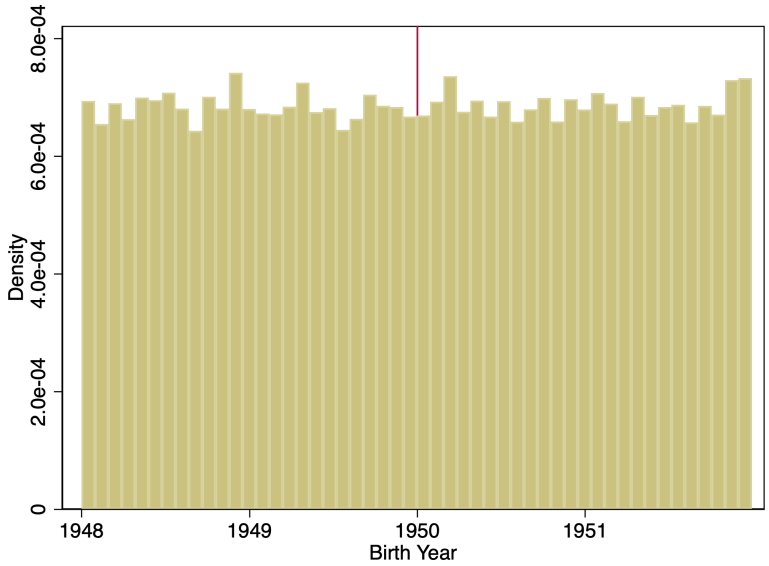
Appendix A: Additional Tables and Figures

Table A1: **Balance Table: High & Low Free Cash Flow Firms**

	(1)	(2)	
	High Cash Flow	Low Cash Flow	P-Value: (1)=(2)
Full-time Workers	13.16	12.31	0.00
Full-time Labor Costs (1000 EUR)	308.87	263.09	0.00
Other Input Costs (1000 EUR)	627.49	517.56	0.00
Material Assets	474.61	403.45	0.00
Share founded before 2001	0.21	0.18	0.00
Share of jobs in manufacturing	0.227	0.245	0.02
Share of jobs in services	0.297	0.298	0.29
N	73,566	71,285	

Note: This table shows summary statistics for firms that had high and low free cash flow prior to the policy change. High and low free cash flow firms are defined as having above and below median free cash flow in 2001-2004.

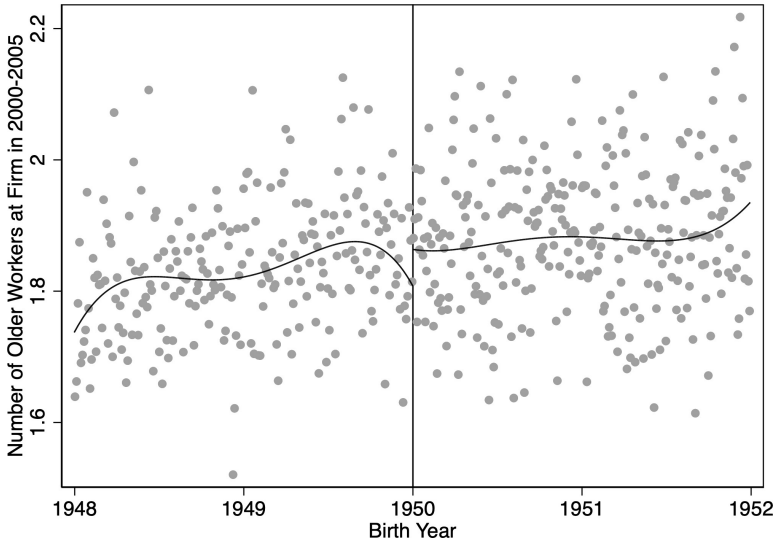
Figure A1: **Histogram of worker birth year around 1950 cut-off employed at firms**



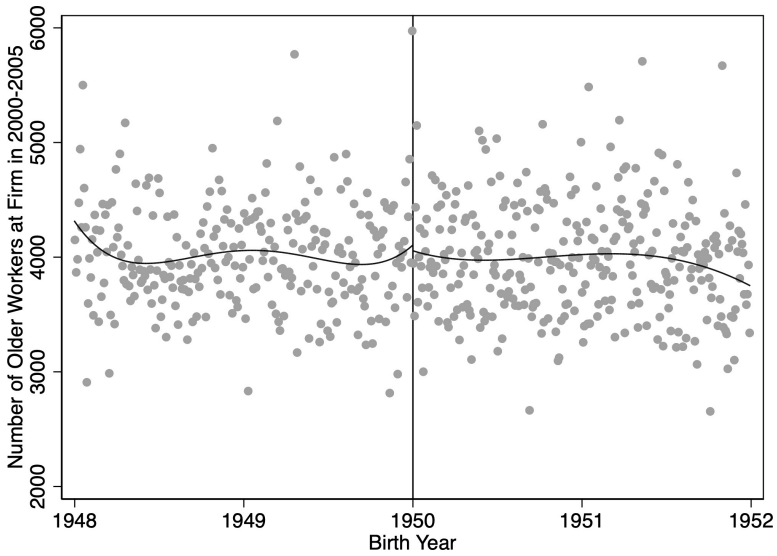
Notes: This figure shows there is no excess mass on either side of the 1950 cohort cutoff among workers employed at firms in 2005.

Figure A2: **Falsification Checks: Covariate Balance – Simple Firm RD**

Panel A: Employment of Older Workers Prior to Policy (2000-2005)

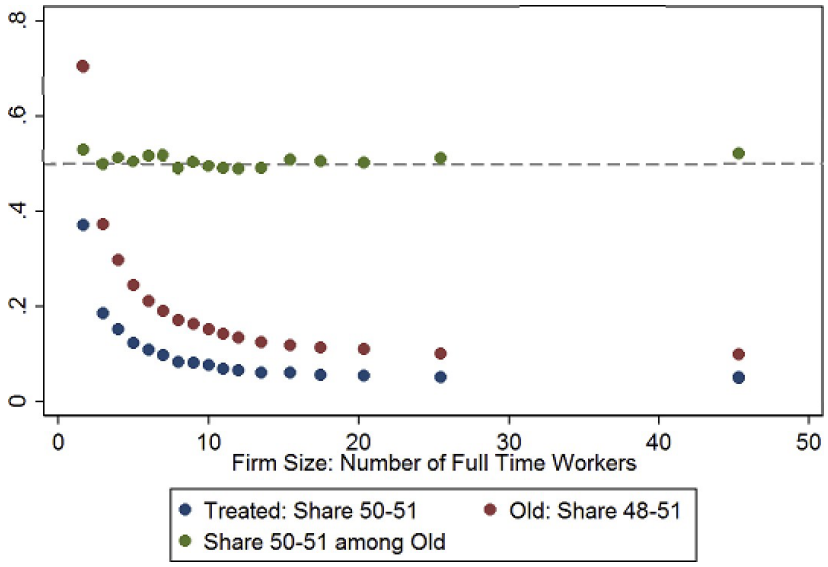


Panel B: Firm Revenue (in 1000s of EUR) Prior to Policy (2000-2005)



Notes: The unit of observation is the firm. I limit to firms with exactly one worker born in the 1948-1952 cohort window. The outcome variables are the mean number of older workers and mean revenue at the firm in 2000-2005, before the policy change had an effect. The figure demonstrates that there is no discontinuity in these pre-policy covariates at the threshold. All workers considered are full-time employed.

