

ACTIVE VS. PASSIVE DECISIONS AND CROWD-OUT IN RETIREMENT SAVINGS
ACCOUNTS: EVIDENCE FROM DENMARK*

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Abstract

Do retirement savings policies – such as tax subsidies or employer-provided pension plans – increase total saving for retirement or simply induce shifting across accounts? We revisit this classic question using a panel dataset with 50 million observations on savings for the population of Denmark. We find that a policy’s impact on total savings depends critically on whether it changes savings rates by active or passive choice. Policies such as tax subsidies that rely upon individuals to take an action to raise savings have small impacts on total wealth. In contrast, policies that raise savings automatically even if individuals take no action – such as employer-provided pensions or automatic contributions to retirement accounts – increase wealth accumulation substantially. Intuitively, price subsidies only affect the behavior of active savers who optimize their portfolios with respect to policy, whereas automatic contributions increase savings of passive individuals who do not reoptimize. We estimate that approximately 85% of individuals are passive savers. The 15% of active savers who respond to price subsidies do so by reallocating savings across accounts. Overall, our results imply that automatic contributions may be more effective at increasing total retirement savings than price subsidies for two reasons: (1) subsidies induce relatively few individuals to respond, and (2) they generate substantial crowdout conditional on response.

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I Introduction

Do retirement savings policies – such as tax subsidies, employer-provided pensions, and savings mandates – raise total wealth accumulation or simply induce individuals to shift savings across accounts? This question is central for understanding the optimal design of retirement savings policies. Despite extensive research, the impacts of retirement savings policies on wealth accumulation remain highly debated, largely due to limitations in data and a lack of sharp research designs.

In this paper, we revisit this classic question using a panel dataset with 50 million observations on savings in both retirement and non-retirement accounts for the population of Denmark. We analyze the impacts of price subsidies and automatic contributions on savings behavior using Danish income tax records.¹ These data provide administrative information on the value of assets and liabilities of all Danish citizens from 1994-2009. The Danish data have two advantages over datasets used in prior work on retirement savings. First, they offer administrative information for a sample of individuals that is much larger than those used in recent studies (e.g., Gelber, 2011), which have been constrained by small survey datasets that typically have less than a thousand observations in the analysis sample. Second, there were a series of sharp reforms in Denmark that provide quasi-experimental research designs to analyze the impacts of retirement savings policies on savings behavior.

We divide our empirical analysis into two sections. First, we analyze the impacts of employer-provided pensions and government mandates, both of which are “automatic contributions” in the sense that they affect savings levels even if individuals take no action. Using event studies of individuals who switch firms, we find that individuals’ total savings rates rise immediately by 86 cents when they move to a firm with \$1 larger employer-provided pension contributions.² Most individuals do not change voluntary pension contributions or savings in taxable accounts at all when they switch firms, consistent with passive behavior.³ The degree of pass-through remains equally high for relatively large changes in employer-provided pensions (such as increases or decreases of 5% of earnings) and the changes in savings behavior persist for several years after the firm switch.

¹Although the variation in our data is in the form of employer-provided pensions and a mandatory government savings plan, we show that the essential feature of these policies is that they increase savings without requiring any action by individuals. Hence, we expect our results to translate to other policies such as defaults and automatic enrollment that share this feature.

²Throughout our empirical analysis, we are careful to account for corners by focusing either on individuals who were already saving more than the change in employer-provided pensions or using statistics such as the fraction contributing above thresholds that are not affected by corners.

³The fact that a large fraction of individuals change total savings by exactly the same amount as the change in employer savings allays concerns that the changes in total saving around firm switches are due to sorting rather than the causal effect of firms’ policies.

We also analyze the impacts of a mandatory savings plan (MSP) that required all Danish citizens to contribute 1% of their earnings to a retirement savings account from 1998 until 2003. We find sharp increases in total savings in 1998 and sharp reductions in total savings in 2004. The MSP raised total savings even for individuals who were previously saving more than 1% of their earnings in voluntary retirement savings accounts, which are nearly a perfect substitute for MSP. We conclude that automatic contributions generate relatively little crowdout and increase total wealth accumulation significantly, suggesting that many individuals are passive savers who reduce consumption when their disposable income is reduced.

In the second part of our empirical analysis, we study the impacts of subsidies for retirement savings. In 1999, the Danish government reduced the tax subsidy for contributing to capital pension retirement savings accounts – analogous to 401(k)'s – by approximately 30% for the top quarter of the population, who had incomes above US \$45,000 (and therefore put them in the top income tax bracket). Individuals below the top income tax bracket were unaffected by the reform. Using a difference-in-difference design around the top tax cutoff, we find that capital pension contributions fell sharply for individuals in the top income tax bracket but remained virtually unchanged for individuals just below that bracket. Importantly, the aggregate reduction in capital pension contributions is entirely accounted for by 15% of prior contributors who stop making capital pension contributions in 1999. Moreover, most individuals do not change their capital pension contributions even though utility maximization would call for some change in contributions when prices change at an interior optimum. This result again supports the view that the majority of individuals are passive savers and is thus consistent with our finding that automatic contributions raise total savings for many individuals. Most of the reduction in capital pension contributions for the 15% of active savers is offset by increases in contributions to other types of retirement savings accounts and increases in non-retirement savings. On average, a \$1 reduction in capital pension savings due to the reduction of the tax subsidy is associated with only a 10 cent reduction in total savings, and the elasticity of total savings with respect to the net-of-tax subsidy for retirement savings is only 0.07. Hence, tax subsidies have much less impact on total savings than automatic contributions.

Our analysis contributes to and builds on two large literatures: research in public finance analyzing crowd-out in retirement savings accounts and research in behavioral economics comparing the impacts of defaults, matches and other policy tools on savings within retirement accounts. While these literatures have developed independently, our results show that there is actually a

deep connection between these two strands of work. In the public finance literature, Venti and Wise (1986), Skinner and Feenberg (1990), Poterba, Venti and Wise (1994, 1995, 1998), Hubbard and Skinner (1996), and Gelber (2011) present evidence that increases in 401(k) savings represent increases in total savings. Engen, Gale and Scholz (1994, 1996) argue that much of the increase in 401(k) savings represents substitution from other accounts. Although some of the difference between the results of these studies likely stems from differences in econometric assumptions, the variation that drives changes in contributions to 401(k)'s could also explain the differences in results. For instance, increases in 401(k) contributions due to company policies may induce little active decision making and generate minimal crowdout, while changes in tax incentives or programs that require voluntary participation could induce more substitution.⁴

The behavioral economics literature has shown that defaults and, to a lesser extent, salient price subsidies significantly increase savings *within* retirement accounts (e.g., Madrian and Shea, 2001; Duflo et al., 2006). Importantly, however, this prior work has not investigated whether defaults raise *total* savings. The impacts of these policies on total savings depend fundamentally on how consumers adjust their budgets when they recognize that they have less disposable income. There is no ex-ante reason to expect that the adjustment occurs by reducing consumption instead of non-retirement saving. Our finding that policies that change savings passively do raise total savings thus significantly strengthens the argument for policies such as automatic enrollment and defaults (e.g., Carroll et al., 2009; Madrian, 2012).

The remainder of the paper is organized as follows. Section 2 describes the Danish data and institutional background that provides our empirical setting. Sections 3 and 4 present the empirical results on automatic contributions and price subsidies, respectively. We conclude in Section 5 by discussing policy implications.

