

How Do Private Equity Buyouts Affect Employee Pension Plans?

by

Wensong Zhong

A dissertation accepted and approved in partial fulfillment of the

requirements for the degree of

Doctor of Philosophy

in Finance

Dissertation Committee:

Youchang Wu, Chair

John Chalmers, Core Member

Brandon Julio, Core Member

Van Kolpin, Institutional Representative

University of Oregon

Spring 2024

© 2024 Wensong Zhong

DISSERTATION ABSTRACT

Wensong Zhong

Doctor of Philosophy in Finance

Title: How Do Private Equity Buyouts Affect Employee Pension Plans?

Using data from the Form 5500 filings, I analyze the impact of private equity (PE) buyouts on the defined benefit (DB) plans of target firms. I find that following a buyout, DB plans are more likely to be frozen or terminated, and defined contribution (DC) plans are not likely to provide sufficient substitutes. Regarding the actuarial assumption and the pension characteristics, I find an increase in the pension liability discount rate and decreases in the projected benefit obligations (PBO), pension assets (PA), and contributions, but I do not find significant effects on funding ratio. Additionally, I find that investment strategies for these plans become riskier, with a higher allocation to equities and lower allocations to cash, government securities, insurance accounts, and mutual funds. However, there is no significant effect on realized returns. Overall, these results suggest that private equity buyouts may negatively affect the retirement welfare of DB plan participants of target firms.

CURRICULUM VITAE

NAME OF AUTHOR: Wensong Zhong

GRADUATE AND UNDERGRADUATE SCHOOLS ATTENDED:

University of Oregon, Eugene
Johns Hopkins University, Baltimore
Beijing Institute of Technology, Beijing, China

DEGREES AWARDED:

Doctor of Philosophy in Finance, 2024, University of Oregon
Master of Science in Business Analytics and Risk Management, 2019, Johns Hopkins University
Master of Science in Finance, 2018, Johns Hopkins University
Bachelor of Engineering/Bachelor of Economics, 2017, Beijing Institute of Technology

AREAS OF SPECIAL INTEREST:

Empirical Corporate Finance
Labor and Finance
Private Equity
Environmental, Social, and Governance

WORKING PAPERS:

How Do Private Equity Buyouts Affect Employee Pension Plans?, 2024

Health for Harm: Strategic Perks in the Pollution Playbook, 2024, Joint with Savannah Guo (University of Nevada, Reno) and Michael Zheng (Missouri State University)

When Mayors Pledge Heroes for Zero: The Effect of Local Governments' Environmental Programs, 2024, Joint with Xuanyu Bai (University of Oregon), Ioannis Branikas (University of Oregon), and Jay Wang (University of Oregon)

Import Competition and Labor Share, 2021, Joint with Xi Li (University of Arkansas), and Youchang Wu (University of Oregon)

The Impact of COVID-19 on Firms' Market Values: Estimates from Geographical Networks, 2020, Joint with Ioannis Branikas (University of Oregon)

GRANTS, AWARDS, AND HONORS:

AFA PhD Student Travel Grant, American Finance Association, 2024

Robin & Roger Best Teaching Award, University of Oregon, 2023

Hopewell/Racette Scholarship, University of Oregon, 2021

ACKNOWLEDGMENTS

I am extraordinarily grateful for the work of my advisor, Youchang Wu, who went to great lengths to help me achieve my personal and academic goals. Youchang has been a great advisor, guiding me and support me through the program. I thank my committee members John Chalmers, Brandon Julio, and Van Kolpin for their expertise, availability, kindness, and especially for their willingness to help me through this amazing adventure. I thank Su Han Chan, Zhaogang Song, and Semih Uslu for introducing me a bright new world to explore when I needed before my PhD.

I acknowledge the support of all the past and present faculty members of the University of Oregon's Department of Finance who have provided assistance to me during my time at the University. In alphabetical order: Ioannis Branikas, Gabriel Buchbinder, Maria Chaderina, Diane Del Guercio, Roberto Gutierrez, Robert Ready, Albert Sheen, and Jay Wang. I also thank my past and current PhD student peers for their companionship and comments during my studies: Abdul Adamu Bukari, Sean Chen, Arash Dayani, Christine (Christie) Downs, Donghyeok Jang, Ying Liu, Seyoung Park, Hunter Pearson, Claire Quinto, Ana Sosa Salgado, Juan Wu, Yi Xiao, and Huiling Zhang. Special thanks to Xuanyu Bai, Hyeonjin Cha, Sina Davoudi, Becky Driver, Abby Frank, Gretchen Gamrat, Woocheol Kim, Steve Liu, Cameron Pfiffer, Yuwen Yuan, Wendi Wu, and Anthony Xu. And I want to extend my gratitude to our amazing staff at the business school for all the assistance and tech support during the program.

I acknowledge the emotional and social support provided by Huafeng Magazine, my basketball teammates, all JX3 players, and League of Legends and Call of Duty community. I further thank uncountable individuals for their small acts of kindness, inspiration, and humor.

DEDICATION

I dedicate this dissertation to my parents, Quanfeng Zhong and Bin Wang. Without your boundless love and unwavering support, I could never have completed my doctoral studies. It is you who have taught me the value of hard work and the importance of education. Your encouragement has paved the way for my achievements, and your listening has helped me go through the obstacles. This work is a testament to your belief in me and a reflection of the values you instilled. Thank you for always being my guiding light.

I also dedicate this work to my cousins Wenjia, Qi, Yiwen and Zepu, my grandparents, Guiquan and Shekun, Chengxuan and Xuefang, and all my families. Thank you all for the emotional support through this journey.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	12
II. LITERATURE REVIEW.....	20
PE buyout effects on employees	20
Strategic management of pension plans.....	23
III. HYPOTHESES	26
PE buyout and the termination/freeze of DB plans	26
PE buyout and actuarial assumptions	27
PE buyout and pension asset allocations	28
IV. DATA	30
DB plan data	30
Firms' fundamental information	31
PE-backed acquisition deal data	31
Return and performance measures.....	32
Summary statistics	33
V. EMPIRICAL METHODOLOGIES	35
VI. RESULTS	37
PE and the termination/freeze of DB plans.....	37
PE and DC plans characteristics	39
PE and DB plan characteristics.....	41
PE and DB plan asset allocation	47
Comparison of PE effect and M&A effect	49

Chapter	Page
VII. ROBUSTNESS	51
Mahalanobis distance matching.....	51
Entropy balancing	52
Time window	54
VIII. CONCLUSION.....	55
TABLES	57
FIGURES	73
REFERENCES CITED.....	76
APPENDIX.....	80

LIST OF TABLES

Table	Page
1. Summary statistics	57
2. Cross-sectional results of PE buyout on termination or freeze of a DB	59
3. PE buyout and DC plans' characteristics at the plan level	60
4. PE buyout and DC plans' characteristics and new establishment at the firm level	61
5. PE buyout and discount rate at the plan level	62
6. PE buyout and PBO at the plan level.....	63
7. PE buyout and other pension characteristics at the plan level.....	64
8. PE buyout and pension discount rate and PBO at the firm level	65
9. PE buyout and pension characteristics at the firm level	66
10. PE buyout and pension asset allocation at the plan level.....	67
11. PE buyout and pension asset allocation at the firm level.....	68
12. PE buyout and realized return on pension assets	69
13. Comparison between the effects of PE and M&A on decision of termination/freeze	70
14. Comparison between the impact of PE buyout and impact of M&A deals on plan-level pension characteristics	71
14. Comparison between the impact of PE buyout and the impact of M&A deals on plan-level pension asset allocation.....	72

LIST OF FIGURES

Figure	Page
1. Coefficient plot of termination/freeze analysis.....	73
2. Coefficient plot of test on discount rate and PBO	74
3. Coefficient plot of test on contribution at the plan-level	75

CHAPTER 1. INTRODUCTION

Private equity (PE) firms become an increasingly important investor in the economic landscape nowadays. According to the statistics from Pitchbook Data, Inc., PE firms have raised more than 2.5 trillion in capital from 2012 to 2022.¹ Despite the enormous volume of capital, PE firms appear to deliver strong financial returns to their investors (e.g., [Harris, Jenkinson, and Kaplan \(2014\)](#), [Korteweg and Sorensen \(2017\)](#)). Existing literature has found several sources of these returns. Researchers suggest that PE firms enhance the total factor productivity ([Davis, Haltiwanger, Handley, Jarmin, Lerner, and Miranda \(2014\)](#)), improve operations ([Bernstein and Sheen \(2016\)](#)), augment innovations ([Lerner, Sorensen, and Strömberg \(2011\)](#)), and reduce agency problems ([Edgerton \(2012\)](#)). These findings suggest that PE firms generate strong financial returns for shareholders by improving efficiencies.