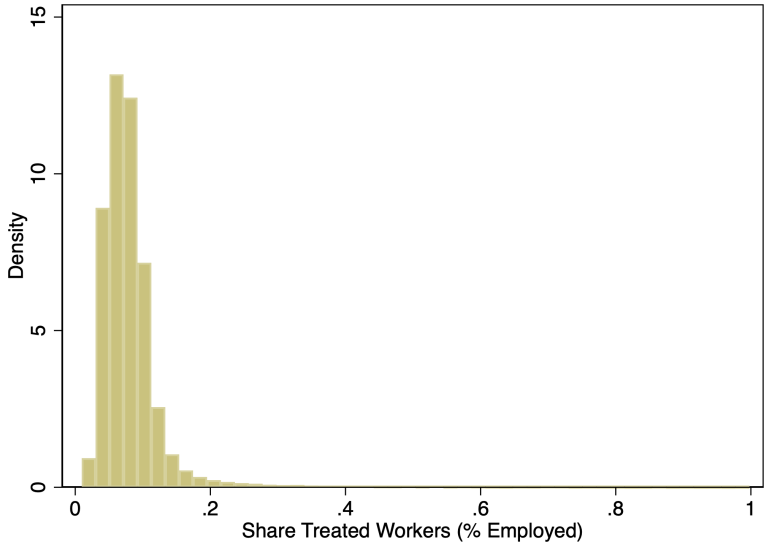
Figure A3: **Firm-level Treatment: Share Born After Cutoff**



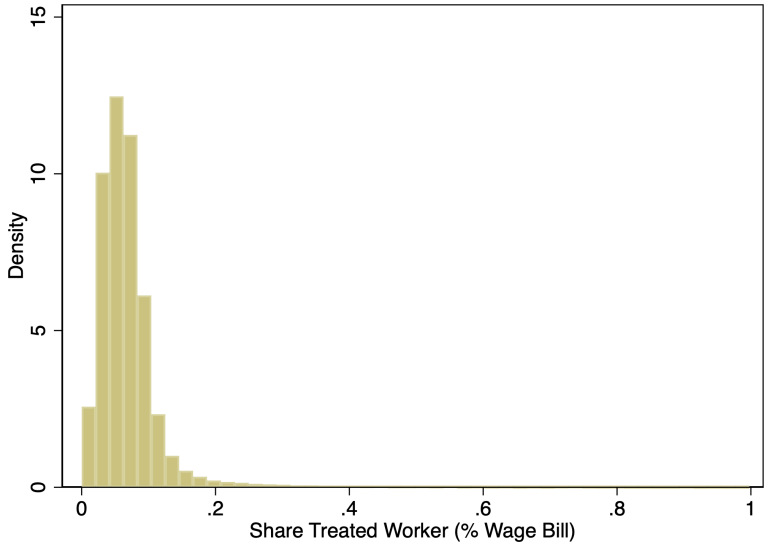
Notes: This figure shows the share of all 2005 full-time workers (1) born 1948-1951 (older workers), (2) born 1950 or 1951 (treated workers) by firm size. In addition, it shows the share of treated workers among old workers. The key observation from this figure is that the share of treated workers (born 1950-1951) among older workers (born 1948-1951) is consistently 0.5 for firms of different sizes. This suggests there is no excess mass of workers born either before or after the 1950 cohort boundary.

Figure A4: **Firm-level Distribution of % Treated Workers**

Panel A: Share of Treated Workers as % of Total Workforce



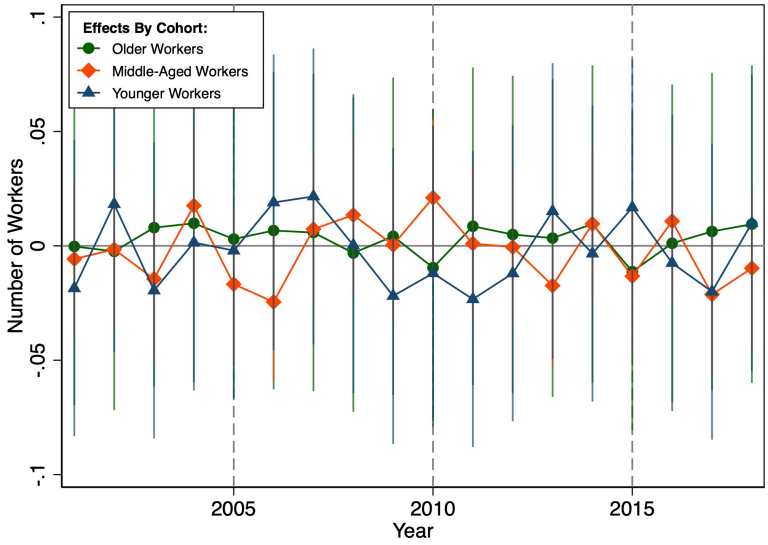
Panel B: Share Wages for Treated Workers as % of Total Wage Bill



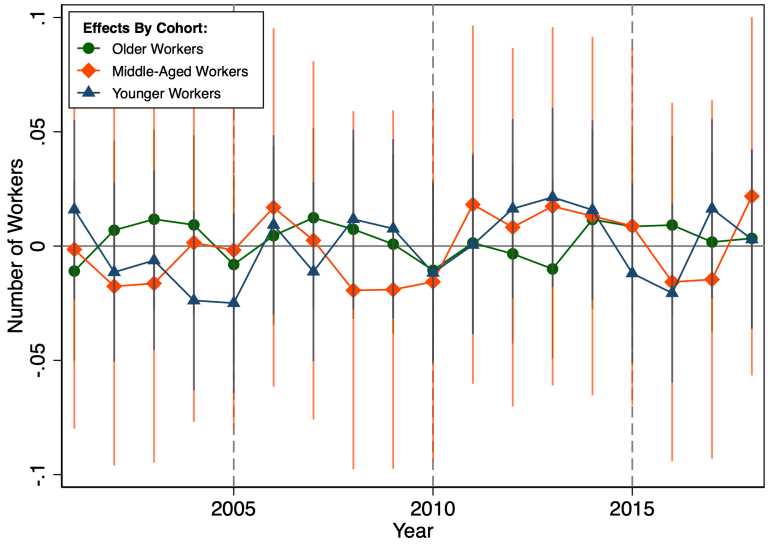
Notes: Limited to firms with at least one treated worker.

Figure A5: **Falsification: All Untreated or Treated**

Panel A: All Untreated (1946-1949, imaginary cutoff at 1948)

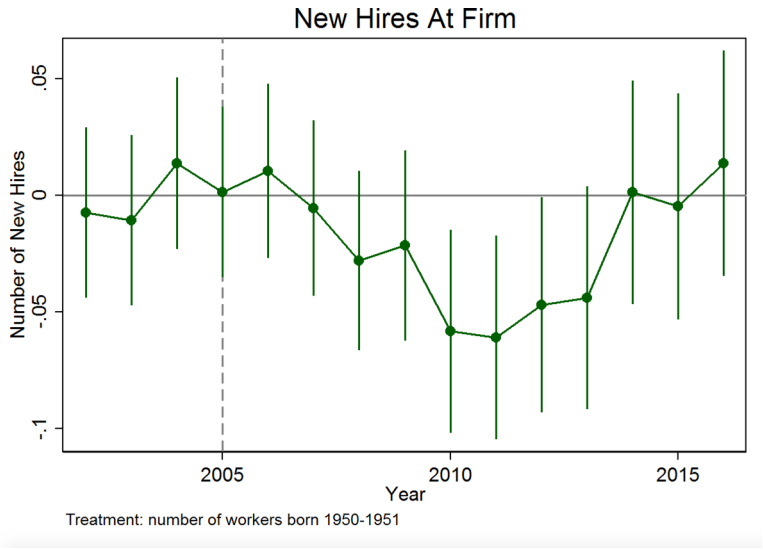


Panel A: All Treated (1950-1953, imaginary cutoff at 1952)



