>22</sup> We use this individual-level optimality benchmark to characterize whether firms optimally responded to the reform.

We simplify the analysis by focusing on workplaces whose entire workforce is above the top income tax threshold and was directly affected by the reform. Inclusion of workplaces with a heterogeneous mix of workers requires additional assumptions regarding how firms weight the utility of its individual workers, which we choose to abstract from here. In addition, we constrain the analysis to workplaces whose default contribution rate to capital accounts was positive in 1998, the year prior to the reform, in order to focus the analysis on employers that could adjust these contributions downward in response to the reform.

To study the optimality of the firms' responses, Figure 4 plots the time series of the fraction of workplaces with positive default capital contributions among those who had positive default contributions in 1998. Within the framework of efficient compensation models, one may expect larger firms to be more responsive to changes in economic incentives if there are significant returns to scale in managing employees' pension products, leading to a more optimal response. In line with this conjecture, we divide workplaces into 2 size categories: "small" workplaces with 5–19 employees, and "large" workplaces with 20 employees or more. Following the reform, for both categories of workplace size, we see a sharp drop in 1999 in the fraction of employers who offer capital savings accounts, with continued declines in the following years. In addition, the figure shows that the decreases are significantly larger for larger workplaces, consistent with the notion of returns to scale in managing employee savings. Specifically, 45 percent of large firms opt out of capital contributions in 1999, compared to 35 percent of small firms. By 2001, almost 70 percent of large firms have opted out of capital contributions, while approximately 52 percent of small firms have opted out by then.

Note that while this response is still far from the assumed optimal benchmark, even for large firms, one important question for policy is how it compares to the average individual response. To answer this question we augment the comparison of employer and individual responses of Section B by focusing here on the "extensive" margin of private capital contributions. This will allow a comparison that is in line with the optimality benchmark of completely opting out of these accounts. We do so by adding to Figure 4 the time series of the fraction of individuals with positive private capital contributions among those who had positive contributions in 1998. The figure reveals that following the reform approximately 35 percent of individuals who had positive contributions to privately managed accounts chose to

<sup>22</sup>This is more likely to be a valid benchmark if the financial incentives within the reform led to similarly desirable re-allocations of savings for attentive and inattentive top income earners. Note, however, that this remains a valid benchmark even if attentive individuals differ by their disutility from making an active choice so long as it is uncorrelated with their optimal allocations. One case where we may worry about this sort of correlation is when the optimal savings adjustment in response to the reform for the "inattentive" affected individuals involves only a small potential utility gain combined with some nonnegligible adjustment costs. In this case, they may not respond since for them the costs of re-optimization outweigh its benefits. However, online Appendix Figure 4 reveals that the difference between the distribution of individual-level annual changes before and after the reform is not distributed smoothly but rather almost entirely concentrated at the mass point of completely opting out. If adjustment costs are distributed smoothly, these findings suggest that opting out of capital accounts is the optimal response for inattentive individuals as well. Nevertheless, the exercise here is merely a rough assessment of optimality and should be taken as such.

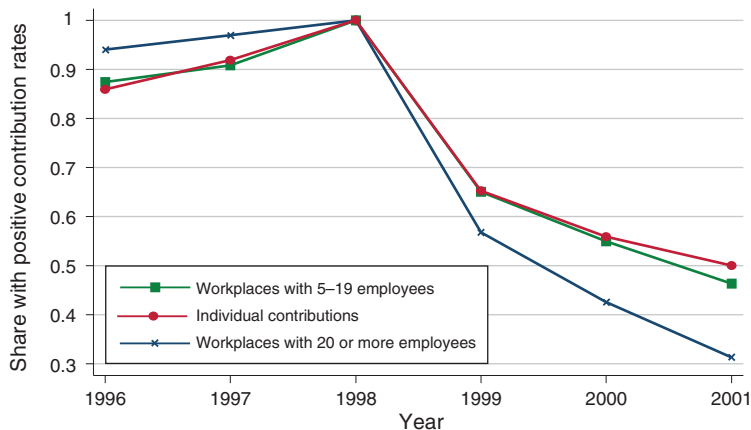


FIGURE 4. EXTENSIVE MARGIN RESPONSES IN CAPITAL PENSION ACCOUNTS BY YEAR

*Notes:* The series marked by squares and the series marked by Xs plot the time series of the fraction of workplaces with positive median contributions to employer-sponsored capital accounts among those who had positive median contributions in 1998. We divide workplaces by the size of their workforce, where a workplace is defined as the group of all employees with the same two-digit occupation code in the same firm. We include only workplaces whose entire workforce was above the top income tax threshold and was therefore directly affected by the reform. In addition, we constrain the sample to private-sector firms and white-collar occupations, and exclude self-employed individuals and workplaces with less than five employees. As a comparison, the series marked by circles plots the time series of the fraction of individuals with positive private capital contributions among those who had positive private contributions in 1998. We include only individuals with income levels above the top income tax threshold who were directly affected by the reform. We additionally constrain the sample to employees with white-collar occupations in the private sector, and exclude self-employed individuals.

opt out of them, with an overall opt-out rate of approximately 50 percent by 2001. Interestingly, it is apparent in the figure that the response of individuals closely follows that of smaller firms. This is consistent with smaller firms having larger average re-optimization costs per employee that are more similar to the associated costs for individuals than to those for larger firms.

Put together, if opting out of capital accounts is the optimal allocation of savings for affected workers, the exercise above suggests that larger firms make more optimal decisions compared to smaller firms. In addition, the analysis is supportive of the notion that delegating decisions to employers may be welfare increasing, in particular in large workplaces whose size may render managing employee savings less costly.

### III. Conclusion

This paper provides evidence that employers set contributions to pension savings accounts in accordance with the savings preferences of their workforce, and that they respond immediately and significantly to changes in their employees' savings incentives. In particular, we find that the change in employer capital contributions in response to an increase in their relative price within the 1999 reform was strongly related to the fraction of workers who were above the top tax threshold and were directly affected by the reform. We also find that employers adjusted their

employees' overall savings portfolios by significant shifts into the more subsidized annuity accounts, with almost no leakage of overall savings.

Since employer contributions and defaults are extremely effective at increasing individuals' total level of savings, some governments are considering implementing policies that incentivize employer based savings accounts and default contribution rates. Given the increasing reliance of individual retirement savings on employers' contributions, our findings are promising and encouraging preliminary evidence that they are set in accordance with workers' savings preferences.

However, there are other important aspects of firm responses that we did not address in this paper. For example, our results do not reveal whether firms' behavior is attributable to benevolence or to competition. Additionally, we are unable to evaluate the optimality of responses for firms with heterogeneous workforces, which include a large share of all firms. We believe that addressing these issues is a fruitful direction for future research, as they have potentially important implications for the optimal design of employer based retirement savings policies.

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