The impact of a PE buyout on employees, an pivotal stakeholder group, remains a topic of debate in existing literature. The media commonly states that private equity firms “frequently slash jobs and benefits for employees, cut services and hike prices for consumers, and sometimes even endanger lives and undermine the social fabric.”² Some studies have indicated that PE firms can improve operations, working conditions, and workplace safety, leading to job creation and overall positive outcomes ([Bernstein and Sheen \(2016\)](#), [Cohn, Nestoriak, and Wardlaw \(2021\)](#), [Davis, Haltiwanger, Handley, Jarmin, Lerner, and Miranda \(2014\)](#)). On the other hand, PE buyouts can lead to layoffs, wage cuts, and reduced work-life balance, as labor cost optimization is a key strategy for these firms ([Davis, Haltiwanger, Jarmin, Lerner, and Miranda \(2011\)](#), [Gornall, Gredil, Howell, Liu, and Sockin \(2021\)](#)). However, little attention has been paid to the impact of a PE buyout on defined benefit (DB) plans, an important component of a company’s labor cost and employee benefits. In 2023, the retirement benefit costs are ranging from 7% to 24% of the total fringe benefits depending

¹Available at <https://pitchbook.com/news/reports/2022-annual-us-pe-breakdown>.

²See at <https://www.nytimes.com/2022/08/04/opinion/private-equity-lays-waste.html>

on the industry.³ As pointed by [Karamcheva and Perez-Zetune \(2023\)](#), although the number of DB plans has been declining, around 30% of the US families are covered by DB plans in 2019. Given the importance of the pension plans, understanding the impact of PE buyouts on pension plans is essential for safeguarding the retirement security of workers, ensuring appropriate regulatory oversight, and promoting responsible investment practices that align with the long-term interests of plan participants and beneficiaries.

DB plans require firms to contribute to the plans to ensure benefits are paid at retirement, and while there are restrictions, managers have discretion to manage these plans strategically. It remains uncertain whether PE firms, prioritizing profit maximization, might explore means to curtail pension expenses after a buyout, potentially through plan freezes and aggressive actuarial assumptions. Also, the risk-shifting behavior in pension asset management may lead to agency problems between shareholders and plan participants. This study explores the post-buyout impact on the target firms' DB plans to explain whether employees benefit from PE buyouts. More specifically, I utilize pension plan data (Form 5500) from Department of Labor (DoL), private equity buyout deals data Pitchbook, and firm-level data from S&P 500 CapitalIQ to conduct a difference-in-difference (DiD) analysis to answer the following questions: (1) are firms more likely to freeze or terminate DB plans after the buyout? (2) do firms adopt more aggressive discount rates to compute the projected benefit obligations (PBO) after the buyout? (3) do firms adjust the asset allocation of the plan assets after the buyout? and (4) do firms use defined contribution (DC) plans to provide additional benefits?

The sample consists of 25,097 firms with 30,774 DB plans from 1999 to 2021. I employ cross-sectional regression to test the relationship between PE buyouts and the probability of a plan being terminated or frozen, as well as the relationship between PE buyouts and the probability of a firm terminating or freezing at least one plan. In Form 5500, the freeze of a DB plan means that no participant will receive any new benefit accrual as of the last day of the plan year, while termination means that the plan has been closed after paying all

³See at <https://www.bls.gov/news.release/ecec.nr0.htm>

accrued benefits.⁴ This is often referred to as a hard freeze in the literature. The analysis at both the plan and firm levels reveals that DB plans are more likely to be terminated or frozen after a buyout. Moreover, using the panel data, I interact the dummy variable of PE buyout with a set of event year dummies, and find that the differences of the probabilities of termination and freeze between the PE-backed plans (firms) and the non-PE-backed plans (firms) are peaked in the third year after the buyout.

To examine the impact of PE buyouts on DB plan characteristics, several key metrics are investigated, including pension obligation discount rates, PBO, the number of plan participants, funding status, and firms' pension contributions.⁵ To address the potential bias in the difference-in-difference framework when there are multiple treatments (Baker, Larcker, and Wang (2022), Goodman-Bacon (2021)), I adopt the stacked difference-in-difference (DiD) approach suggested by Gormley and Matsa (2011), Sheen, Wu, and Yuan (2021), and Callaway and Sant'Anna (2021). The time window is six years before and six years after the buyout. I find that after PE buyouts, PE-backed plans tend to use higher discount rates and have lower PBO. After adding the discount rate, a dummy variable indicating whether a plan is frozen in a given year, and natural logarithm of number of participants, the magnitude of the treatment effect decreases, suggesting that the lower PBO may be due to higher discount rates, frozen plans, and less participants. While the PE buyout negatively affects the market value of pension assets or the number of participants, the funding ratio of PE-backed plans is not impacted. This could be attributed to the simultaneous decreases in the PBO and pension assets, which occur at similar magnitudes. Regarding the contribution, I find that following a buyout, PE-backed sponsors tend to contribute less to their pension plans, suggesting a reduction of pension expenses for the sponsoring firms. The firm-level results are generally consistent to the plan-level findings. I find that after the buyout, the

⁴Detailed definitions in the instruction for Form 5500 in 2021, available at <https://www.dol.gov/sites/dolgov/files/EBSA/about-ebsa/our-activities/public-disclosure/foia/form-5500-2021-data-dictionary.zip>

⁵Note that assumed rate of return on pension assets is another essential assumption within the reach of the firm, but this variable is not explicitly provided in the Form 5500 data set for each plan. Some firms disclose the value in the actuarial report attached to the filed forms, but the availability is rare.

PE-backed firms use higher pension obligation discount rates, have lower PBO, fewer DB plan participants, fewer pension assets, and less contributions, while the funding ratio remain unaffected. Overall, the findings suggest that PE firms cut labor costs for their target companies by modifying the DB plan and reduce contribution amounts, which potentially enables the firms to have more financial slack.

Both plan-level and firm-level analyses reveal that after a private equity (PE) buyout, PE-backed plans and firms contribute less to pensions. This reduction in employer contributions is not inherently detrimental if the plan is managed more efficiently and yields higher returns. However, if investment returns do not improve, the lower contributions might jeopardize the ability to pay out benefits at retirement. It is therefore essential to examine how PE buyouts affect the realized returns and asset allocation of defined benefit (DB) plans. I analyzed post-buyout asset allocation changes using financial data from Form 5500 Schedule H and I, for large and small plans respectively. I observed that PE-backed firms' DB plans decrease their allocations to mutual funds and safe assets, such as cash, government securities, and insurance accounts, and increase allocations to corporate equities and preferred stocks. However, there were no significant changes in allocations to trusts or risky debts, including corporate debt and other loans. Further, I investigated whether these allocation shifts correlate with improved realized returns. Using net-of-fee return calculations based on methods from [Jang and Wu \(2021\)](#) and [Munnell, Aubry, Crawford, et al. \(2015\)](#), I found no evidence of enhanced returns in PE-backed firms' DB plans. This suggests that the plans are not managed more profitably post-buyout. At both the firm and plan levels, the data consistently indicate that PE-backed firms' DB plans take on greater risks after a buyout without showing improved investment performance. This increased risk, combined with reduced contributions, could potentially lead to a failure to meet obligations, pushing firms towards riskier investments. As the lack of improved returns indicates, such investments may not yield the expected benefits. Consequently, the reduction in contributions and changes in discount rates could compromise the security of employees' post-retirement benefits.

The negative impact of PE buyout on DB plans does not necessarily lead to employee's benefits loss. The employer may provide benefits from defined contribution (DC) plans or establish new DC plans to compensate the DB plan participants, which may offset the potential benefit loss. To assess whether the employee's welfare is negatively impacted, it is crucial to investigate whether participants are offered more generous benefits or transitioned to newly-established DC plans. To address this, I construct a dataset specifically focused on DC plans. The dataset exclusively comprises firms that sponsored DB plans prior to the PE buyout. I implement a stacked DiD methodology. The dependent variables encompass the natural logarithm of employer contributions, number of participant, employer contributions per participant, the match ratio (employer's contribution to employee's contribution ratio), and a dummy variable indicating the establishment of new DC plans. In both plan-level and firm-level analyses, I observe negative impacts on the DC plans. Following buyout, PE-backed firms tend to reduce their total contributions to the DC plans, contributions per participant, and match ratios. These results suggest that the DC plans are also negatively affected post PE buyout. Additionally, there is evidence of a negative impact on the number of participants, indicating a net negative effect, possibly stemming from employee layoffs. Regarding the establishment of new plans, no significant impact of PE buyouts is identified, implying that PE-backed firms are not more likely to create new DC plans to accommodate former DB plan participants. In summary, former DB plan participants can possibly join existing DC plans, but these plans do not offer benefits as favorable as before. This suggests that the retirement benefits of participants are negatively impacted by PE buyouts.