Notes: The unit of observation is the firm-year. Panel A is a falsification check of all untreated workers, that plots coefficients β_t from equation (2), which represents the effect in each year t of having an additional placebo treated worker (born 1948 or 1949) at the firm in 2005, controlling for the number of old workers (born 1946-1949) and the total number of workers. The outcome variable is the number of older workers. Panel B is a falsification check of all treated workers that plots coefficients β_t from equation (2), which represents the effect in each year t of having an additional placebo treated worker (born 1952 or 1953) at the firm in 2005, controlling for the number of old workers (born 1950-1953) and the total number of workers. The outcome variable is the number of older workers. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

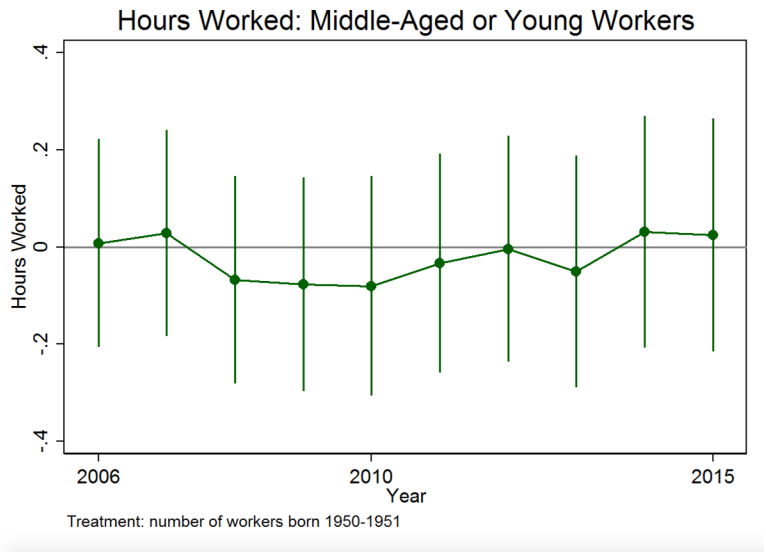
Figure A6: **Overall firm hiring effects**



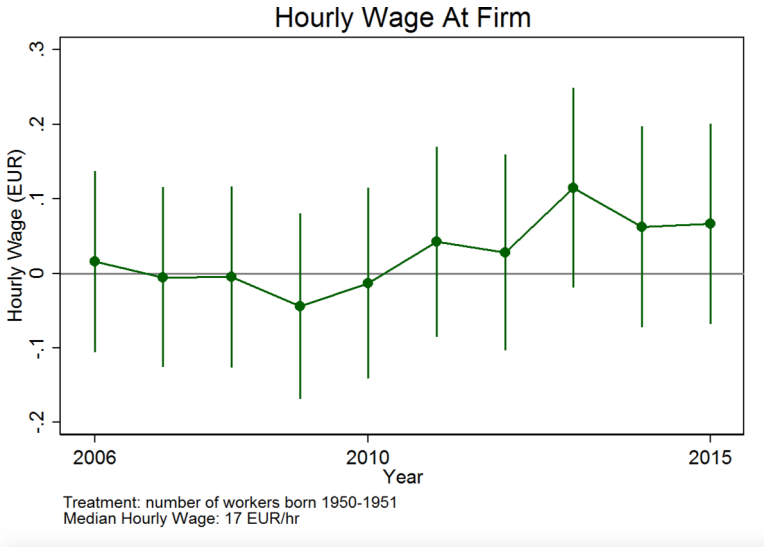
Notes: The unit of observation is the firm-year. The figure coefficients β_t from equation (2), which represents the effect in each year t of having an additional percent of the 2005 workforce treated, controlling for the share of old workers at the firm. The coefficient for $t = 2005$ is normalized to 0. The outcome variable is the number of new hires at the firm. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

Figure A7: **Overall changes in hours worked and hourly wages - young and middle-aged**

Panel A: Hours Worked

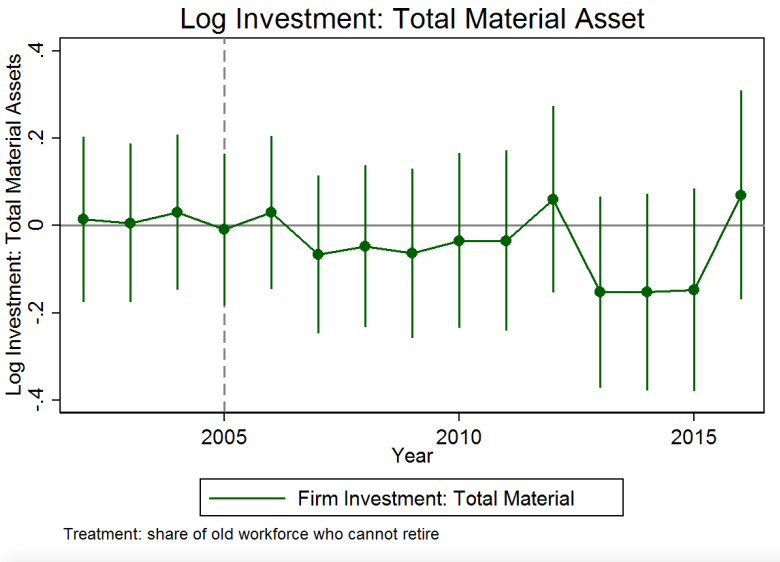


Panel B: Hourly Wages



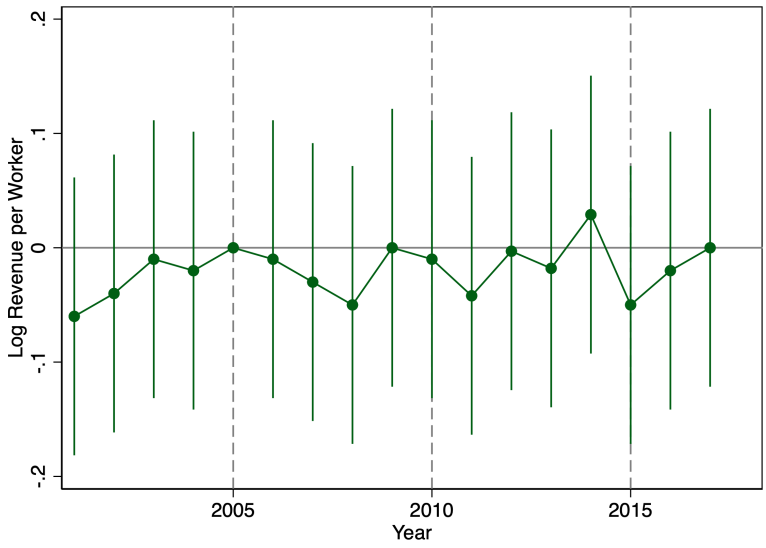
Notes: The unit of observation is the firm-year. The figure coefficients β_t from equation (2), which represents the effect in each year t of having an additional percent of the 2005 workforce treated, controlling for the share of old workers at the firm. The coefficient for $t = 2005$ is normalized to 0. The outcome variable is the hours worked and hourly wages at the firm. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