II Data and Institutional Background

Danish individuals rely on state-provided defined benefits, payouts from mandatory savings schemes, employer administered pension plans, individual pension plans for income during retirement. Both the employer-administered plans as well as pension plans set up by an individual can have different payout profiles with different tax consequences. We exploit this variation between plans and within plans over time. Pension savings that are paid out as a lump sum are taxed at 40% on

⁴In addition, Gelber (2011) analyzes an anticipated change in eligibility for tax-deferred savings accounts, which could generate very different behavioral responses than the permanent changes we study here.

payout, whereas pension plans that are paid out over several years, or as a life annuity, are taxed as regular income. The lump sum schemes are called capital pensions, while the latter schemes are called rate and annuity schemes. Over the period we study, 1994-2009, the tax treatment of rate and annuity pensions remain largely unchanged, while the tax treatment of capital pensions was changed in 1999, lowering the tax subsidy for capital pension contributions for people in the top income bracket. The period we study is interesting not only because of this price change, but also because the government experimented with mandatory savings schemes in the period 1998-2003.

For many wage earners the major pension savings instrument is an employer administered pension plan, called the Labor Market Pension (LMP) plan. Most jobs in Denmark are covered by collective bargaining agreements between workers' unions and employer associations. These agreements set wages and often include a pension savings plan where a fixed proportion of earnings is paid in to an LMP.

Under Danish tax law, all pension schemes are tax-favored in that the tax on capital gains of wealth in pension accounts is fixed at 15%. This is substantially lower than both the capital gains of shares held outside of pension accounts (25-45%) and capital gains on bonds and other non-share instruments (taxed as regular income at rates in excess of 50% for top tax payers). For rate and annuity pensions, an extra benefit is the deferred tax aspect. This allows people who expect to be in a lower tax bracket upon retirement to shift from the higher taxation of current income to the expected lower taxation of income upon retirement. For capital pension schemes, the extra benefit is the ability to replace higher income taxation now with a lower flat 40% tax at pension payout. This makes capital pensions quite attractive for many people, but there is a cap of DKR 33,100⁵ (1998 level) on the contributions that can be made to capital pensions each year. Prior to 1999, the same-year tax subsidy to pension contributions was identical across capital, rate and life annuity pensions. Starting in 1999, the same-year tax subsidy of an extra dollar saved in a capital pension plan was approximately 15 cents less than for rate and annuity contributions (44 cents versus 59 cents). In 1998, the top income bracket started at DKR 251,200, and 26% of our sample were top tax payers. For a more detailed description of the tax system, see Danish Ministry of Taxation (2002).

The Mandatory Savings Plan (MSP) existed in the period 1998-2003. During this period all Danish residents under the age of 67 automatically had 1% of their labor market income deducted by their employer and contributed to a governmental administered pensions savings plan. In 1998

⁵The average exchange rate over the period 1994-2009 was 6.5 DKR/USD

persons with income below DKR 34,500 were not subject to the MSP and we exploit this kink in our analysis. The plan was originally announced as a provisional plan for 1998 only, but the year after it was made permanent and it was in operation until the end of 2003, at which point it was suspended. For 1998, and for 2002-2003, 100% of an individual's contributions were deposited to that individual's account, while in 1999-2001 there was a redistributive element, so that every full time employee got the same amount deposited in her account.

Data. For this study we merge a number of Danish administrative registers. These registers include annual longitudinal information for the entire Danish population (approximately 5 million people) for the period 1994-2009. The primary register used is the Income Tax Register which contains an extensive set of relevant income and wealth variables. We merge this with the Danish Integrated Database for Labor Market Research (IDA) in order to link employees with their employer and to get educational and occupational information. Finally we make use of population register data to get various information such as age and gender.

An important feature of the income tax register is that it includes information about total wealth that can be divided into the total value of assets and liabilities and subdivided into housing assets and liabilities as well as non-housing assets and liabilities. Wealth data exist because Denmark levied a wealth tax until 1997; data collection continued after that and the tax authorities use the wealth data to cross check if reported income is consistent with the level of asset accumulation from one year to the next. We believe that the wealth data provide accurate information for the vast majority of households. The data may miss some assets such as cash holdings outside bank accounts or exotic assets such as yachts, but such assets likely account for a small fraction of total wealth and are unlikely to be the main substitutes for savings in retirement accounts.

The income-tax register data is collected by the tax authorities in order to calculate the amount of taxes to be paid by all persons in Denmark by the end of each calendar year. The tax authorities collect information from many sources. Most important for this study are earnings and pension contributions collected directly from employers and pension funds; information about transfer income is collected from government institutions, and information about interest payments/income and the value of assets and liabilities by the end of the year is collected directly from banks. A recent study by Kleven et al. (2011) conducted a large scale randomized tax auditing experiment in collaboration with the Danish tax authorities and documents that tax evasion in Denmark is very limited, in particular among wage earners. This implies that the third party reported information collected by the tax authorities is of very high quality. See Chetty et al. (2011) for more detailed

information on the income data and Leth-Petersen (2010) for a detailed description of the wealth data.

We impose two sample selection criteria: We include individuals aged 18-60, and we exclude self-employed individuals because income and own-business wealth is not likely to be measured accurately and because a major break in the definition of the wealth variables for this group occurred in 1997. This leaves us with a sample consisting of about 45 million observations for 9.3 million individuals. Table 2 presents summary statistics for the analysis sample.

III Impacts of Automatic Contributions

We begin our empirical analysis by studying the impacts of automatic contributions on savings behavior. We use two sources of variation for identification: (1) changes in employer provided pensions and (2) the introduction of a mandated government savings plan. We discuss results using each of these research designs in turn.

III.A Employer Provided Pensions

Changes in employer provided pensions are analogous to changes in M in our model because they increase individuals' total savings if they take no action. The ideal experiment to analyze the impacts of employer-provided pensions on total savings would be to randomize employer contributions holding fixed total compensation. For example, we would like to randomly increase the employer contributions of a set of individuals by \$1,000 while reducing their take-home pay by \$1,000 so that total compensation remains fixed. We generate quasi-experimental variation of this form using event studies of individuals who change jobs. Job changes can lead to sharp increases and decreases in employer pension contributions and also in wage rates. By comparing the impacts of changes in employer pension contributions and wage rates on total savings, we identify the extent to which individuals offset changes in employer contributions by reducing savings in other accounts.

Because employer-provided pensions are typically determined by collective bargaining agreements that bind at the occupation by firm level, we define the predicted employer pension contribution \bar{e}_{oft} in occupation o in firm f in year t as the average observed employer pension contribution rate (as a fraction of gross earnings) for individuals in that cell. There is still some heterogeneity in employer pension contributions across individuals within each of these cells due to idiosyncracies in the bargaining and contracting process. A regression of actual employer pension contributions on \bar{e}_{oft} produces a coefficient of 0.5 and an R-squared of 0.3, showing that a substantial portion of

the variation in employer contributions is explained by occupation by firm-occupation means but there is still considerable unexplained heterogeneity. We therefore treat \bar{e}_{oft} as an “intent-to-treat” instrument for actual employer provided pensions in the analysis that follows.

There are two sources of variation in \bar{e}_{oft} : changes in firms’ policies and changes in a worker’s firm or occupation. Changes in firm pension policies in Denmark are typically very gradual and small, making it difficult to disentangle the causal impacts of changes in firms’ policies from other confounding factors that trend over time. We therefore focus here on the second source of variation - changes in employer pensions that occur when workers switch jobs. Because there is considerable heterogeneity across firms and occupations in \bar{e}_{oft} , such switches generate sharp changes in employer pension contributions that are plausibly orthogonal to other determinants of savings behavior at high frequencies.