I investigate the divergence in effects between PE buyouts and non-PE-backed merger and acquisition (M&A) deals. I identify 1,329 M&A transactions from the Pitchbook dataset spanning 1999 to 2000. My empirical approach is similar to the baseline tests, incorporating a dummy variable, *MAtreat*, set to one when a firm is the target of an M&A deal in the termination/freeze analysis. In the analysis of pension characteristics and asset allocation, I introduce the interaction of *Post* and *MAtreat*. I utilize F-tests to compare coefficient

estimates. The findings reveal that PE buyouts result in a higher likelihood of terminating or freezing the DB plan after the buyout compared to M&A deals. In terms of pension characteristics, the F-tests comparing the coefficients of $Post \times PE_{treat}$ and $Post \times MA_{treat}$ indicate that the effects of PE buyouts on discount rates, PBO, funding ratios, and contributions are statistically distinct from those of M&A deals, with PE buyouts exhibiting a greater magnitude of impact. Moreover, the effects on asset allocation differ. Coefficient estimates and F-tests demonstrate that M&A deals tend to reduce investment risk by allocating more to safe assets and less to risky debt, whereas PE buyouts elevate investment risk in pension assets by increasing equity allocation and decreasing investments in safe assets.

For robustness check, I use Mahalanobis distance matching to mitigate the difference between the PE-backed firms and the non-PE-backed firms. I conduct the 1-to-1 matching without replacement using all control variables including expense ratio, and natural logarithm of PA, number of participants, plan age, firms' total assets and total revenue. Then I repeat the tests with the matched sample. The results are similar to the baseline results. I also use the entropy balancing proposed by [Hainmueller \(2012\)](#) and [Hainmueller and Xu \(2013\)](#), to make PE-backed firms similar to the control firms in terms of the covariates. More specifically, I use the data of all covariates in year $t - 1$ which is one year before the buyout, and generate the entropy balancing weight by each cohort. I repeat the test with the entropy balancing weight. The results are generally consistent to the main results. Regarding the choice of time window, I replace the 6-year cohort with 5-year cohort (4-year) cohort, which covers five years (four years) before and after the buyout. The results are consistent with the main findings. These suggest that my results are not driven by the selection bias or the selection of time window.

This study contributes to the literature of post PE buyout effects on employees. Regarding this topic, researchers have found mixed evidence ([Sorensen and Yasuda \(2023\)](#)). On the positive side, several studies have found that PE buyouts can have beneficial effects on employees, including increased job availability ([Davis, Haltiwanger, Handley, Jarmin,](#)

Lerner, and Miranda (2014)), better management (Bloom, Sadun, and Van Reenen (2015)), greater wage equality within the firm (Fang, Goldman, and Roulet (2022)), improved workplace safety (Cohn, Nestoriak, and Wardlaw (2021)), more studying opportunities (Agrawal and Tambe (2016)), and higher job satisfaction (Gornall, Gredil, Howell, Liu, and Sockin (2021)). On the other hand, some studies have reported negative impacts of private equity (PE) buyouts on employees, such as less job opportunities (Davis, Haltiwanger, Jarmin, Lerner, and Miranda (2011) and Davis, Haltiwanger, Handley, Lipsius, Lerner, and Miranda (2019)), lower pay (Antoni, Maug, and Obernberger (2019)), worse health status (Garcia-Gomez, Maug, and Obernberger (2020)), poor work-life balance (Gornall, Gredil, Howell, Liu, and Sockin (2021)), less job satisfaction (Lambert, Moreno, Phalippou, and Scivoletto (2021)), higher misconduct rate (Sheen, Wu, and Yuan (2021)), and less job stability (Olsson and Tåg (2017)). As the literature on the effects of PE buyouts on employees continues to expand, it is becoming increasingly important to know how PE buyouts affect the interests of employees at target firms. This study contributes to the existing literature by providing the evidence on how PE buyout harm the employee benefits from the aspect of retirement plans. The empirical results offer a detailed analysis that highlights a potential deterioration in employee benefits.

This study also contributes to the literature which investigates the impact of changes in firms' ownership structure on employees' post-retirement benefits. Previous studies suggest that manipulation of pension funds can contribute to gains from ownership changes. For example, Pontiff, Shleifer, and Weisbach (1990) shows that acquirers transfer the wealth from the DB plan participants to shareholders by reversing the target firms' DB plan after the acquisition. Similarly, Agrawal and Lim (2022) find that after the acquisition of hedge fund, the targets' DB plan experience under-funded, less contribution and riskier assets allocation, and these changes contribute to roughly 7% of the wealth gains to shareholders. My study extends this stream of literature to examine the effects of PE buyouts on pension plans. The findings indicate that PE buyouts are associated with a higher likelihood of

terminating/freezing the DB plan and increasing the discount rate and investment in risky assets. These changes may reduce labor costs, provide financial slack for investments, and suggest risk shifting practices.

This study adds to the existing literature on firms' strategic manipulation of pension funds. Previous research has demonstrated that pension plans can serve as a source of financial flexibility. Sponsors often adjust actuarial assumptions, such as increasing assumed returns ([Bergstresser, Desai, and Rauh \(2006\)](#) and [Bartram \(2018\)](#)), or reducing the discount rate ([Chu, Goldstein, Li, and Yu \(2020\)](#), [Kisser, Kiff, and Soto \(2017\)](#)), to bolster the firm's cash reserves. Regarding pension asset allocation, findings vary among studies. Some suggest that managers may opt for riskier investments when they exhibit high wealth-risk sensitivity and low wealth-price sensitivity ([Anantharaman and Lee \(2014\)](#)) or when the firm's governance is poor ([Cocco and Volpin \(2005\)](#)). Conversely, other studies present opposing results ([Rauh \(2009\)](#), [Pedersen \(2019\)](#), and [Phan and Hegde \(2013\)](#)). Additionally, the termination or freezing of a DB plan can create opportunities for firms to address their financial needs ([Pontiff, Shleifer, and Weisbach \(1990\)](#) and [Harper and Treanor \(2014\)](#)). In this study, I provide evidence that PE buyouts are also linked to strategic management of pension funds, where PE-backed firms may increase financial flexibility by reducing their contributions.

The remainder of this paper is organized as follows. In chapter [2](#), I discussed the related literature. In chapter [3](#), I discuss hypotheses related to PE buyout and DB plan management. Chapter [4](#) describes the data and the empirical methods. Chapter [6](#) shows the results, Chapter [7](#) provide robustness check, and Chapter [8](#) concludes.

CHAPTER 2. LITERATURE REVIEW

I review two sets of related literature in this chapter: the literature on the impact of PE buyout on employees, and the literature on firms strategically manipulating the pension plans.

2.1. PE buyout effects on employees

Historically, PE firms have been portrayed by journalists as profit-seeking entities that exploit workers, but the actual impact of buyouts on employees is a complex issue that remains under debate in the academic literature.

Prior research has documented various aspects of the impact of PE buyout on workers. Regarding the non-pecuniary interests of employees, researchers provide findings from both positive and negative sides. For example, [Bernstein and Sheen \(2016\)](#) use the data on the restaurants industry in Florida and discover that the restaurants acquired by PE firms are cleaner, safer and better maintained, due to operational engineering, rather than hiring more employees. Meanwhile, [Cohn, Nestoriak, and Wardlaw \(2021\)](#) analyze the data on occupational injury and find that workers that remain employed appear to report less occupational injuries, indicating that buyouts can improve workplace safety. This improvement in safety is also found to benefit PE investors by increasing the likelihood of an IPO.

[Agrawal and Tambe \(2016\)](#) use the data from online job website and find that employees benefited from PE buyouts by acquiring transferable human capital, which improve their long-run employability and wages. This suggest that PE can benefit the employees who might be restricted by their exposure to outdated production methods. [Gornall, Gredil, Howell, Liu, and Sockin \(2021\)](#) observe that higher-skill workers and managers became more satisfied with their compensation and benefits after a PE buyout. [Bloom, Sadun, and Van Reenen \(2015\)](#) shows that the private equity-owned companies have better management practices than most other company types such as family-run, founder owned, or government owned

firms, such as setting realistic target for the whole company.

Fang, Goldman, and Roulet (2022) analyzed data from French firms and find that expensive workers, typically older male, are more likely to be replaced by cheaper workers, who are typically younger ones. This replacement leads to a lower wage inequality within firms. Additionally, Bacon, Wright, Ball, and Meuleman (2013) develop a framework for analyzing the effects of PE buyouts on employment, finding that most buyouts did not prioritize short-term ownership and were less likely to have negative implications for employees' interests.

On the other hand, some studies suggest that employees may experience a decline in benefits following a buyout. For example, Gornall, Gredil, Howell, Liu, and Sockin (2021) analyze data from Glassdoor.com between 2008 and 2019 and find that PE buyouts lead to declines in job satisfaction, particularly in terms of compensation, for long-tenured, low-skill, and less-educated workers. Additionally, high-skill workers and managers report larger declines in work-life balance. Similarly, Lambert, Moreno, Phalippou, and Scivoletto (2021) also find that the employee satisfaction drops around leverage buyout transactions, and that the drop is more pronounced in public-to-private deals than in private-to-private ones. Sheen, Wu, and Yuan (2021) find that financial adviser misconduct rises after PE buyouts, suggesting that financial advisers may face higher work pressures in PE-backed financial advisory firms.