Figure A8: **Overall firm material investment effects**



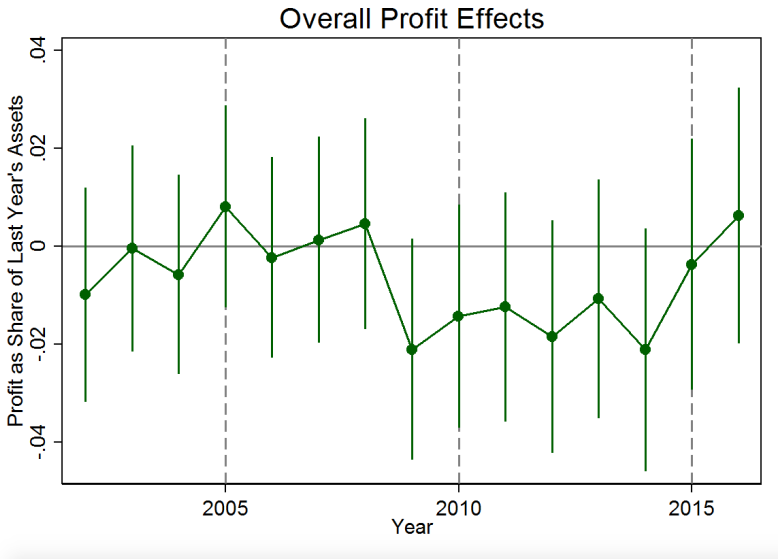
Notes: The unit of observation is the firm-year. The figure coefficients β_t from equation (3), which represents the effect in each year t of having an additional percent of the 2005 workforce treated, controlling for the share of old workers at the firm. The coefficient for t = 2005 is normalized to 0. The outcome variable is log investment in total material assets. Standard errors are clustered at the firm level.

Figure A9: **Overall firm revenue per worker effects**



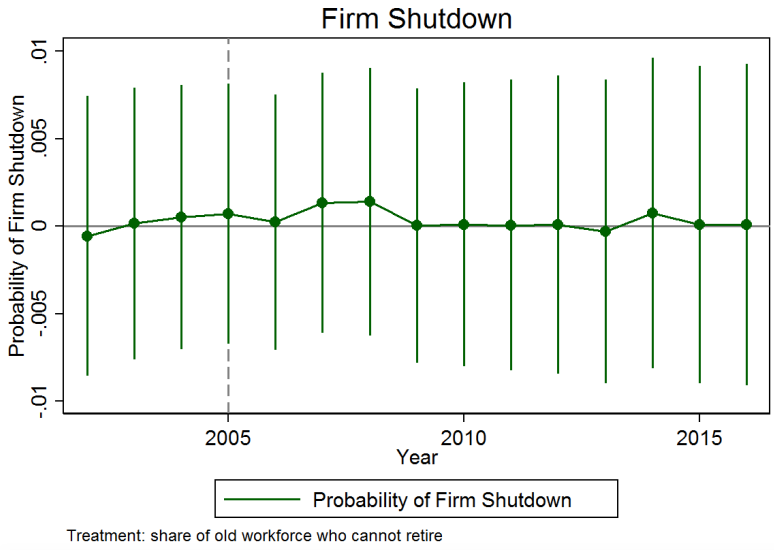
Notes: The unit of observation is the firm-year. The figure coefficients β_t from equation (3), which represents the effect in each year t of having an additional percent of the 2005 workforce treated, controlling for the share of old workers at the firm. The coefficient for $t = 2005$ is normalized to 0. The outcome variable is log revenue per worker. I winsorize revenue per worker at the 1st and 99th percentile to take out extreme outliers. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

Figure A10: **Overall profit effects**



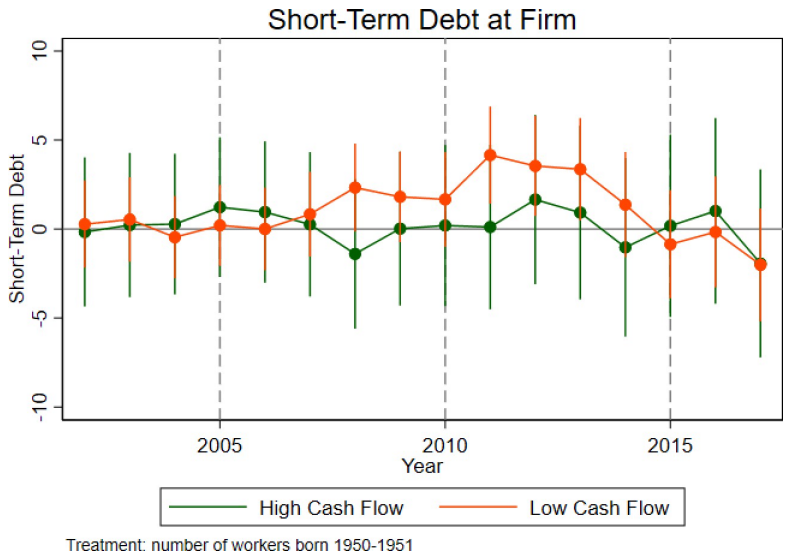
Notes: The unit of observation is the firm-year. The figure coefficients β_t from equation (3), which represents the effect in each year t of having an additional percent of the 2005 workforce treated, controlling for the share of old workers at the firm. The coefficient for t = 2005 is normalized to 0. The outcome variable is profits as a share of last year's assets. I winsorize this measure at the 1st and 99th percentile to take out extreme outliers. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

Figure A11: **Overall effects on firm shutdown**



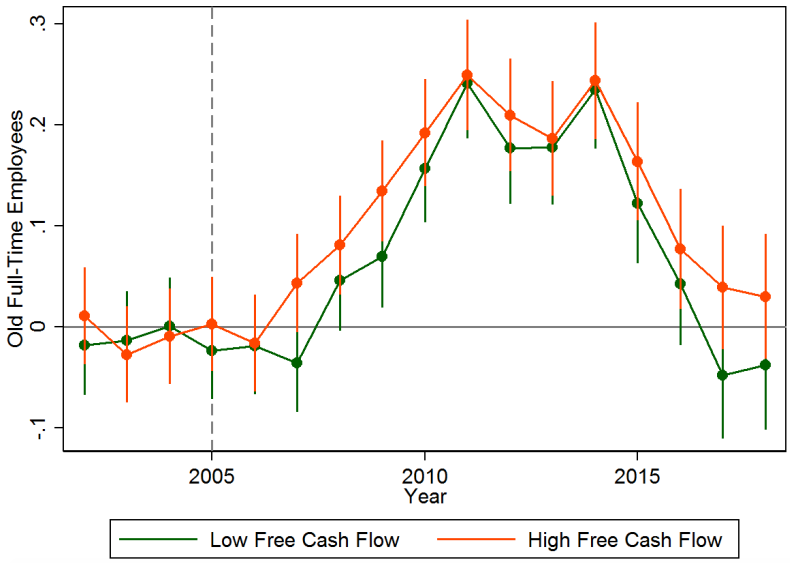
Notes: The unit of observation is the firm-year. The figure coefficients β_t from equation (3), which represents the effect in each year t of having an additional percent of the 2005 workforce treated, controlling for the share of old workers at the firm. The coefficient for t = 2005 is normalized to 0. The outcome variable is firm shutdown. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