To study the impacts of changes in employer pensions due to firm switches, we first define the change in predicted employer pensions for individual i who switches from firm f_0 to firm f_1 in year t as $\bar{e}_{of_1t} - \bar{e}_{of_0t}$. To illustrate our research design, we begin in Figure 1a by analyzing individuals who move to a firm whose mean employer contribution rate is at least 2 percentage points larger than at their previous firm. Let year 0 denote the first year in the sample that an individual switches firms and define all years relative to that year (e.g., if the individual switches firms in 2001, year 1998 is -3 and year 2003 is +2). For individuals who hold multiple jobs within a single year, we define a firm switch as working at a completely different set of firms in year t relative to year $t - 1$.

The series in circles in Figure 1a shows the first-stage impact of switching to a firm with where $\bar{e}_{of_1t} - \bar{e}_{of_0t} > 0.02$. The average increase in predicted employer pensions \bar{e}_{oft} at year 0 is 3.3 percentage points in this sample. The mean increase in actual pensions for the affected individuals is only 1.8 percentage points, because occupation-by-firm means do not fully determine individual-level pensions as noted above. Nevertheless, it is clear that moving to a firm with higher average employer-provided pensions has a significant and immediate effect on the employer contributions one receives, with little trending before and after the firm switch. Hence, this firm switcher design provides a sharp change in automatic employer contributions in an otherwise stable environment.

We begin by testing whether increases in employer pension contributions are offset by reductions in voluntary contributions to retirement savings accounts. Because employer and individual retirement savings accounts have identical properties, one would expect active optimizers to undo increases in automatic contributions by employers by reducing their own contributions (P in our model). The series in triangles in Figure 1a tests this hypothesis by plotting the sum of employer

and individual pension contributions ($M + P$) around the firm switch. Total pension contributions increase almost 1-for-1 with the increase in employer contributions, implying that few individuals offset the increased employer contribution by reducing voluntary contributions. Importantly, the increases in savings persist even five years after the firm switch, showing that individuals do not learn about the employer contributions and undo them over time.

One concern with the research design in Figure 1a is that individuals may switch to firms that provide more generous pension plans at times when they themselves wanted to begin saving more for retirement. In this case, the pattern in Figure 1 would be driven by changing tastes rather than the causal effect of employer pensions. Two pieces of evidence suggest that employer contributions actually have a causal effect. First, there is no evidence of a trend toward higher individual pension contributions prior to year 0 in Figure 1a, as one would expect if individuals' tastes are actually changing around the job switch. Second, and more importantly, Figure 1b shows that a large fraction of individuals leave their individual pension contributions literally unchanged at the time of the job switch. This is the primary reason that total pension contributions move nearly 1-1 with automatic employer contributions. The fact that total pension contributions rise by almost exactly the amount of the change in employer contributions strongly suggests that the employer contribution has a causal effect; given switching costs and search frictions, it is quite unlikely that individuals who want to save 2% more of their income in a given year manage to switch to firms that contribute exactly 2% more of income to retirement savings.⁶ In addition, Figure 1b directly demonstrates that many individuals are passive savers in that they do not update their pension contributions at all even when their incentives to save change.

Figure 1c generalizes the research design in Figure 1a to include changes in employer pension contributions of varying sizes. This figure is a binned scatter plot of changes in total pension contributions ($M + P$) from period -1 to period 0 vs. changes in employer-provided pensions from period -1 to 0. To construct this figure, we divide the x axis into twenty equal-sized bins (vingtiles) and plot mean total pension contributions within each bin. There is a clear positive relationship between the size of the change in employer contributions and an individual's total retirement savings. On average, a \$1 increase in employer contributions M raises total pension contributions $M + P$ by 97 cents. The relationship between $M + P$ and M is essentially linear: both increases and decreases in employer contributions have similar impacts on total retirement contributions.

⁶Moreover, because individual and employer contributions have identical tax benefits, there is no reason to switch firms in order to save more rather than just raising one's own contributions to retirement savings accounts.

Moreover, large changes (e.g. +/-5% of earnings) continue to have significant impacts on savings behavior, showing that it is not merely because of adjustment frictions that individuals do not respond to changes in employer contributions (Chetty et al., 2011; Chetty, 2012).

The analysis in Figure 1 focuses exclusively on savings behavior within retirement accounts. In Figure 2, we analyze impacts on total savings, including savings in taxable non-retirement accounts. As discussed above, while attentive individuals who are not at a corner should undo employer contributions by reducing voluntary pension contributions, passive savers may respond by reducing savings in other accounts if they target consumption. It is therefore critical to examine whether savings in non-retirement accounts change to understand impacts on total wealth accumulation even though Figure 1 suggests that most individuals do not actively reoptimize their pension contributions. Figure 2a replicates Figure 1a using total savings ($M + P + S$). We see that the total savings rates jump immediately when individuals switch to a firm with higher employer contributions. Figure 2b replicates Figure 1c, showing that both increases and decreases in employer contributions of varying size linearly affect total savings rates.⁷ We estimate that a \$1 increase in M increases total savings $M + S + P$ by 86 cents. Hence, it appears that most passive savers target non-retirement savings rather than consumption and, as a result, automatic contributions end up increasing total wealth accumulation significantly.

As noted above, the ideal experiment would hold total compensation fixed as employer pension contributions rose. This is because an increase in employer pension contributions could affect savings through an income effect by raising an individual's permanent income. To assess the importance of the income effect channel, we replicate our event study analysis of individuals who switch firms, but analyze the impacts of increases in earnings rather than increases in employer pension contributions. Figure 2c plots the relationship between changes in savings rates and changes in earnings during firm switches, effectively replacing the x axis in Figure 2b with changes in earnings instead of changes in employer provided pensions. The slope of the relationship in Figure 2c can be interpreted as the marginal propensity to save out of increases in earnings. We see that a \$1 increase in earnings increases total savings by only 5 cents, far less than the 86 cent increase observed for employer pensions. Because individuals' marginal propensity to save out of employer contributions is an order of magnitude larger than their marginal propensity to save out of earnings, we can infer that a shift in compensation toward automatic contributions would increase

⁷Unlike in Figure 1b, we do not observe a sharp spike at 0 in non-retirement savings because our measure of non-retirement savings is based on changes in wealth and is thus rarely zero even if individuals make no active changes in their savings behavior.

total wealth accumulation.

III.B Government Mandatory Savings Plan

One shortcoming of the variation in employer-provided pensions is that the increases in employer contributions are not directly offset by reductions in earnings. Although we have shown that individuals' marginal propensity to save out of earnings is small, it is useful to study an experiment that directly raised pension contributions by reducing earnings.⁸ In this section, we exploit a second source of variation that exactly matches the ideal experiment. In 1998, the Danish government introduced a mandatory savings plan (MSP) that took 1% of individuals' income and automatically allocated it to a retirement savings account. In 1998, individuals with incomes below DKr 34,500 (US \$6,000) were excluded from the program; starting in 1999, all individuals were included in the program. The MSP was terminated in 2004. The motivation for the MSP was to reduce consumption in 1998, when the Danish economy was viewed as being at risk of "overheating," and a change of regime in 2004 led to termination of the program.

The variation in the MSP generates two quasi-experimental designs that estimate different local average treatment effects (LATE's). The sharpest design is a regression-discontinuity design around the DKr 34,500 eligibility cutoff. The drawback of this approach is that it estimates a LATE for very low income and relatively young individuals whose savings behavior may not be representative of the broader population. The second design is a difference-in-differences approach that exploits the fact that all individuals had to contribute 1% of income to the MSP, and thus in level terms higher-income individuals experienced a larger treatment than lower-income individuals. While this approach yields treatment effect estimates across the income distribution, it provides weaker counterfactuals and thus yields more limited estimates as we discuss below.