In terms of the impact of PE buyouts on gross employment and wages, the evidence is mixed. On the one hand, some studies suggest that PE buyouts may lead to business expansion and job creation. For instance, Davis, Haltiwanger, Handley, Jarmin, Lerner, and Miranda (2014) use U.S. census data to track employment at 3200 portfolio companies and their establishments that are acquired by PE firms. They find that PE buyouts result in substantial increases in gross job creation and destruction, with only modest net job losses. Their results suggest that PE owners actively reallocate the employment through exit of less productive establishments and greater entry of more productive ones, leading to a total

factor of production gains at the target firms. [Davis, Haltiwanger, Handley, Lipsius, Lerner, and Miranda \(2019\)](#) expand this study and data coverage to a longer period. They find that the employment in firms previously under private ownership rises 13 percent, while employment in firms that were publicly listed shrinks by 13 percent. The authors attribute this discrepancy to the different goals of PE deals. For public-to-private deals, reducing the agency problem is the goal, while access to the capital markets is the goal for the private-to-private deals. Some industry-sponsored studies also claim positive employment effects of PE deals (e.g., [Taylor and Bryant \(2007\)](#) and a report by British Venture Capital Association).⁶

While some studies suggest that PE buyouts can create jobs and boost business expansion, other research indicates that they can also have negative consequences. In [Davis, Haltiwanger, Jarmin, Lerner, and Miranda \(2011\)](#), the authors document employment and job losses due to PE buyout amount to 3 percent in two-year period after the buyout and 6 percent over five years. In the follow-up study mentioned above, the author also find the employment reduction in the target establishment. Similarly, [Antoni, Maug, and Obernberger \(2019\)](#) study on 511 German PE buyouts and find that employment at PE-backed companies decreases by 8.96 percent, with a higher increase in the firing rate than the increase in the hiring rate (18.75 percent vs. 9.79 percent). They also find that the annual earnings per employee drop by 2.8 percent of the median earnings, which amounts to 980 euro dollar. More severely, [Garcia-Gomez, Maug, and Obernberger \(2020\)](#) use data on 274 PE buyouts in Netherlands involving 55,752 employees from 2007 to 2013, and find that employees with worse health status before the buyout face more losses of income and employment after the buyout. [Olsson and Tåg \(2017\)](#) find that workers performing automatable routine tasks and offshorable tasks at targets that is less productive than peers are more likely to lose their jobs. They also find that after leaving the portfolio company, they tend to have less income from their new jobs.

⁶The report is available at <https://www.bvca.co.uk/Research/BVCA-Publications/Details/Economic-contribution-of-UK-private-equity-and-venture-capital-in-2023>

2.2. Strategic management of pension plans

The foundational pension decision a firm makes centers on the type of plan it chooses to sponsor. DB plans guarantee a specified retirement benefit to employees, with contributions adjusted accordingly to fulfill this promise. In contrast, DC plans involve fixed annual contributions from the firm, with the final retirement benefit determined by the cumulative contributions and the investment performance of the assets. Given that DB and DC plans offer distinct commitments to employees, firms strategically choose the type of pension plan that best aligns with their operational needs and financial objectives. This selection process underscores the alignment between corporate strategy and employee benefit structure. [Peterson \(1994\)](#) suggests that when a firm is facing high variability of cash flows, it is more likely to select DC plans to reduce the operating leverage and increase the financial flexibility. [Harper and Treanor \(2014\)](#) find that firms tend to convert the DB plans to defined contribution plan and cash balance plan, or simply terminate them, due to the related wealth transfer. This conversion contributes to the labor cost reduction in the sponsor firm, as discussed by [Rauh, Stefanescu, and Zeldes \(2013\)](#). They find that even starting a DC plan after the termination or freeze of a DB plan, the sponsoring firm save 2.7-3.6% payroll per year.

In a DB plan, the sponsor firm has the responsibility to manage the plan so that the plan assets are able to cover all benefits owed to the participants. Otherwise, the sponsor must contribute to the plan to fill the gap between the plan assets and the projected benefit obligations, which reduces the firm's cash flows available for other uses.

The liability of a DB plan is calculated based on various actuarial assumptions, such as the discount rate and assumed rate of returns. However, regulations allow plan sponsors to adjust these assumptions to align with their strategic objectives. For instance, [Bergstresser, Desai, and Rauh \(2006\)](#) demonstrate that the assumed rate of return on pension assets can be used as a tool to manipulate earnings. They provide evidence that higher assumed rates

of return lead to lower costs and higher earnings. Additionally, their results show that firms use higher assumed returns during critical events, such as acquiring other firms or when managers exercise stock options. [Chu, Goldstein, Li, and Yu \(2020\)](#) provide both theoretical and empirical evidence that firms set the PBO discount rate higher when they encounter good investment opportunities. This effect is more pronounced for firms with lower financial risks. Meanwhile, [Bartram \(2017\)](#) find that DB plan sponsors contribute less when they have low cash reserves and undertake real investments, indicating that DB plans can be utilized as a real option for sponsors. [Kisser, Kiff, and Soto \(2017\)](#) study a sample from 1999 to 2007 and find that underfunded plans utilize substantially higher discount rates to reduce the reported value of pension liabilities, which consequently reduces the cash contributions to the pension plan. In addition, [Bartram \(2018\)](#) finds that DB plan sponsors use more aggressive pension assumptions when they have less cash, especially during economy downturns. Regarding the asset allocation, [Andonov, Bauer, and Cremers \(2017\)](#) find that U.S. public pensions with a higher percentage of retired participants maintain higher liability discount rates and invest more in risky assets, especially when the pensions have fewer retirement obligations.

Besides the actuarial assumptions, the termination and freeze of a DB plan can also provide opportunities for firms to address their needs. For example, [Pontiff, Shleifer, and Weisbach \(1990\)](#) analyze 413 takeover deals between 1981 and 1988 and find that pension funds were reverted by 15.1% of acquirers following hostile takeovers, compared to 8.4% following friendly deals. This effect is more pronounced with overfunded plans. Their results suggest that acquirers transfer the wealth from the DB plan participants to shareholders by reversing the target firms' DB plan after the acquisition. Similarly, [Petersen \(1992\)](#) also finds evidence that firms terminate their pension plans to relieve themselves of promises to workers of future compensation.

The ability to manage the DB plan may result in risk-shifting behavior and agency problems. According to [Anantharaman and Lee \(2014\)](#), managers' equity incentives affect a firm's pension policy, and when CFOs have high wealth-risk sensitivity (high vega) and

low wealth-price sensitivity (low delta), they tend to engage in risk-shifting by underfunding the DB plan. But this effect is lower when CFO has larger personal stake in the pension plan. Despite this finding, [Pedersen \(2019\)](#) finds no evidence that managers shift risks to DB plan beneficiaries by underfunding the DB plan when firms have higher bankruptcy risk. The author attributes this finding to managers' concern to damage the reputations of employees. Furthermore, [Rauh \(2009\)](#) provides evidence against the risk-shifting in pension fund operation. They find that firms have less risky pension asset allocation when their financial condition is weaker. On the other hand, [Phan and Hegde \(2013\)](#) find that firms with higher external governance tend to take more risks by allocation higher proportion of the pension assets to equities, and they attribute this risk-taking behavior to firms seeking higher investment returns and better funding status. However, [Cocco and Volpin \(2005\)](#) find the opposite results, suggesting that indebted firms with poor governance (measured by the number of insider-trustees) tend to have a greater proportion of equity investments in their pension assets.

CHAPTER 3. HYPOTHESES

In this chapter, I develop the hypotheses about potential impacts of PE buyouts on DB plans.

3.1. PE buyout and the termination/freeze of DB plans

To explore why PE firms might opt to terminate or freeze DB pension plans in their target firms, it is crucial to understand the financial implications and strategic motivations behind such decisions. The literature identifies labor cost optimization as a key factor enabling PE firms to achieve high returns. Managing a DB plan involves significant effort and costs, including close fund management and adherence to regulatory requirements. Terminating or freezing these plans can substantially reduce both immediate expenses related to plan management and future pension liabilities, thereby enhancing shareholder returns.

Moreover, the strategic removal of a DB plan might align with PE firms' primary objective of maximizing profitability post-buyout. This is particularly relevant when considering the flexibility PE firms seek in managing their financial strategies and operational efficiencies. However, it's important to recognize the potential strategic value of maintaining a DB plan. According to [Ballester, Fried, and Livnat \(2002\)](#), [Bartram \(2017\)](#), and [Bartram \(2018\)](#), DB plans can serve as a reserve to fund investments, especially when external financing options are limited. While contributions to these plans are mandatory, the timing and amounts can be strategically adjusted to align with the firm's immediate financial needs, essentially allowing firms to use these contributions as an alternative financing method, akin to borrowing from employees.

If the focus of the PE firm extends to long-term goals, as suggested by [Bacon, Wright, Ball, and Meuleman \(2013\)](#), retaining the DB plan might offer a vital source of internal funding that can bolster the target firm's financial stability and contribute to sustained growth and profitability. This dual perspective highlights a complex decision-making landscape

where PE firms must weigh the immediate financial benefits of terminating or freezing DB plans against the potential long-term strategic advantages of maintaining them as a financial buffer and funding mechanism.