Figure A12: **Short-term Debt Impacts**



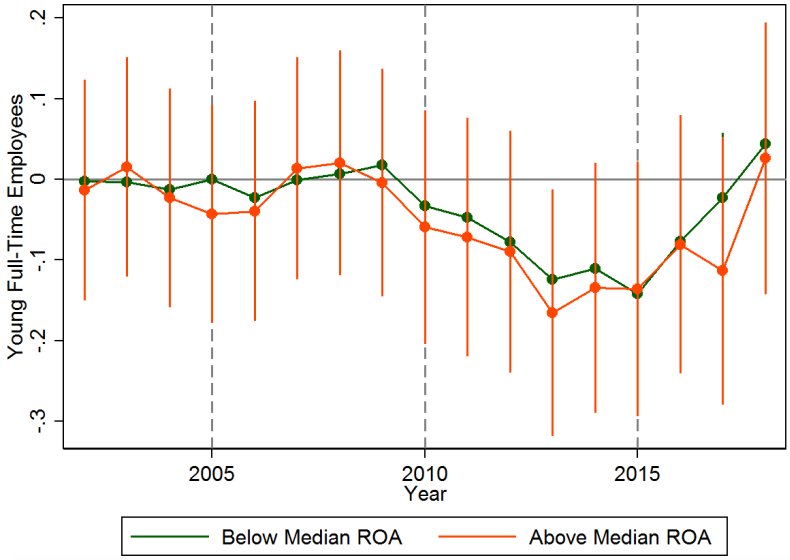
Notes: The unit of observation is the firm-year. The figure demonstrates the effect of the policy on short-term debt levels at the firm, depending on whether firms had above or below median free cash flow prior to the policy. The coefficients plotted represent the effect in each year t of having an additional treated worker (born 1950 or 1951) at the firm in 2005, controlling for the number of old workers (born 1948-1951) and the total number of workers. These correspond to β_t from equation (2). The coefficient for $t = 2005$ is normalized to 0. Standard errors are clustered at the firm level.

Figure A13: **First Stage by FCF**



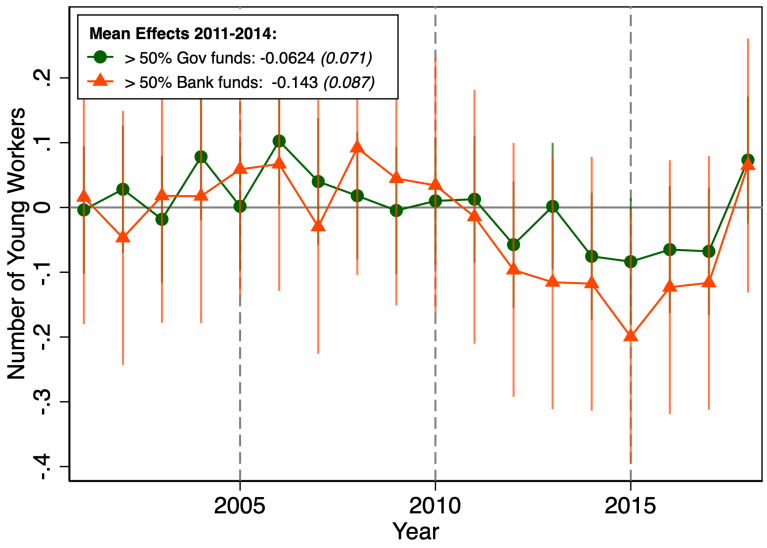
Notes: The unit of observation is the firm-year. The figure demonstrates the effect of the policy on the number of older workers at the firm, depending on whether firms had above or below median free cash flow prior to the policy. The coefficients plotted represent the effect in each year t of having an additional treated worker (born 1950 or 1951) at the firm in 2005, controlling for the number of old workers (born 1948-1951) and the total number of workers. These correspond to β_t from equation (2). The coefficient for $t = 2005$ is normalized to 0. Standard errors are clustered at the firm level.

Figure A14: **Young Worker Adjustments - By Baseline Productivity**



Notes: The unit of observation is the firm-year. The figure demonstrates the effect of the policy on the number of younger workers at the firm, depending on whether firms had above or below median return on assets prior to the policy. The return on assets measure is residualized with respect to the firm's industry mean. The coefficients plotted represent the effect in each year t of having an additional treated worker (born 1950 or 1951) at the firm in 2005, controlling for the number of old workers (born 1948-1951) and the total number of workers. These correspond to β_t from equation (2). The coefficient for $t = 2005$ is normalized to 0. Standard errors are clustered at the firm level.

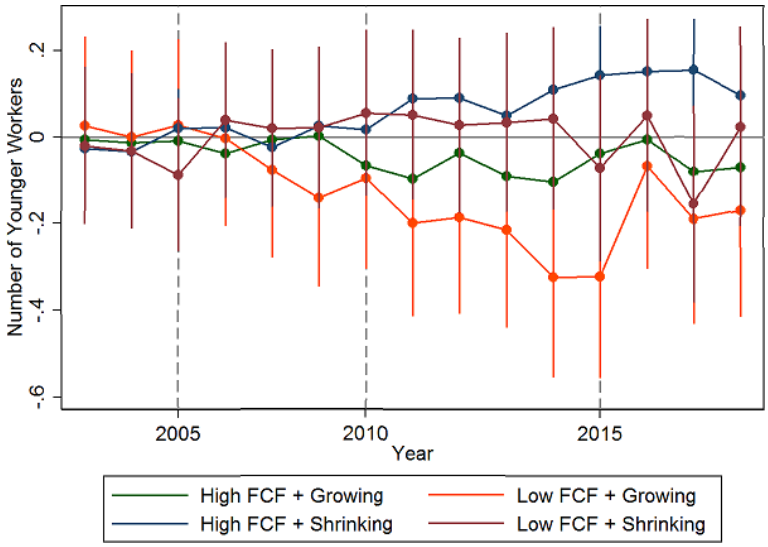
Figure A15: **Young Worker Adjustments - By Pre-Policy Bank Funding Share**



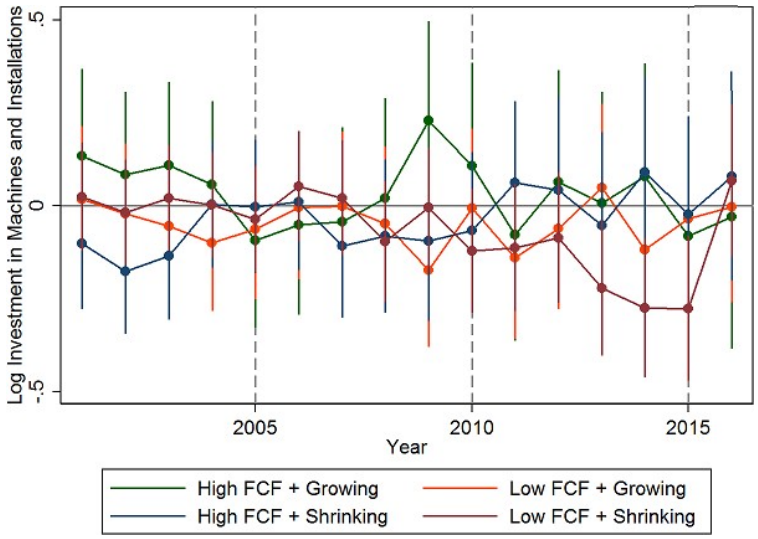
Notes: The unit of observation is the firm-year. The figure demonstrates the effect of the policy on the number of younger workers at the firm, depending on whether firms had above or below median return on assets prior to the policy. The analysis is run separately for firms that relied primarily on government funds vs. bank funds prior to the policy. The coefficients plotted represent the effect in each year t of having an additional treated worker (born 1950 or 1951) at the firm in 2005, controlling for the number of old workers (born 1948-1951) and the total number of workers. These correspond to β_t from equation (2). The coefficient for t = 2005 is normalized to 0. Standard errors are clustered at the firm level.