Figure 3a illustrates the regression discontinuity design by plotting MSP contributions in DKr vs. income as measured to determine the MSP in 1998 in 1000 DKr income bins. Individuals who earn just below DKr 34,500 make no contribution to the MSP; individuals just above DKr 35,000 are forced to make a contribution of DKr 350. The size of the contribution then increases linearly (with a slope of 1%) with income. Figures 3b and 3c assess the validity of the assumptions underlying the RD design, namely that individuals to the left and right of the cutoff are comparable in other dimensions. Figure 3b plots a histogram of the income distribution around the eligibility

⁸For instance, one may be concerned that passive individuals' consumption and savings behavior may be sensitive to the way in which pensions are changed: increases in pensions that do not change earnings directly may lead to little change in non-retirement savings whereas automatic pension contributions that come out of earnings may be accommodated by reducing non-retirement savings because individuals seek to maintain a fixed level of consumption.

cutoff. There is no evidence of manipulation of income around the cutoff, which is not surprising given prior evidence that individuals are typically unable to sharply manipulate their earnings to take advantage of even much larger tax incentives (Chetty et al., 2011, 2012). Following standard practice, we also test whether several observable characteristics – such as age, gender, etc. – are smooth around the cutoff. For example, Figure 3c shows that the fraction of individuals who are college graduates is smooth around the cutoff, supporting the identification assumption underlying the RD design.

Figure 4 analyzes the impacts of the MSP on pension contributions and total savings. Figure 4a plots the mean change in total pension contributions ($M+P$) from 1997 to 1998 in 1000 DKr income bins around the cutoff. There is a sharp jump in total pension contributions of approximately DKr 350 exactly at the cutoff, showing that a large fraction of the increase in savings due to the MSP is passed directly into higher pension contributions. This increase in retirement contributions induced by the MSP could be consistent with the neoclassical model if individuals were at a corner solution, i.e. they would optimally have saved less than the MSP amount. To evaluate this possibility, we replicate Figure 4a for the subset of individuals who made personal pension contributions that were larger than the MSP requirement in 1997, before the MSP was introduced. The introduction of MSP is completely inframarginal for these individuals and does not affect their budget sets. Yet, as Figure 4b shows, the MSP raised total savings for these individuals as much, if not more, than for the population as a whole. Given that the other retirement savings accounts to which these individuals were contributing have very similar properties to the MSP, this finding constitutes evidence rejecting neoclassical models of consumption and retirement savings.

In Figure 4b, we analyze impacts on total savings, including savings in non-retirement accounts ($M + S + P$). As noted above, because we infer non-retirement savings from changes in total wealth, there is much more noise in savings measures S than in flow contributions to retirement accounts P . Because of the relatively small number of individuals around the DKr 34,500 cutoff, we find that simply studying mean savings rates around the cutoff yields very imprecise estimates that are far too noisy to detect plausible impacts of the MSP on total savings. We therefore study other moments on the total savings distribution that are less affected by noise in the tails of the distribution. In particular, in Figure 4b we plot the fraction of individuals saving more than than DKr 1000 total across their retirement and non-retirement accounts. We see that the fraction of individuals saving more than this threshold rises from 47% to 50% for individuals who are forced to participate in the MSP. Note that because the MSP contribution was only DKr 350 at the cutoff,

this result cannot be driven by corners, as any individual saving more than DKr 1000 would have been able to fully offset the increase in the MSP by reducing other savings. To translate this impact into a measure of the degree of crowdout, we mechanically add 1% of income to observed savings on the left side of the discontinuity to estimate what the level of savings would look like if the MSP were passed through 1-1 into total savings. We see that the observed increase lines up almost exactly with the predicted increase with mechanical 1-1 pass through, implying that few if any individuals act to offset the MSP by reducing savings in other accounts.

Next, we turn to the difference-in-differences in design in order to assess if similar impacts are observed for higher income individuals for whom the MSP generated larger changes in savings. We divide the full population into three terciles based on their current personal income, as defined for calculating the MSP contribution. Figure 5a plots the levels of MSP contributions from 1995 to 2005 for these three groups. Individuals in the top tercile (incomes above DKr 240,000) were forced to contribute approximately DKr 3,500 on average between 1998 and 2003 to the MSP. Individuals in the middle tercile were forced to contribute approximately DKr 2,000, while individuals in the bottom tercile were forced to contribute only about DKr 500 on average.

Figure 5b plots individual retirement savings – including contributions to the MSP and individual pension contributions – for the same three income terciles. As expected, the level of retirement savings varies substantially across the income groups. The introduction and termination of the MSP have sharp effects on total contributions to retirement accounts. Total retirement savings remain virtually unchanged over the period we study for individuals in the bottom third of the income distribution. In contrast, there is a clear increase in total pension contributions in 1998 for both the middle and high income groups and a drop of commensurate magnitude in 2004.

To quantify the impact of the MSP on retirement savings, we scatter changes in total pension contributions vs. changes in the MSP in Figure 5c. The observations above 0 on the x axis reflect changes from 1997 to 1998 (when the MSP was introduced), while those below 0 reflect changes from 2003 to 2004 (when the MSP was terminated). On average, we estimate that a \$1 increase in the MSP (M) raises total pension contributions ($M + P$) by 92 cents, similar to the estimate obtained from the variation in employer provided pensions.

Figure 5c focuses exclusively on total pension contributions. When we replicate Figure 5c for total savings, we obtain very noisy and fragile estimates. The reason is that this research design relies on comparisons in trends in wealth across different income groups. Unfortunately, savings and wealth are highly volatile and there are strong differential shocks in the aggregate time series by

income group (e.g., because portfolio shares vary with income), making such comparisons highly unstable. Abstractly, even though the MSP variation comes closer to identifying the crowd-out parameter of interest in our model, it is weaker from a statistical perspective because it essentially generates time series variation that affects all individuals similarly. The lack of sharply staggered variation makes it much more difficult to identify total savings impacts, as total savings rates are highly correlated across individuals in the time series. This evidence should therefore be viewed as complementary to the analysis of employer-provided pensions. Together, the two strands of evidence indicate that automatic contributions significantly increase total savings for most individuals.

IV Price Subsidies

In this section, we study the impacts of price subsidies on savings.

IV.A Research Design and Institutional Background

In Denmark, there are two types of pension accounts: “capital” pensions (which pay out savings as a lump sum upon retirement) and “annuity” pensions (which pay an annuity). Contributions to each type of account are deductible from taxable income, and workers pay the same 15% capital gains tax on accruals within each account. While the payout from annuity pensions is taxed as regular income, the lump-sum payout from capital pensions is taxed at a flat 40% rate. Workers with earnings in addition to the basic publicly provided pension (for instance, from individual pensions or side jobs) have tax rates above 40%, and as a result capital pensions offered a more tax attractive option for savings.

In June 1998, the Danish government approved the “Pentecostal” reforms, which reduced the tax deductibility of capital pensions for high income individuals. Workers in the top tax bracket (whose incomes exceeded Dkr 251,000 \simeq US \$43,100) had to pay a 12% tax on contributions to the capital pension; annuity pension contributions remained fully deductible. As a result, the net-of-tax subsidy for savings in capital pensions fell by roughly 30 log points. Roughly 25% of individuals qualify for the top tax bracket in each year and were affected by this reform.

The reform did not change any other aspect of the tax treatment of these two pension accounts. As a result, the reform had no effect on the value of existing balances. What is more, the favorable tax treatment at retirement for capital pensions (which did not change) roughly offsets the 12% additional tax at the time of contributions, and so for most affected individuals capital pensions became about as attractive as annuity pensions after 1999. The reform can therefore be thought of

as a 30 log point reduction in the net-of-tax subsidy at the outer envelope of the retirement savings budget set.

IV.B Effect of Tax Subsidies on Contributions in the Subsidized Account

We now exploit this reform to analyze the effect of tax subsidies on savings. Because the reform only applied to workers earning above the top tax threshold, this reform naturally motivates a difference-in-differences approach. We compare changes in savings for those above vs. below the top bracket threshold around the 1999 reform.