3.2. PE buyout and actuarial assumptions

When a DB plan is underfunded, the plan sponsor is required to make contributions to rectify the shortfall. For those plans that remain active, sponsors possess the latitude to adjust the discount rate, thus altering the PBO and influencing the plan's funding ratio. This strategic adjustment of the discount rate can effectively modify their required contributions. As [Chu, Goldstein, Li, and Yu \(2020\)](#) indicates, firms that are poised with favorable investment opportunities and exhibit limited financial slack are likely to set a higher discount rate, thereby reducing their obligation to make additional contributions.

Further, [Bartram \(2018\)](#) illustrates that firms in financial distress often set higher assumed returns on plan assets, thereby justifying smaller pension contributions. This maneuver is part of a broader financial strategy that enables PE firms to leverage regulatory flexibility to their advantage. By adopting more aggressive financial assumptions, PE firms can minimize their contribution outlays, thereby freeing up capital for investment in operational enhancements.

Conversely, firms with DB plans may opt to increase contributions to their pension assets to maximize the tax benefits associated with pension contributions, which are generally tax-deductible within the parameters defined by IRC section 404.⁷ These approaches underscore the nuanced financial tactics that firms deploy to navigate between immediate economic pressures and maintaining long-term stability and compliance of their pension schemes.

⁷Available at <https://www.law.cornell.edu/uscode/text/26/404>.

3.3. PE buyout and pension asset allocations

PE buyout may lead to higher risk in the pension asset allocation due to risk shifting. The practice of risk shifting suggests that managers acting in the interests of shareholders may underfund the DB plan and to invest the pension funds in risky assets, which may earn higher pension investment return but put the employees' post-retirement benefits in danger. This creates a wealth transfer from the employees to the shareholder, which could be one consequence of the PE deals.

The seminal theory work of [Treyner \(1977\)](#) shows that stockholder wealth can be increased through deliberate underfunding of pension plans and the allocation of assets into riskier investments. Furthermore, [Andonov, Bauer, and Cremers \(2017\)](#) and [Agrawal and Lim \(2022\)](#) show that with higher discount rate and assumed rate of return, firms tend to invest more in equity to justify the change, which introduces higher risk into the pension funds. Additionally, PE firms might seek ways to reduce the agency problem and improve the corporate governance in order to obtain the gains, as discussed in [Edgerton \(2012\)](#) and [Nikoskelainen and Wright \(2007\)](#). Improved corporate governance, as indicated by [Phan and Hegde \(2013\)](#), is often associated with a higher allocation to equities and a reduced investment in safer assets, such as cash and insurance.

Conversely, firms might reduce the risk associated with pension plans when confronted with elevated bankruptcy risks, as evidenced by studies such as [Rauh \(2009\)](#) and [Anantharaman and Lee \(2014\)](#). Given that PE takeovers are typically financed through significant debt, this introduces additional financial liabilities into the target firms, potentially heightening bankruptcy risks—even though PE firms often select firms with relatively robust financial health ([Kaplan \(1989\)](#), [Kaplan and Stein \(1993\)](#), and [Tykvová and Borell \(2012\)](#)). Therefore, it is plausible for PE firms to decrease the allocation of risky assets in pension portfolios in response to increased bankruptcy risks.

By using the PE data and DB plan data, I am able to test these alternative hypotheses

at both plan level and firm level. And this can help understand how PE affects the employee treatment after the buyout.

CHAPTER 4. DATA

This chapter describe the dataset I construct to test the hypotheses. The section 4.1 details the DB plan data used in this study. The section 4.2 describes the firm-fundamental information. The section 4.3 provides the details of PE buyout deals data, section 4.4 describes the return definitions, and section 4.5 shows the summary statistics. The dataset covers the U.S. firms filed Schedule SB of Form 5500 with all control variables available from 1999 to 2020.

4.1. DB plan data

The DB plan data are collected from the Form 5500 database. The Form 5500 (Annual Return/Report of Employee Benefit Plan), including all required schedules and attachments, is used to report information concerning employee benefit plans.⁸ The form is filed annually with the IRS and the Department of Labor’s Employee Benefits Security Administration by corporate pension plan sponsors. All firms with DB plans are required to file the schedule SB and corresponding Form 5500 or Form 5500-SF.

I obtain the fundamental DB plan data from Form 5500/5500-SF and Schedule B/SB, and financial data from Schedule H and Schedule I. According to the instruction, all sponsors of an employee benefit plan subject to Employee Retirement Income Security Act must file information about each plan every year.⁹

All firms covered by the database are identified by unique employer identification number (EIN), and the plans are identified by the plan number within the firm. However, firms may have multiple EINs due to geographical dispersion, so two EINs may represent one firm. I manually identify and merge duplicate EINs, using the earliest EIN as the unique ID.¹⁰ Also,

⁸Available at <https://www.dol.gov/agencies/ebsa/about-ebsa/our-activities/public-disclosure/foia/form-5500-datasets>. The data were downloaded in 2022

⁹Details at <https://www.law.cornell.edu/uscode/text/26/6058>

¹⁰For example, if A firm has two EINs in the dataset, xx-xxxxxx1 and xx-xxxxxx2, and xx-xxxxxx1 appears earlier, I will assign xx-xxxxxx1 as the EIN for the A firm.

there are cases where one EIN leads to multiple firm names (e.g., firm changes the name). After correcting the typo and expanding the abbreviations, I assign the earliest name as the correct name for the firm, which are used in the matching process.¹¹ And I combine the EIN and the plan number as the identifier of an unique DB plan.

The database uses the acknowledgement ID (ACK ID) as a unique identifier to link schedules and main forms. Each form submission is assigned a unique ACK ID. If a plan submits the same form multiple times, each submission has a unique ACK ID. To remove duplicates, I keep the first submission in a given year based on the recorded receipt time.

4.2. Firms’ fundamental information

Given that the majority of PE deals involve private firms, essential data is frequently lacking for many entities in the Form 5500 datasets. To address this, I gather industry classifications, total assets, and total sales for firms from the S&P 500 CapitalIQ dataset, using the firms’ names as recorded in the Form 5500 dataset. The matching process utilizes the firms’ names as listed in the Form 5500 dataset.¹² I match using the CapitalIQ Excel plug-in, and manually check the results. This approach enables a comprehensive analysis of the financial and operational status of firms involved in PE transactions, enhancing the robustness of the research findings.

4.3. PE-backed acquisition deal data

The PE-backed merger and acquisition events are collected from Pitchbook database. To be in the sample, the deal has to be completed between 1999 and 2020, the deal type has to be “Buyout/LBO”, the deal class has to be “Private Equity”, and the headquarter locations must be in the U.S., including the deals made by PE firms or PE-backed firms. The sample

¹¹For example, if xx-xxxxxx1 has two names in the dataset, A and B, and A appears earlier, I will assign A as the true name for xx-xxxxxx1

¹²If the name contains abbreviations, such as LLC, L.L.C., P.C., Corp, and Inc, or if the matches only miss the abbreviations or suffix, I treat them the same as the full words.

only includes the first deals of the same firm in the sample period.

To match the deals with the firms in my sample, I first fuzzy match the target firms' names in the Pitchbook database with firm names in Form 5500 dataset. I then manually check the accuracy of the matches through similarity score filtering and internet searches. In total, I end up with 25,097 U.S. firms with 30,774 DB plans spanning from 1999 to 2021. I identify 1,191 U.S. deals involving 1,622 DB plans.

4.4. Return and performance measures

Following [Munnell, Aubry, Crawford, et al. \(2015\)](#) and [Jang and Wu \(2021\)](#), I define the realized return on pension asset as:

$$R_{i,t} = \frac{NetAssets_{i,t} - NetAssets_{i,t-1} - Contribution_{i,t} + Distribution_{i,t} + NetTransfer_{i,t}}{NetAssets_{i,t-1} + 0.5Contribution_{i,t} - 0.5Distribution_{i,t} - 0.5NetTransfer_{i,t}} \quad (1)$$

where $NetAssets_{i,t-1}$ and $NetAssets_{i,t}$ are the net assets of the plan i at the beginning and the end of the year t, respectively, $Contribution_{i,t}$ represents the amount contributed to the plan, $Distribution_{i,t}$ denotes the amount paid out to beneficiaries during the year t, and $NetTransfer_{i,t}$ is difference between the amount transferred out of the plan and the amount transferred into the plan, which occurs when a plan is merged or terminated. An underlying assumption of this definition is that the cash flows are made in the middle of the year. Alternatively, I compute the return using the incomes and expenses in Schedule H and I of Form 5500 as follows:

$$R'_{i,t} = \frac{InvestmentEarnings_{i,t} - InterestExpense_{i,t} - AdministrativeExpenses_{i,t}}{TotalAssets_{i,t-1}} \quad (2)$$

where $InvestmentEarnings_{i,t}$ include the interest income, dividends, rents, realized and unrealized capital gains.