Figure A16: **Interaction: Labor Adjustment Costs and FCF**

Panel A: Employment of Younger Workers



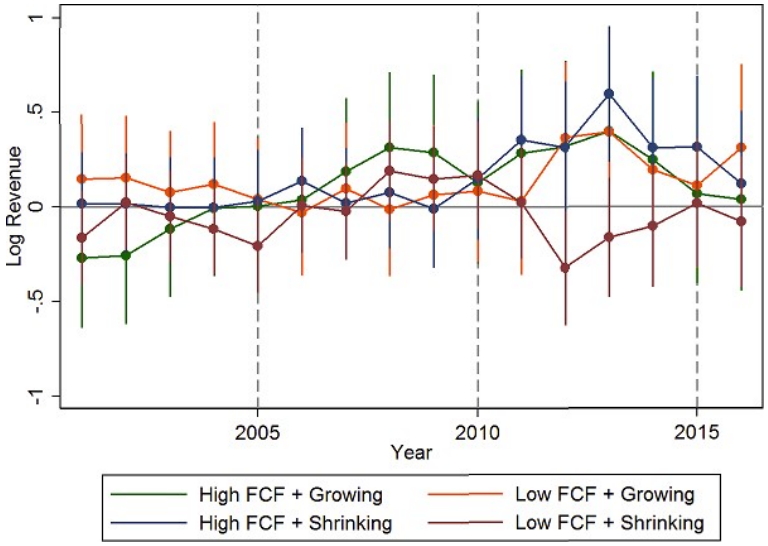
Panel B: Log Investment in Machines and Installations



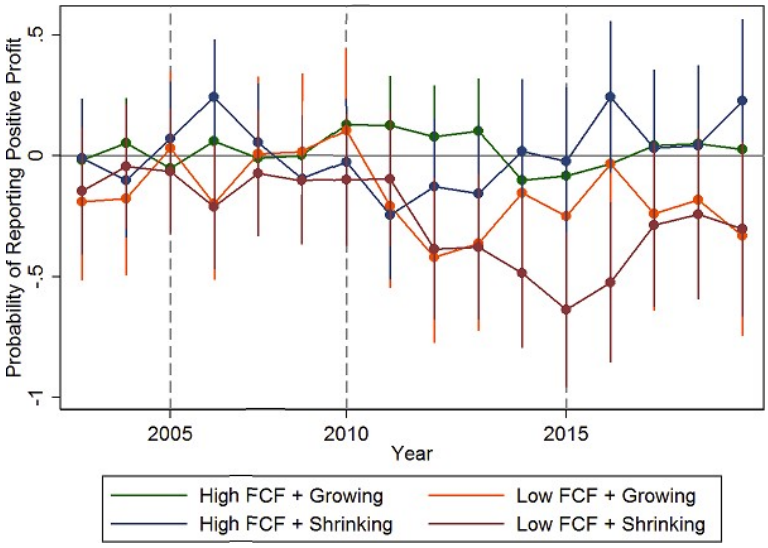
Notes: The unit of observation is the firm-year. Panel A plots coefficients β_t from equation (2), which represents the effect in each year t of having an additional treated worker at the firm in 2005, controlling for the number of old workers and the total number of workers. The outcome variable is the number of young workers. Panel B plots coefficients β_t from equation (3), which represents the effect in each year t of having an additional percent of the 2005 workforce treated, controlling for the share of old workers at the firm. The outcome variable is log investment in machines and equipment. The coefficient for t = 2005 is normalized to 0. In each case I run four separate regressions for the two-way interaction between high and below median free cash flow firms at baseline and growing/shrinking firms. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

Figure A17: **Interaction: Labor Adjustment Costs and FCF**

Panel A: Log Revenue



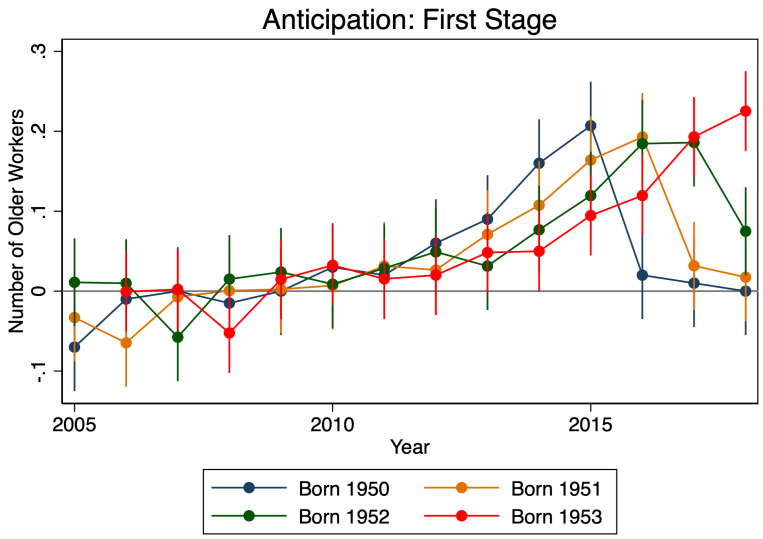
Panel B: Reporting Positive Accounting Profit



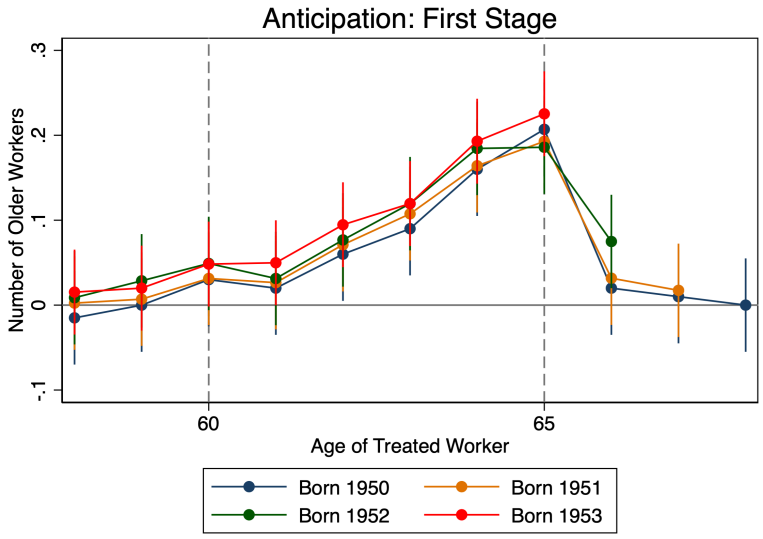
Notes: The unit of observation is the firm-year. The figure plots coefficients β_t from equation (3), which represents the effect in each year t of having an additional percent of the 2005 workforce treated, controlling for the share of old workers at the firm. The coefficient for t = 2005 is normalized to 0. In Panel A the outcome variable is log revenue. I winsorize revenue per worker at the 1st and 99th percentile to take out extreme outliers. In Panel B the outcome is the probability of reporting a positive profit in any given year. In each case I run four separate regressions for the two-way interaction between high and below median free cash flow firms at baseline and growing/shrinking firms. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

Figure A18: **Single Worker Level: Anticipation First Stage**

Panel A: By Calendar Year



Panel B: By Age of the Treated Worker



The sample is restricted to firms with below median free cashflow at baseline that have exactly one worker born between 1949 and 1953. The figure shows the first stage effect of anticipation on the firm's retention of older workers over time. Each consecutive cohort c gives the firm an additional year to anticipate the policy change. The coefficients represent the difference in the number of older workers of a firm employing a treated worker of cohort $c = \{1950, 1951, 1952, 1953\}$ relative to the outcome of a firm employing a control worker born in 1949. Panel A shows the first stage by calendar year, demonstrating that the onset of the treatment is shifted by a year for each consecutive cohort c. Panel B shows the first stage by age of the treated worker., demonstrating that the magnitude of the first stage is similar. Note that data are censored for younger cohorts. The last year in the data is 2018, for individuals born in 1953 are observed until they are 65 years old. Standard errors are clustered at the firm level.