Figure 6a plots the direct treatment effect of this reform on capital pension contribution for workers near the threshold. We include all individuals with income within DKr 100,000 of the top tax threshold (represented by the vertical dashed line). To construct this figure, we group individuals into income bins that are DKr 10,000 wide based on their income relative to the threshold. For each bin, we then plot the average contribution to the capital pension in each year from 1996 to 2001. The relationship between income and capital pension contributions is remarkably stable from 1996 to 1998, before the reform. In 1999, there is a sharp break in the series around the top kink, as individuals above the kink (and now subject to the new 12% tax) significantly cut back on capital pension contributions. In contrast, contributions by those below the kink do not change in 1999. The relationship between capital pension contributions and income then remains stable at this lower level in subsequent years.

In Figure 6b, we present the same evidence in a time-series format. For each year between 1995 and 2005, we plot mean capital pension contributions for two groups: those with incomes between 25,000 to 75,000 DKr *below* the top tax bracket cutoff and those with incomes between 25,000 to 75,000 *above* the top tax bracket cutoff. The first group is the control group in that their incentives to contribute to capital pensions remained unchanged, while the second is a treatment group whose incentives fell sharply in 1999. The figure shows that capital pension contributions fall by nearly DKr 5,000 (40%) for the treated group after the reform and converge rapidly to the pre-reform levels of the control group.

Figure 6 provides strong evidence that changes in tax incentives induce sharp changes in savings behavior within the affected account, consistent with prior results in the literature (e.g., Duflo et al., 2006). However, the 40% fall in contributions in 1999 is consistent with two sharply contrasting models of response. It could be that nearly all of those affected by the reform cut capital pension contributions by 40%, so that the response is broad and homogeneous. Alternatively, the large

aggregate response might reflect more extreme responses by just a few individuals.

Figure 7a investigates heterogeneity of response to the 1999 reform. To do so, we plot the distribution of changes to capital pension contributions (as a fraction of lagged contributions) for individuals in the treatment group in Figure 6b. In both 1998 and 1999, there is a large point-mass of individuals at 0%, implying that an individual’s capital pension contribution in that year was identical to that in the previous year. In 1999, approximately 19% more individuals entirely stop capital pension contributions (i.e., the change is -100%) than in 1998; this excess mass comes almost entirely from a reduction in the fraction of taxpayers who make no change to contributions. These distributions suggest that the response to the 1999 reform is in fact highly heterogeneous. In fact, the 19% of individuals who additionally move from 0% to -100% in 1999 can entirely account for the 40% aggregate reduction in contributions because they make particularly large contributions in the pre-reform period. Figure 7b replicates Figure 7a for the control group in Figure 6b, confirming that there was no excess propensity for workers to stop contributing to the capital pension in 1999 for those unaffected by the reform. These results suggest that the mode of response to the reduction in tax subsidies is very similar to the responses to changes in automatic contributions discussed above. Most individuals are entirely passive, with just a small fraction of active individuals accounting for the aggregate response.

IV.C Effect of Tax Subsidies on Total Savings

When capital pension contributions fall following the reform, where does the money go? We begin by analyzing other tax-deferred pension savings accounts. Figure 8a analyzes the affect of the 1999 reform on one of the alternative retirement accounts, “private” (i.e. non-firm) annuity pensions. We use the same format as Figure 6a; for each DKr 10,000 income bin relative to the kink, we plot mean contributions to annuity pensions in each year from 1996 to 2001. The pattern is almost the exact opposite of that in Figure 6a. The relationship between income and annuity pension contributions is highly stable in 1996 through 1998, before the reform. After the reform there is a sharp increase in contributions for individuals above the top tax threshold, for whom the annuity pensions are relatively more attractive than before. There is no change in the contribution levels of those unaffected by the reform.

The evidence in Figure 8a suggests that approximately half of the reduction in contributions to capital pension accounts was offset by increases in contributions to private annuity pensions. When we combine all types accounts together, the effect on total pension savings is even less. Figure 8b

plots mean total pension contributions (as a fraction of income) for the treatment and control groups (as in Figure 6b) between 1995 and 2005. There is a small reduction in total pension contributions, but this effect is far smaller than the initial drop in capital pension contributions (displayed with the dashed line). We can quantify the extent of crowd-out by comparing the estimate of the narrow and broad treatment effects, each estimated from a dif-in-dif regression comparing the treatment and control groups in 1998 and 1999. We estimate that, for each \$1 reduction in capital pension contribution, total pension contributions fall by only 22 cents. This substitution between tax-deferred accounts is analogous to substitution between 401(k)s and IRA's or 529 college savings plans that one might observe following changes in firm match rates in the U.S..

Figure 8c replicates the results in Figure 8b using total savings rate, including both pension contributions and wealth accumulation in taxable accounts such as stock portfolios or bank accounts. The year-to-year fluctuations in aggregate savings rates are much larger, but average savings in the treatment group relative to the control group are still quite stable. Here we estimate that total savings fall by only 10 cents for each \$1 reduction in capital pension contribution. Those 10 cents represent a 2.2 log-point reduction in total savings; therefore the elasticity of total savings with respect to the best available net-of-tax subsidy is only 0.073.

Our baseline figures for total savings omit several potential savings channels due to data restrictions. Table 5 calculates the crowd-out ratio in a number of different empirical specifications to explore the sensitivity of our analysis to the limitations in our measure of savings. The estimate in Figure 8c appears in Column 1. Our baseline measure for total savings does not include high-frequency changes in home equity. It is possible that individuals reduce savings following the reform by taking out home equity loans, or by postponing value-increasing renovations. To rule out this possibility, in Column 2 we recalculate the crowd-out estimate restricting to a sample of individuals of renters who do not have any home equity. The estimate of crowd-out is very close to that in Column 1. Our baseline savings figures also omit non-mortgage liabilities (e.g., car-loans) because the data are only available beginning in 1998. However, Column 3 shows that the 1999 reform does not have a significant affect on this aspect of personal finances. A final possibility is that individuals choose to pay off their home mortgage more slowly or more quickly following the reduction in tax subsidies. While we cannot observe the remaining principal on an individual's mortgage, we do observe the magnitude of interest payments. Column 4 shows that this channel does not seem important. Column 5 then presents a robustness check, re-estimating crowd-out using our baseline measure of savings but including all years in the dif-in-dif. The estimate is slightly

V Conclusion

This paper has used Danish administrative records to estimate the effect of different policies on total savings. Policies such as tax subsidies that rely upon individuals to take an action to raise savings have small impacts on total wealth. When tax rates on the most-favored retirement account increase by 12 percentage points (30 log points), total savings falls by only DKr 400 per year, implying an elasticity of just 0.07 for savings with respect to net-of-tax return. In contrast, policies that raise savings automatically even if individuals take no action – such as employer-provided pensions or mandated savings contributions – increase wealth accumulation substantially.

The U.S. spent \$125 billion on the tax subsidy for retirement savings in 2010. To the extent that our findings in Denmark apply more generally to policy in the U.S. and other countries, these findings suggest that this policy may not be effective in raising total savings in the U.S. for two reasons. First, roughly 85% of individuals are passive individuals who do not respond at all to price subsidies because of inattention or some other deviation from neoclassical behavior. As a result, much of the subsidy accrues to individuals who are entirely inframarginal. Second, individuals who respond largely do so by reallocating savings from one account to another. Company policies that match worker contribution to retirement plans may be ineffective for similar reasons. Instead, features of retirement accounts such as automatic payroll deduction of savings contributions and default contribution rates may be more effective tools.