4.5. Summary statistics

The summary statistics are shown in Table 1 and variable definitions are shown in Table A.1. All values are winsorized at 1st and 99th. Panel A describes the variables at the plan level, while Panel B summarizes these variables at the firm level. To be in the sample, the plans have to be active before the PE buyout year. Once the firm decides to terminate or freeze the plan, it has to file the Form 5500/Form 5500-SF with the specific code.¹³ On average, there are roughly 4.9% of the DB plan file with termination or freeze, and the majority of them file freeze. Among all DB plans, the average age of the plan is 37 years, defined as the number of years since the starting year of the plan. Panel A also shows that plan size (“LogPA”), a natural logarithm of fair value of pension assets, is greater than the plan obligation (“LogPBO”), leading to the funding ratio is above 1.

I compute the weight on each asset category as the ratio of the value of an asset to the total market value of the pension assets at the end of each year. The observations with the weight greater than one or less than zero are treated as the error and are excluded from the analysis. On average, a plan invests 14% to equity, 11% to safe assets, 5% to risky debt, 33% to mutual fund and 48% to trust. Since the form does not require the sponsors to disclose the detailed asset allocations held by mutual fund and trust, I am not able to get this information from the database.¹⁴ The last two categories in the Schedule H of Form 5500 are real estate and others. Since the values of these two classes are largely missing or 0, it is not used in the analysis.

The realized returns are computed as Equation 1 and Equation 2. Following Rauh (2009), I treat all the returns greater than 500% or less than -80% as errors and exclude all of them from the analysis. The average return of the pension assets is approximately 7%. As schedule H and Schedule I are missing for some plans, the total number of the plans in

¹³According to the instruction, the code for termination is “1H” and the code for freeze is “1I”.

¹⁴The searchable database contains the submissions of each plan after 2009, available at <https://www.efast.dol.gov/5500search/>, and some firms submit the actuarial reports covering the detailed holdings in trust and mutual funds. However, the submissions are scanned PDF and the reports are not standardized, which makes it too difficult to extract the information efficiently.

the asset allocation is smaller.

CHAPTER 5. EMPIRICAL METHODOLOGIES

For the termination/freeze analysis, I employ a cross-sectional regression. I construct the sample using the PE buyout year. Each PE buyout year was treated as a cohort, consisting of observations from plans (and firms) that were bought by PE firms in that year, plans (and firms) that were never bought by PE firms, and plans (and firms) that had not yet been bought by PE firms. I estimate the following equation for the analysis:

$$Y_{i,j,c} = \beta Treat_{j,c} + X'_{i,j,c}\lambda_1 + X'_{j,c}\lambda_2 + \gamma_{c,I} + \epsilon_{i,j,c}, \quad (3)$$

where $Y_{i,j,c}$ is the dummy variables equal to one when the plan i of firm j is terminated or frozen within one year, three years and five years after the buyout, $Treat_{j,c}$ is the dummy variable equal to one when the firm j is bought by a PE firm, and the subscript c represents the cohort. $X'_{i,j,c}$ and $X'_{j,c}$ are vectors of time-varying plan-related control variables and firm-related control variables in the year before the buyout year, respectively. $\gamma_{c,I}$ capture the cohort-by-industry fixed effects, where the industry is denoted by Fama-French 30 industry code. I cluster the standard errors by firm. To reflect the higher weights of large plans in the sample, I weight each observation by the actuarial pension asset value in the year before the buyout year for each cohort.

In the analysis of pension characteristics and asset allocation, I follow [Gormley and Matsa \(2011\)](#) and [Callaway and Sant'Anna \(2021\)](#) to use a difference-in-difference design with multiple treatment time. I split the sample into multiple cohorts based on the buyout year, and each cohort has five years before and after the treatment year. In each cohort, I use the later-treated and never-treated firms as the control group.¹⁵ More specifically, I

¹⁵The later-treated firms represent firms that are bought by a PE firm in the years after the last year in the time period of a cohort. The never-treated firms are the ones that have never been acquired by a PE firm in the sample.

estimate the following equation for the plan-level analysis:

$$Y_{i,j,c,t} = \beta Treat_{j,c,t} \times Post_{c,t} + X'_{i,j,c,t} \lambda_1 + X'_{j,c,t} \lambda_2 + \quad (4)$$

$$\theta_{c,I,t} + \delta_{c,i} + \epsilon_{it}, \quad (5)$$

where the $Y_{i,j,c,t}$ is the dependent variable of plan i of firm j in year t within cohort c , $Post_t$ is a dummy variable that equals one from buyout year onward and zero for the earlier years. $X'_{i,j,c,t}$ and $X'_{j,c,t}$ are vectors of lagged time-varying plan-related control variables and firm-related control variables, respectively. I set the value of control variables in the post period to their levels in one year prior to the buyout. $\theta_{c,I,t}$ and $\delta_{c,i}$ capture the cohort-by-industry-by-year and cohort-by-plan fixed effects. The main interest is in the coefficient on the interaction term $\beta Treat_j \times Post_t$, which captures the effect of PE buyout on the dependent variable $Y_{i,j,c,t}$. For the firm-level analysis, I aggregate all plan-related variables to firm level, and include the cohort by firm fixed effects instead of cohort-by-plan fixed effects. I cluster the standard errors by cohort by firm. To reflect the higher weights of large plans in the sample, I weight each observation by the actuarial pension asset value at the beginning year of each cohort.

CHAPTER 6. RESULTS

I now present the main empirical results and show how PE buyout affects the post-buyout DB plan management at the plan and firm levels.

6.1. PE and the termination/freeze of DB plans

As employees accumulate working years, the accrued benefits increase, consequently growing the liability associated with a pension plan. To manage this escalating liability, plan sponsors may need to increase contributions or seek higher returns from existing assets, both of which impose additional costs on the sponsor. According to [Rauh, Stefanescu, and Zeldes \(2013\)](#), one strategy to mitigate these costs is through the freeze or termination of the DB plan.

In the context of DB plan, there are mainly two types of freeze. A hard freeze means that the pension plan no longer accrues any benefits for additional working year, although the sponsor must still maintain the plan and ensure timely payout of existing benefits. A soft freeze allows current participants to continue accruing benefits by extending their service, but there will not be new participants joining the plan. Different from freezes, termination means that after paying out all the existing benefits, the pension no longer exists, and the excess pension assets are distributed to the sponsor. In the data, only hard freeze and termination of the plan are observable through the code in Form 5500 and Form 5500-SF.

Table 2 presents the results of cross-sectional analysis. For the plan-level analysis, the sample is restricted to plans active in the year preceding the PE buyout and excludes plans initiated post-buyout. The analysis uses a set of dummy variables as dependent variables, which are set to one if the plan is either terminated or frozen within one, three, and five years following the buyout, respectively. All analyses incorporate cohort-by-industry fixed effects, and standard errors are clustered at the firm level to account for potential within-firm correlations.

The first three columns of Table 2 present the plan-level results. The coefficient estimates

of PE buyout dummy are significantly positive, suggesting that compared to the control plans, the probability of PE-backed plans getting terminated or frozen is significantly higher compared to non-PE-backed plans following a buyout. More specifically, the coefficient estimates imply that the probability of termination or freeze for the PE-backed plans is 0.045 percentage point higher than the non-PE-backed plans within one year after the buyout. This disparity reaches 0.142 percentage points in the third column, suggesting a growing likelihood that PE-backed plans will be terminated or frozen within five years post-buyout.

As a firm may have multiple DB plans, after the PE buyout, the firm may choose to terminate or freeze multiple plans all together or one at a time. Plan-level analysis is not able to capture this effect. I aggregate the plan-level data to firm level. I construct a set of dummy variables that equal one when the firm terminates or freezes at least one plan within one, three, and five post-buyout years, respectively, and use them as the dependent variable. The regressions also consider the cohort-by-industry fixed effects, and the standard errors are clustered at firm level. In all three columns, I find that the coefficient estimates are significantly positive, meaning that the probability of PE-backed firms terminating or freezing at least one plan is higher than the non-PE-backed firms. The coefficient is 0.059 in the first year after the buyout and increases to 0.157 over the five years, which is similar to the plan level results.

The control variables reveal that the probability of terminating or freezing the DB plan is positively correlated to the number of plan participants, plan age, and the expense ratio, while being negatively correlated to the market value of the pension assets and number of DB plans. Interestingly, no significant results were found with the firm book value of assets or the total sales.

To explore the dynamics of the PE effect on DB plans termination or freeze year by year, I construct a stacked dataset and replace the *PEtreat* dummies with a set of year dummies (using year one year before the buyout as the base year) interacted with *PEtreat* dummies. The year-by-year coefficient plots are shown in Figure 1. The results suggest that the positive

effect of PE buyout on the probability of termination or freeze for the PE-backed plans is mainly driven by the effect in the first year, the second year and the fourth year after the buyout.

At the firm level, the results suggest that the coefficients in the first four years are statistically significant, meaning that effects are concentrated in the first four years after the buyout year. The plan-level and firm-level results also indicate that the effect on the decision of termination/freeze is not simply stemmed from the buyout event, but also comes from the later PE involvement.