Appendix B: Background on Dutch Pension System

B1. Dutch Pension System

The Dutch pension system consists of three pillars.

The first pillar is a public old age pension provided by the government to all residents of the Netherlands when they reach the legal retirement age of 65. This is a pay-as-you-go system financed through income taxation which provides pension benefits that are tagged to the minimum wage.

The second pillar of the pension system consists of employer-employee pensions. Pensions agreements are negotiated between unions and employers at the sector or firm level and are set in collective agreements. While membership of a pension fund is not mandatory by law, 90% of Dutch employees belong to a pension fund. Prior to 2005, workers were able to retire early (before the legal retirement age of 65) through the second pillar of the pension system. These early retirement schemes were tax deductible, and the tax advantage was approximately 25% of early retirement benefits. Typically, before 2005 workers could retire in their early 60s and get a large share of their final earned wage as pension benefits. For example, in the public sector a worker who had served for 40 years in the public sector could retire at the age of 62 and three months at a replacement rate of 70%. As a result, early retirement, was the social norm in the Netherlands.

The third pillar consists of individual pensions, used mainly by self-employed individuals or as supplemental pension. This pillar is relatively insignificant in the Netherlands. By comparison, the retirement benefits belonging to the second pillar are about twenty times as large as retirement benefits belonging to the third pillar (Bovenberg and Gradus, 2015).

B2. 2005 Early Retirement Reform

The early retirement scheme was first introduced in the 1980s. The scheme consisted of two main parts. The first was a pay as you go scheme ("VUT") in which employees pay for current early retirees. The second was an employer-employee savings plan ("pre-pension") which enabled workers to save for early retirement during their employment. Together, the schemes gave individuals the opportunity to retire in their early 60s, rather than at the legal retirement age of 65. The exact early retirement age varied by sector and industry.

The scheme was jointly funded by employers and employees. Contributions were a share of wages earned by employees, typically 8%. Employees and employers contributed 3.5% of wages to fund the pay as you go scheme and 4.5% of wages to fund the employer-employee savings plan. Approximately 60% of these contributions came from employers, and 40% from employees. There was a fiscal advantage to these schemes as well: contributions to the early retirement scheme were tax deductible, meaning that the government was an important funder of early retirement.

Aside from increasing the effective retirement age, abolishing the early retirement scheme also had financial consequences for both affected workers and firms. These effects are small relative to the primary employment effect I exploit in this paper, however.

B3. Other financial consequences of the policy for workers and firms

Aside from increasing the effective retirement age, abolishing the early retirement scheme also had financial consequences for both affected workers and firms. These effects are small relative to the primary employment effect, however.

First, affected individuals no longer had to make contributions to the employer-employee savings scheme, which accounted for approximately 1.8% of their wage. Until 2014 these cohorts still made contributions to the pay-as-you go component to fund current early retirees.[29] Second, the affected workers got to use any benefits they accumulated up to 2005 in the employer-employee savings plan for early retirement or to increase the benefits in their old age pension. Such contributions were no longer tax deductible, however. In practice this likely contributed to the fact that some affected workers still retired before the legal retirement age of 65, but not at as high a rate as they would have absent the policy change. The difference in post-retirement income is negligible, however. The tax data - described below - shows that the difference in mean income from pensions after retirement between individuals born in 1950 and 1949 is less than 200 euros (220 USD) annually (less than 1% of mean annual pension income).

Second, affected firms faced a small reduction in the early retirement benefits paid for by employers. Firms no longer had to contribute to the employer-employee savings scheme, which accounted for approximately 2.7 percent of each affected worker's wage. Similar to workers, firms continued to contribute to the pay as you go component until 2014. These reductions in contributions were small relative to the wages firms continued to pay when retaining an older worker.

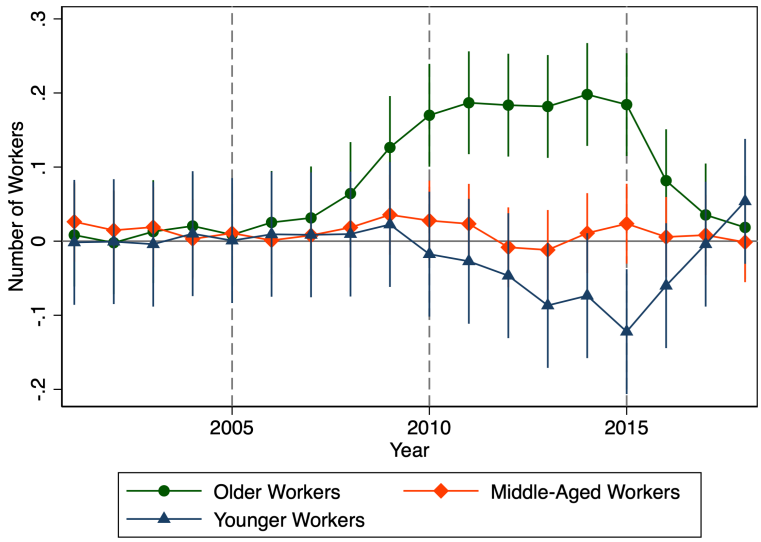
Appendix C: Empirical Approach

C1. Robustness to window size

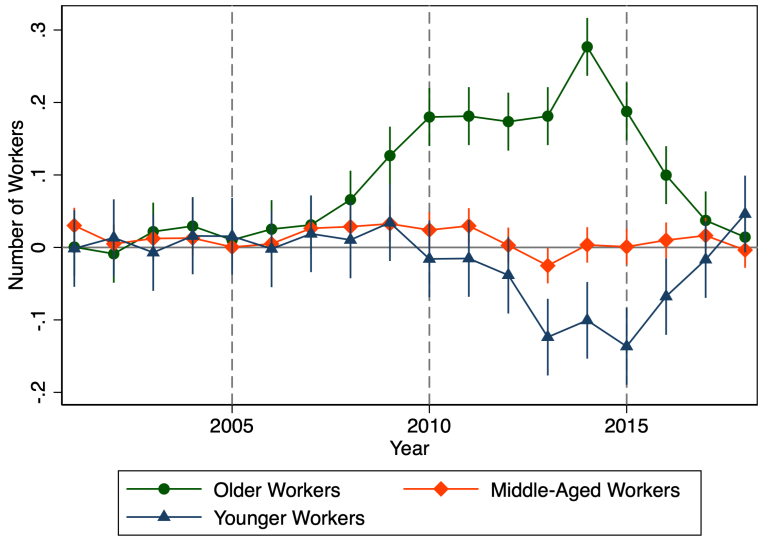
[29] Note that 2014 is the year in which the last eligible cohort, born in 1949, reached the statutory pension age of 65.