There are a number of questions that this paper leaves open for future research. Our identification strategy only permits identification of the short-run effects of savings policies. These policies may not have as starkly different effects in the long-run, though. Another fertile area for future work is the welfare consequences of different savings policies. For instance, workers whose savings rates are increased through automatic default contribution rates may consume less than optimally given the true budget set. Similarly, policies that forcibly increase savings are only of interest when many individuals are below the level of savings that is socially optimal; future research might attempt to estimate the social returns to the marginal dollar saved.

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TABLE 1

Impacts of Government Policies on Savings for Active vs. Passive Savers

	Mandate / Default		Price Subsidy	
	Raises Pension Contributions M+P?	Raises Total Savings M+P+S?	Raises Pension Contributions M+P?	Raises Total Savings M+P+S?
Active Savers (Neoclassical)	No	No	Yes	Uncertain
Passive Savers	Yes	Uncertain	No	No

TABLE 2
Summary Statistics

Variable	Full Sample (1)	Top Bracket Sample (2)
Personal Income	200,912	248,656
Capital Income (incl. mortg. int. deduc.)	-14,059	-19,883
Assets	64,933	75,096
Changes in Assets	7,485	7,370
Liabilities (including mortgage debt)	71,080	89,997
Mortgage Interest Payments	11,533	15,997
Pension Flows		
Individual Capital Pension Contribs.	1,896	2,670
Individual Annuity Pension Contribs.	1,332	1,576
Fraction with Any Individual Pension	0.264	0.36
Employer Capital Pension	2,282	3,684
Employer Annuity Pension	11,798	16,596
Fraction with Any Pension	0.636	0.871
Demographics		
Age	38	42
Female	52.00%	47.70%
College	27.00%	40.50%
Number of Observations	44,813,391	20,888,615

TABLE 3
Employer Pensions: Pass-Through Estimates

Sample:	Firm Switcher	Firm Switcher	Full Sample	Renters	Full Sample	Full Sample
Dep. Var.:	Δ Savings (1)	Δ Savings (2)	Δ Savings (3)	Δ Savings (4)	Δ Non- Mortg. Debt (5)	Δ Mortg. Interest (6)
Δ Emp. Pens. Contrib. Rate	0.77 (0.018)	0.96 (0.069)	0.83 (0.010)	0.91 (0.012)	0.02 (0.022)	0.004 (0.0017)
Estimation	OLS	IV	IV	IV	IV	IV
No. of Obs.	380,946	380,946	21,936,446	6,534,425	21,726,576	21,936,446

TABLE 4

Mandated Savings Plan: Pass-Through Estimates

Sample:	Full Sample	Full Sample	RD Sample	RD Sample	RD Sample Renters	RD Sample	RD Sample
Dep. Var.:	Private Pensions (1)	Private Pensions (2)	Δ Private Pensions (3)	Savings (4)	Savings (5)	Δ Non-Mortg. Debt (6)	Placebo: College Atten. (7)
Pass-Through Estimate	0.92 (0.01)	0.89 (0.05)	0.98 (0.10)	1.16 (0.32)	1.28 (0.33)	-0.27 (0.87)	0.003 (0.004)
Research Design	Levels	Threshold	RD	RD	RD	RD	RD
No. of Obs.	6,121,434	6,121,434	214,648	214,648	108,412	214,648	214,648

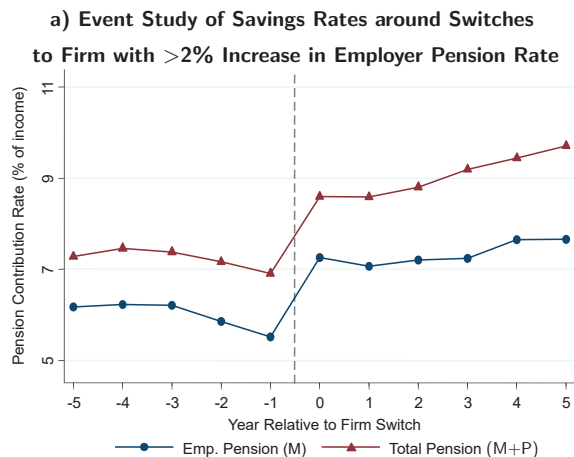
TABLE 5

Capital Pensions: Pass-Through Estimates

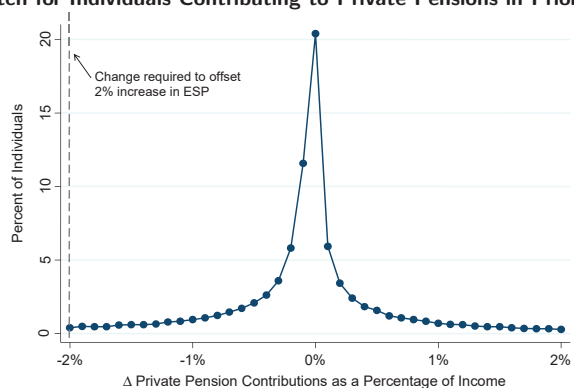
	Effect on Total Savings (1998-99)	Renters Only	Including Non-Mortg. Liabilities	Effect on Mortg. Interest Payments	Effect on Total Savings Using all Years
	Δ Savings Rate (1)	Δ Savings Rate (2)	Δ Savings Rate (3)	Δ Mortg. Interest (4)	Δ Savings Rate (5)
Δ Capital Pension Contrib. Rate	0.10 (0.188)	0.06 (0.410)	0.16 (0.117)	0.01 (0.150)	0.23 (0.165)
Empirical Design	IV D-D	IV D-D	IV D-D	IV D-D	IV D-D
No. of Obs.	1,999,158	656,318	1,975,674	1,999,158	12,799,703

FIGURE 1

Employer Provided Pensions: Impacts on Total Pension Contributions



b) Changes in Private Pension Contributions in Year of Firm Switch for Individuals Contributing to Private Pensions in Prior Year



c) Changes in Total Pension Contributions vs. Changes in Employer Pension Rates for Firm Switchers

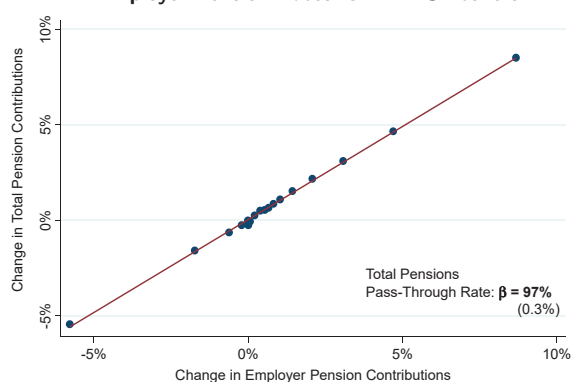
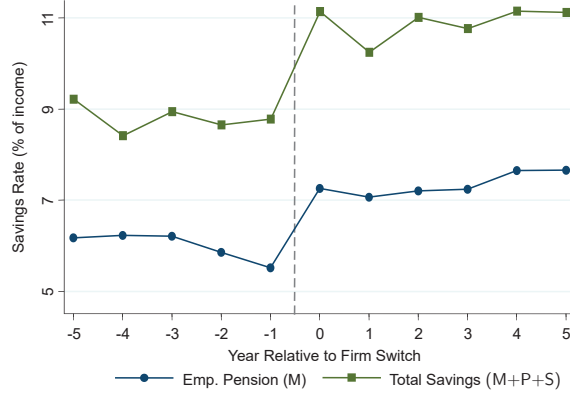