To summarize, my analysis reveals that PE buyouts have a significant and positive impact on the likelihood of target firms terminating or freezing their DB plans. These plans often provide post-retirement benefits as a form of deferred compensation, but freezing or terminating the plan reduces the promised benefits and can result in lower labor costs for PE-backed firms, as noted by [Rauh, Stefanescu, and Zeldes \(2013\)](#). Together with the findings on the termination/freeze analysis, the results suggest a potential welfare damage to the employees after the PE buyout. Comparing to the control groups, the PE buyout leads to a higher probability of terminating/freezing the DB plans within the five years after the buyout. This indicates that the employees working at the PE-backed firms are more likely to lose their DB plans support.

6.2. PE and DC plans characteristics

Employers may provide benefits from DC plans or establish new DC plans to offset losses from modifications to DB plan participants. In both scenarios, employee benefits may not necessarily suffer. Thus, examining how a PE buyout impacts DC plans is crucial for assessing potential adverse effects on employee welfare post-buyout. To explore this, I compiled a dataset exclusively comprising firms that sponsor DB plans prior to the PE buyout.

The analysis employs a stacked DiD approach at both the plan and firm levels. The dependent variables include the natural logarithm of employer contributions, the natural

logarithm of participant numbers, the natural logarithm of employer’s contribution per participant, and the match ratio, which represents the proportion of employer contributions relative to employee contributions. The regression models incorporate cohort-by-plan (firm) fixed effects to account for time-invariant characteristics of the plans (firms) and cohort-by-industry-by-year fixed effects to adjust for industry trends over time. Standard errors are clustered at the firm level, and the regressions are weighted by the pension assets at the start of each cohort period.

The plan-level results are shown in Table 3. The result in column one shows that the employer’s contribution to other pension plans is negatively affected by the PE buyout. The coefficient estimates of -0.265 implies that the plan receives 26.5% less contribution after the PE buyout. The results in column two and three show that the number of participants and the employer’s contribution per employee are also negatively affected. The coefficient estimates imply that the number of employees decreases by 5.2% after the PE buyout, and the contribution per person decreases by 18.1%. Column four discusses the match ratio, showing a decrease of 5.1 percentage points post-buyout, which constitutes 11.4% of the sample median. The analysis indicates a concurrent negative impact on both DB and DC plans, meaning that even if the participants of DB plans get coverage from the existing DC plans, their benefits are likely to be negatively affected. The result on the participants shows a net effect on the number of participants, suggesting employees may lose their pension after the PE buyout.

The firm-level results are shown in the Table 4. I aggregate the plan-level data to the firm level. Since it is possible for employees to transfer between plans, the plan-level results might be driven by the within firm transfer. The firm-level analysis can capture the effect and provides more insight of how the pension is affected in general. The results are consistent with the plan-level results. The coefficient estimates of the interaction term imply that after the PE buyout the employer’s contribution, the number of participants, the employer’s contribution per employee, and the match ratio drop by approximately 33.9%, 11.4%, 23.7%

and 7.8 percentage points, respectively.

To test whether the PE-backed firms are more likely to establish a new non-DB plans after the PE buyout, I replace the dependent variable with a dummy variable that equals one when there is a new non-DB pension plan established within five years after the buyout. The result is presented in column five. Interestingly, the coefficient of estimates of $Post \times PE_{treat}$ is positive but not statistically significant. This result means that the PE-backed firms are not more likely to set up a new pension plans to cover the former DB plans' participants compared to the non-PE-backed firms.

The plan-level and firm-level results suggest that even if the firm provides the substitute coverage from the existing DC plans and other plans, it will not contribute as much as they did before the PE buyout. The declines of the contributions and match ratio indicate that the coverage from DC plans is not likely to be the back-up option for employees who lost benefits from DB plans. The decrease of the number of participants at both plan level and firm level also signal the potential layoff after the PE buyout. Given the observed negative impact on DC plans following a PE buyout, it seems improbable that employers would rely on DC plans to adequately compensate participants of affected DB plans. Consequently, these findings underscore the adverse effects on employee benefits resulting from PE buyouts.

6.3. PE and DB plan characteristics

While the termination/freeze analysis provides valuable insights into the impacts of PE buyout on DB plan management, it does not fully capture the effects on firms managing active DB plans, such as changes in actuarial assumptions or wage adjustments. Consequently, I have extended my examination to include the impacts of PE buyouts on actuarial assumptions and plan characteristics.

The Form 5500 data mandates that sponsors of DB plans disclose the discount rate used to compute the current Projected Benefit Obligation (PBO). These rates are listed as “effective interest rates” in the Form 5500 Schedule B/SB. The effective interest rate is

defined as the single rate that, when applied to the present value of future benefits, results in an amount equal to the funding target determined for the plan year, as per Code section 430(h)(2)(A).

In a DB plan, pledged benefits are estimated using a formula that considers employees' salary, tenure, age, and actuarial assumptions such as discount rates, mortality rates, and retirement age. The current PBO is calculated based on the segment rates determined by the Commissioner on the basis of the average of the monthly corporate bond yield curves for the 24-month period ending with the month preceding that month, considering the 5-year, 15-year, and 40-year benefits (Code section 430 (h)(2)(A)).¹⁶ According to Statement of Financial Accounting Standards (SFAS) 158, the projected benefit obligations can be matched in timing and amount with a portfolio of high-quality zero-coupon bonds, but the files provide no specific requirements for the yield curve or high-quality zero-coupon bonds used, giving firms some discretion in choosing their discount rates for the PBO.

Table 5 presents the results for the discount rate at the plan level. I exclude the plans that are terminated or frozen before the buyout year. The first column shows a parsimonious model that includes only the DiD term $PE_{treat} \times Post$ as the explanatory variable, while the remaining columns include the full set of controls. In first three columns, I include cohort-by-plan fixed effects and cohort-by-year fixed effects. In the last two columns, I replace the cohort-by-year fixed effects with cohort-by-industry-by-year fixed effects to control for the industry time trend. The regressions are weighted by the value actuarial pension assets at the beginning of the cohort time window. The standard deviations are clustered at the firm level.

Across all specifications, the coefficient on the DiD term $PE_{treat} \times Post$ is significantly positive, indicating that plans sponsored by PE-backed firms tend to have higher discount rates after the buyout year. For example, in column four, the coefficient estimate suggests that if a DB plan is sponsored by a PE-backed firm ($PE_{treat} = 1$), the discount rate will

¹⁶Definitions are available at [https://www.law.cornell.edu/cfr/text/26/1.430\(h\)\(2\)-1#d](https://www.law.cornell.edu/cfr/text/26/1.430(h)(2)-1#d)

increase by 0.130% after the buyout ($Post = 1$), which is 13% of the standard deviation of the discount rate in the sample.

In column five, I add a dummy variable that equals one when the plan is frozen in the year and zero otherwise. The coefficient of the dummy variable indicates that frozen plans tend to have higher discount rates compared to active plans, but the difference is not statistically significant. Additionally, I find that the discount rate is positively correlated with the expense ratio and the natural logarithm of the number of participants and the firm's book value of assets, while it is negatively correlated with the natural logarithm of the plan age, market value of pension assets, and total revenue.

Theoretically, higher discount rate should lead to lower PBO, while PBO can still increase each year due to employees' additional working years and higher salaries. The results of the effect of a PE buyout on PBO are shown in the Table 6. The sample is consistent with the one in Table 5. I control for cohort-by-plan fixed effects and cohort-by-industry by year fixed effects in all specifications. In the first column, I present the results on PBO, with the DiD term as the only independent variable. In subsequent columns, I add a full control set. I find negative and significant coefficients of the DiD term in all specifications, indicating that after the buyout, the DB plan sponsored by PE-backed firms tends to have a lower PBO. In column two, the coefficient estimate of the DiD term suggests that all else equal, when the DB plan is sponsored by a PE-backed firm, the PBO tends to drop by roughly 0.064 log points. I further add a dummy variable equal to one when the plan is frozen in a given year in column three, the discount rate in column four, and the natural logarithm of the number of participants in column five to control for the effects of these factors on PBO. The coefficient estimates become less significant in column three and four and insignificant in column five. This suggests that the drop in PBO cannot be explained by the less participants, the higher discount rate or the frozen status of the plan. Because the total PBO is a function of discount rate, number of participants, the expected salary growth, retirement age and mortality rate of the employees, the results imply that apart from the actuarial assumptions and the status

of the plan, the pension participants of DB plan may also experience layoffs, salary cut or slower salary growth after the buyout, which represents that employees' benefits are hurt by the PE buyout.

To see the dynamics of the PE effect on the discount rate and PBO, I replace the *PEtreat* dummies with a set of event year dummies (using the starting year of each cohort as the base year) interacted with *PEtreat* dummies. The year-by-year coefficient plots are shown in Figure 2. The panel A shows the coefficient plot of test on discount rate, while panel B shows the results on PBO. The results of panel A shows that the positive effect on the discount rate is driven by the effect in year one, three and six after the buyout, while the panel B shows that the negative effect on PBO is significant in year one, three and five after the buyout, which is consistent with the results from the discount rate. Besides, the negative effect is also significant in other years, meaning that the potential layoffs or salary cuts happen to the plan participants after the buyout. These graphs also indicate that there is no obvious pretrend before the buyout, which validate the parallel assumption of the DiD framework.