Figure A19: **Robustness: window size around 1950**

Panel A: 1949 vs. 1950



Panel B: 1947-1949 vs. 1950-1952



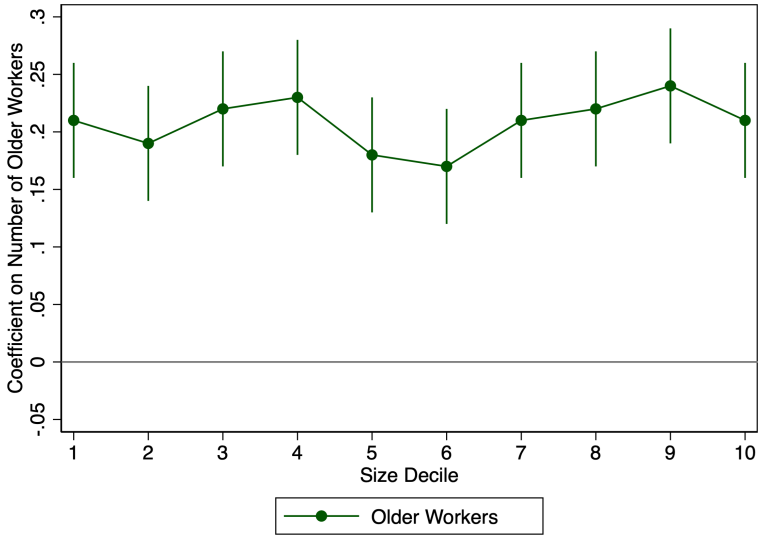
Notes: The unit of observation is the firm-year. The figures demonstrate robustness to adjusting the window size around 1950 which are used for identification. The main analysis takes a two year window on either side and compares the effect of having additional workers born in 1950/1951 (treated) to workers born in 1948/1949 (control). Panel A replicates this using only 1950 versus 1949 (one year window) and Panel B using 1950-1952 versus 1947-1949 (three year window). The coefficients plotted represent the effect in each year t of having an additional treated worker (born 1950 or 1951) at the firm in 2005, controlling for the number of old workers (born 1948-1951) and the total number of workers. These correspond to β_t from equation (7). The coefficient for $t = 2005$ is normalized to 0. In each case the three lines represent three separate regressions. The outcome variables are the number of older workers (born 1945-1955), the number of middle-aged workers (born 1955-1965) and the number of younger workers (born 1965 and after) at the firm over time. All workers considered are full-time employed. The dotted lines represent key timing of the policy: the policy was announced in 2005 and had its main impact in 2010-2015. Standard errors are clustered at the firm level.

C2. Labor and Production Specification: Levels and Shares

As specified in section 3, the exact empirical specification differs slightly depending on the outcome studied. The primary reason for this is that I study firms of different sizes. We might expect that the units in which effects are homogenous across different firms might be different depending on the outcome.

For labor adjustments I study the effects in terms of the *number* of treated workers employed at a firm. Figure A20 shows that this approach yields roughly the same treatment effect across firms of different sizes.

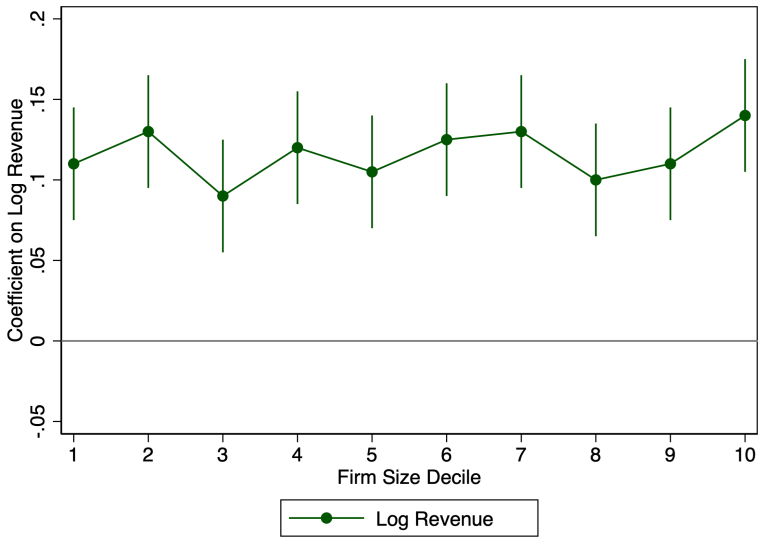
Figure A20: **First Stage by Firm Size Decile**



Notes: The figure demonstrates that the treatment effect of the policy in terms of the number of older workers retained is homogenous in the size of firms. The coefficients plotted represent the mean effect on the number of older workers in 2011-2014 of having an additional treated worker (born 1950 or 1951) at the firm in 2005, controlling for the number of old workers (born 1948-1951) and the total number of workers. Standard errors are clustered at the firm level.

Second, I examine the effect of having an additional *percent* of the workforce treated for firm investment, production and profits. Similarly, Figure A21 shows that this approach yields similar treatment effects across firms of different sizes.

Figure A21: **Revenue Effects by Firm Size Decile**



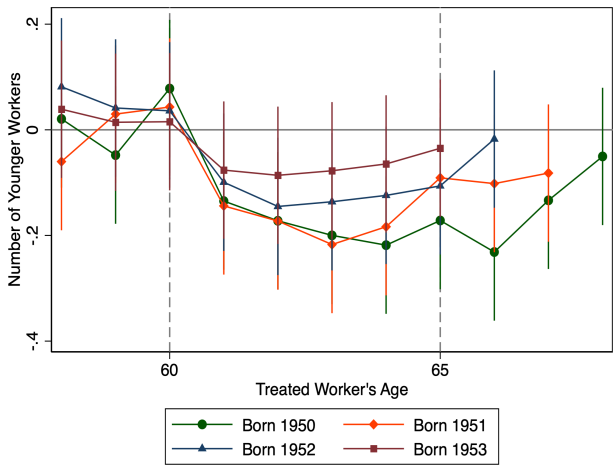
Notes: The figure demonstrates that the treatment effect of the policy in terms of log revenue is homogenous in the size of firms. The coefficients plotted represent the mean effect on log revenue in 2011-2014 of having an additional percent of the workforce treated (born 1950 or 1951) at the firm in 2005, controlling for the share of old workers (born 1948-1951) at the firm. Standard errors are clustered at the firm level.

Studying the effect of the *number* of treated workers for these outcomes would lead to mis-specification. This makes sense intuitively given that a levels approach would imply that adding a worker would have the same effect on production no matter the firm's size, which would only hold for the specific case in which firms faced constant returns to labor.

C3. Firm Level Anticipation Approach

In Section 5.2 I use the mean birth year among treated born 1950-1953 workers at firms. To validate that the mean is the appropriate transformation I compare rounded mean birth year plots to the plots in Figure 10. The latter plots show adjustments for firms with exactly one treated worker born 1950-1953. The Figure below shows that the rounded mean birth year approach yields adjustments very similar to those found in Figure 10. This suggests that the mean birth year of treated workers is the appropriate measure to use when examining the effect of anticipation at the firm level.

Figure A22: **Firm Level: Response by Rounded Mean Birth Year**



Notes: The sample is restricted to firms with below median free cashflow at baseline. The figure shows adjustments in the younger workforce by rounded mean birth year of treated workers at the firm. The plot demonstrates the effect of anticipation on the firm's labor adjustments. Each consecutive cohort c gives the firm an additional year to anticipate the policy change (see Appendix Figure A18 for the first stage plots by birth year). The coefficients represent the difference in the outcome of a firm employing a treated workers with rounded mean cohort $c = \{1950, 1951, 1952, 1953\}$ relative to the outcome of a firm employing a control worker born in 1949, when both workers were of the same age a. These correspond to coefficients $\beta_{c,a}$ from equation (9), which represent firm adjustments in the number of younger workers depending on the treated worker's cohort c. The dotted lines represent the window within which a treated worker could have retired early absent the policy change, but is now more likely to work. Note that data are censored for younger cohorts. The last year in the data is 2018, for individuals born in 1953 are observed until they are 65 years old. Standard errors are clustered at the firm level.