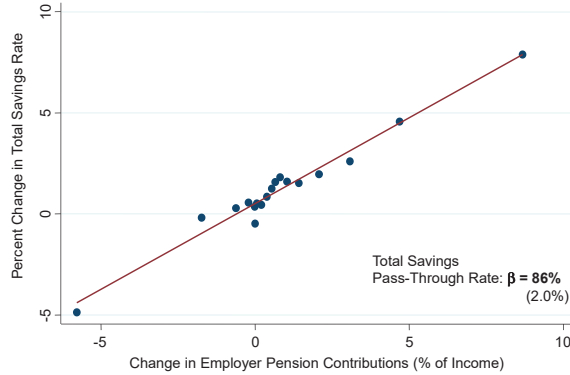
FIGURE 2

Employer Provided Pensions: Impacts on Total Savings

a) Event Study of Savings Rates around Switches to Firm with >2% Increase in Employer Pension Rate



b) Changes in Total Savings Rates vs. Changes in Employer Pension Rates for Firm Switchers



c) Changes in Total Savings Rates vs. Changes in Wage Rates

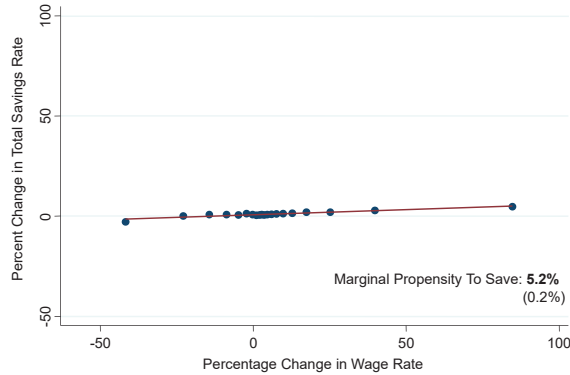
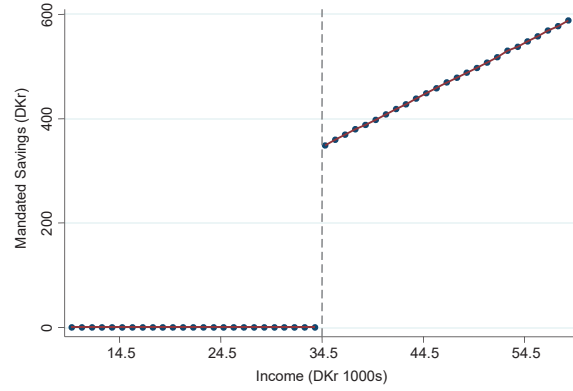


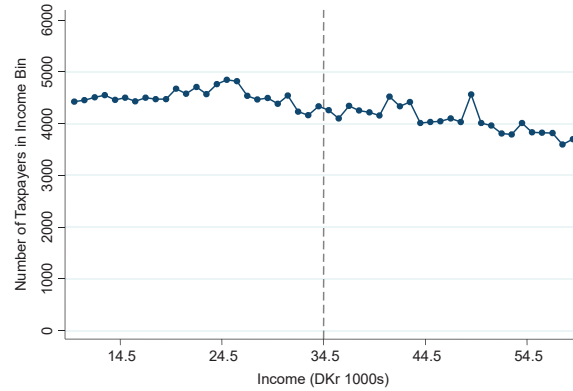
FIGURE 3

Mandated Savings Plan – Regression Discontinuity Design:
First Stage and Tests for Balance

a) Mandated Savings Around Eligibility Threshold in 1998



b) Balance Test 1: Income Distribution Around Eligibility Threshold



c) Balance Test 2: Fraction Attending College Around Threshold

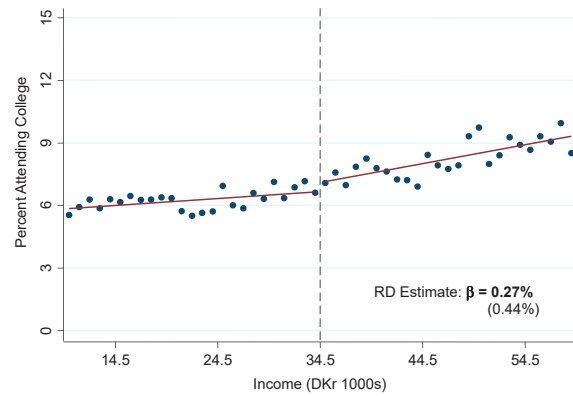


FIGURE 4

Mandated Savings Plan – Regression Discontinuity Design:
Impacts on Savings Behavior

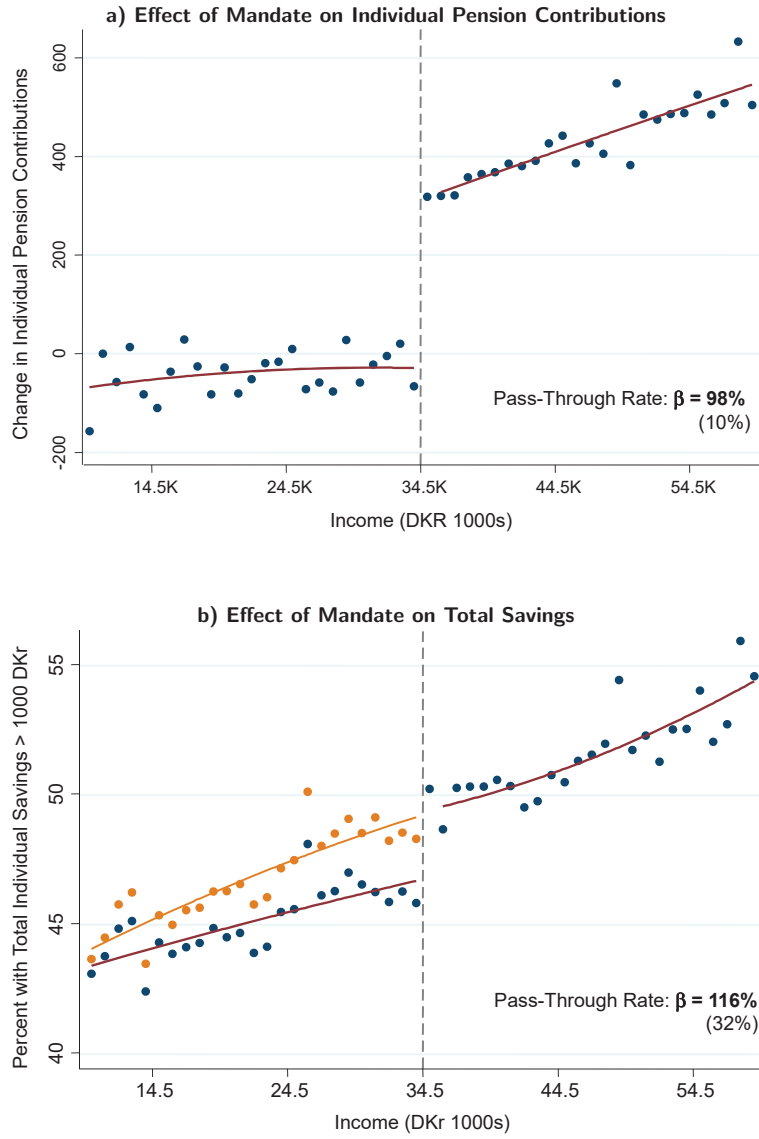


FIGURE 5

Mandated Savings Plan – Difference-in-Differences Design

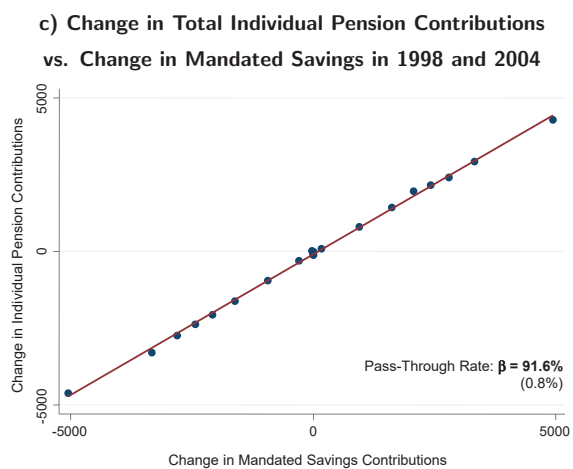
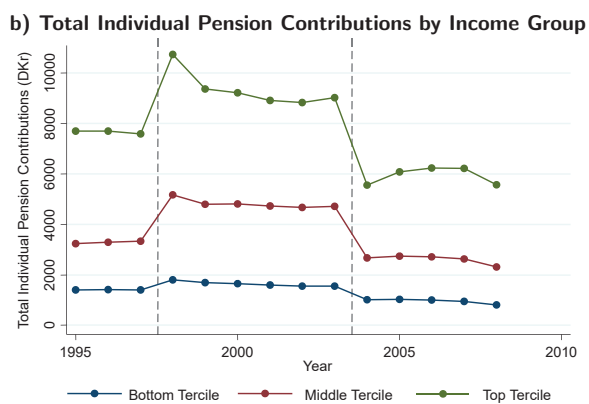
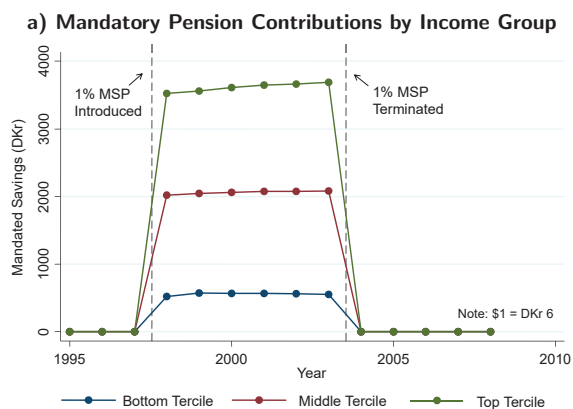


FIGURE 6

Impact of Subsidy Reduction On Capital Pension Contributions

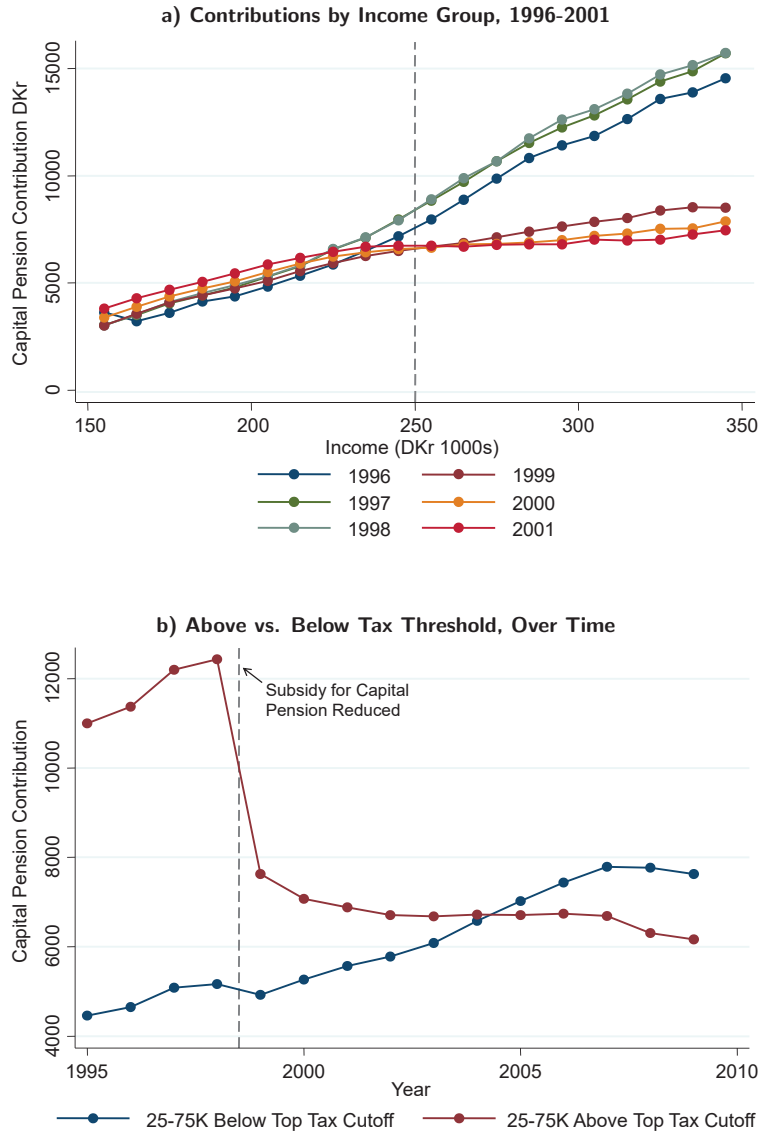


FIGURE 7

Impact of Subsidy Reduction on Distribution of Changes in Capital Pension Contributions

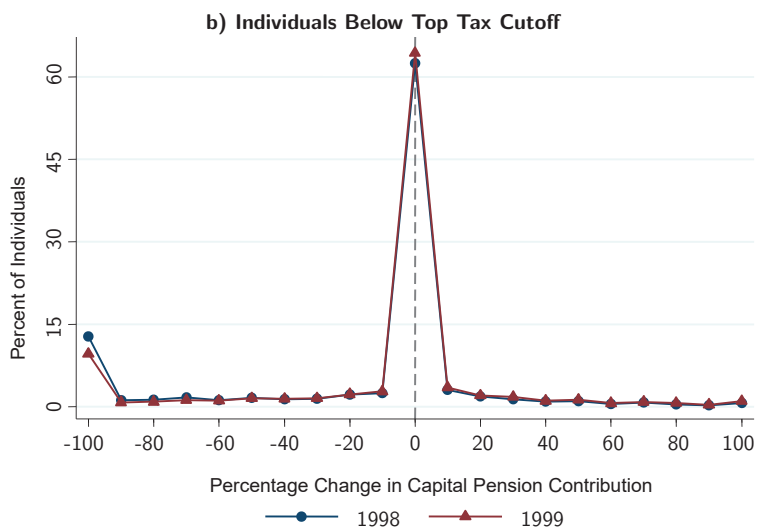
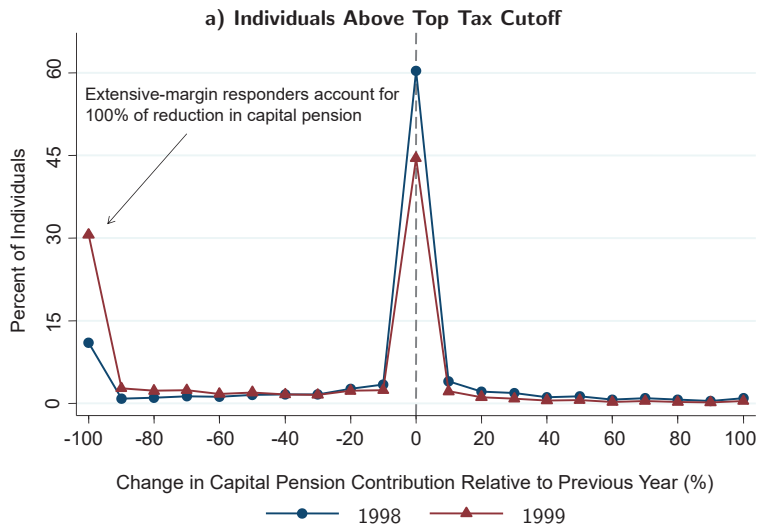


FIGURE 8

Impact of Capital Pension Subsidy Reduction on Savings in Other Accounts