Table 7 presents the results on other plan characteristics, including the natural logarithm of the number of plan participants, market value of pension assets, funding ratio, and contribution. The empirical setups are similar to the ones in the previous tables. The frozen plan dummy variable, which indicates whether the plan is frozen or not in the given year, is included in even columns. The results indicate a significant and negative impact of the PE buyout on the number of plan participants, as evidenced by the statistically significant and negative coefficients of the DiD term in columns one and two, which include all control variables and fixed effects. The coefficient estimate suggests that, all else being equal, the number of plan participants decreases by 0.063 log points following the buyout. Given that plan sponsors cannot compel participants to exit the plan, this decline likely reflects layoffs post-buyout, aligning with findings reported by [Davis, Haltiwanger, Handley, Jarmin, Lerner, and Miranda \(2014\)](#).

Columns three and four focus on the natural logarithm of the market value of PA, where the DiD term’s coefficients are also statistically significant and negative. This indicates a decrease in the market value of pension assets post-buyout. For instance, in column three, the coefficient suggests that pension assets decline by 0.075 log points after the buyout. This decrease, coupled with similar reductions in the PBO, results in an unchanged funding ratio, as demonstrated in columns five and six.

Further analysis reveals that contributions from PE-backed employers decrease following the buyout. For example, the coefficient in column seven indicates a reduction in contributions by 0.222 log points post-buyout. In column eight, the addition of a frozen dummy variable shows that the decision to freeze the plan does not significantly alter these findings.

Overall, these results suggest that the PE buyout leads to a reduction in contributions received by the plan, potentially freeing up cash for the employer. This reduction in contributions is likely a contributing factor to the observed decrease in pension assets.

To explore the dynamics of the PE effect on the contribution received by plans, I replace the *PEtreat* dummies with a set of year dummies (using the starting year of each cohort as the base year) interacted with *PEtreat* dummies. The year-by-year coefficient plots are shown in Figure 3. The results suggest that the negative effect of PE buyout on the contribution is mainly driven by the effect in the third year and the fifth year after the buyout. The plot also shows that there is no obvious pre-trend before the buyout, which validates the parallel assumption for the DiD test.

Table 8 presents the firm-level analysis. The sample is constructed by aggregating plan-level data to the firm level. The results show that the PE buyout positively affects the firm-level average discount rate. Specifically, the coefficient estimate of the DiD term implies that the discount rate of the PE-backed firm will increase by 0.130% after the buyout, similar to the magnitude estimated at the plan level. Column two and three show that PE-backed firms have lower PBO after the buyout. I add discount rate as control variable in column three and add natural logarithm of the number of participants as control variable in column four.

The coefficients become smaller and insignificant in column four. This is consistent with the plan-level results and shows that the reason for the decrease of PBO is higher discount rate and less participants.

The results of PE buyout effect on other pension characteristics are shown in the Table 9. I find that, consistent with the plan-level results, the natural logarithm of the number of participants is negatively affected by the PE buyout, and the funding ratio is unchanged after the buyout for PE-backed firms, primarily driven by similar decreases in both PBO and pension assets, as the PE buyout negatively and significantly affect the market value of pension assets shown in column two. In column four, I also find that PE-backed firms contribute less after the buyout.

In summary, these results indicate that after the buyout, the PE-backed firms and their DB plans will have higher discount rates, less PBO, less pension assets, less pension participants, and less contribution. The reduction of contribution saves the cash payment to the DB plan, but it also reduces the pension assets. To maintain the existing funding ratio, companies set a higher discount rate and/or fire the pension participants to cut the liability. The findings are consistent with the literature (e.g., [Chu, Goldstein, Li, and Yu \(2020\)](#) and [Kisser, Kiff, and Soto \(2017\)](#)) that firm set higher discount rate to report less PBO and to contribute less to the pension plan. In this process, the reduction of contribution after the buyout provides the firm with higher financial slack and less required cash outflows. The reduction can also be seen as PE-backed firms taking additional debt from the DB plans, since the sponsor has to make up the shortage when DB plan assets are not able to distribute the promised benefits at employees' retirement. This later payment may introduce more risks from firm's operation to employees' retirement benefits. It could also apply for the help of Pension Benefit Guaranty Corporation (PBGC). After proving to PBGC that it cannot remain in business unless the plan is terminated, PBGC would take over the DB plan and pay the benefits with maximum limits, which could be less than the benefits promised

by the employer.¹⁷ In either scenario, the employees welfare can be potentially negatively affected.

6.4. PE and DB plan asset allocation

An assumption underlying concerns about post-retirement benefit security is that PE-backed firms may not manage pension plans effectively after a buyout. To investigate this assumption, I analyzed financial and asset allocation data from Form 5500 Schedule H and I to determine if asset allocation changed and if returns improved for DB plans sponsored by PE-backed firms after a buyout.

Table 10 presents the results of my analysis on asset management at the plan level. The dependent variables are the weights assigned to different asset categories, including safe assets, risky debt, equities, mutual funds, employer's securities and trust, and the rest of the assets, which mostly comprise real estate and other categories that have limited data availability. To account for potential confounding factors, I include cohort-by-plan and cohort-by-industry-by-year fixed effects in my analysis.

The results indicate that PE buyouts have negative and statistically significant effects on the weights assigned to safe assets and mutual funds, as shown in columns one and three. Conversely, the allocation to equities increases for DB plans sponsored by PE-backed firms, as demonstrated in column three. Specifically, the coefficient estimates of the DiD term in columns one and three indicate that DB plans sponsored by PE-backed firms reduce their weight on safe assets and mutual funds by 2.6% and 4.7%, respectively, while increasing their weight on equities by 3.2%. No significant effects are found in all other asset categories.

Table 11 presents the firm-level results of my analysis on the effect of PE buyouts on asset allocation. To aggregate the plan-level variables, I combine the data from all active and frozen plans to capture the overall impact of PE buyouts on the firms' asset allocation decisions. The dependent variables are the firm-level weights assigned to different asset

¹⁷The maximum limits are shown in <https://www.pbgc.gov/wr/benefits/guaranteed-benefits/maximum-guarantee>.

categories, and I find that, consistent with the plan-level results, PE-backed firms increase their allocation to equities and decrease their allocation to mutual funds after the buyout. Specifically, the coefficients indicate that equity weight increases by 3.2 percentage points, while safe assets weight decreases by 2.4 percentage points and mutual funds weight decreases by 3.4 percentage points. This result suggests that PE-backed firms tend to replace mutual fund investment with equity investment following the buyout. However, I do not find any significant effects of PE buyout on the weights assigned to risky debt or trust. Overall, my results suggest that DB plans sponsored by PE-backed firms tend to take on more risk by increasing their allocation to equities.

In Table 12, I present the results on realized returns at both plan level and firm level. The realized returns are computed as Equation 1 and Equation 2. Apart from the control variables in the previous tables, I further add the lagged weights on each asset as the control variables. The empirical setups are similar to the ones in the previous tables. In all specifications, I do not find significant coefficient of the DiD term. The results suggest that the net-of-fee return on pension assets of PE backed plans and firms are not improved after the buyout. The higher risk taken by these plans found in Table 10 and Table 11 does not translate to better investment performance.

The findings suggest that after a PE buyout, pension assets are managed more aggressively, but the returns are not significantly improved. This result implies that the shift towards more risky investments does not necessarily lead to higher returns, which may have negative implications for pension plan beneficiaries. Furthermore, the results also indicate that the reduction of contribution is not made up by better investment performance. The reason for unaffected funding ratio with less contribution is that PE-backed firms raise the discount rate to cut the PBO at the same time. However, since the pension asset is less, the ability to pay the benefits is deteriorating. This may cause managers to take more risks by increasing the allocation to equities in an attempt to reduce the concern, even though this approach does not appear to be effective in increasing realized returns. And when pension

assets are invested in higher-risk assets, post-retirement benefits are exposed to greater risks, which can lead to not only bondholders but also employees shouldering the costs.

6.5. Comparison of PE effect and M&A effect

The business model of PE firms is to acquire the target firms with leverage, and create value through operating performance improvements (Palepu (1990)). Since both PE and mergers and acquisitions (M&A) start with acquiring the target firm, one following question could be whether the impact of PE buyout is different from the impact of M&A. I identify the M&A deals from Pitchbook dataset and remove the firms that are involved in both M&A deals and PE deals. To compare the impact of the PE buyout and M&A on the decision of termination/freeze, I add one dummy variable equal to one when the firms is the target of the M&A. The firms that are target of M&A deals within six years after the PE buyout are excluded from the sample. The results are presented in Table 13. The empirical strategy is the same as the one in Table 2. I add one dummy variable that equal to one when the firm is the target of the M&A deal. Similar to Pontiff, Shleifer, and Weisbach (1990), I find that the M&A deals have positive impact on the probability of terminating/freezing the DB plan after the event year. However, the magnitudes of the coefficients are smaller than the coefficients of PE buyout. According to the F-test results presented in the last row of the table, the PE buyout effect is statistically different from the M&A effect within the five years after the event year. The results suggest that the impact of PE buyout is more aggressive in terminating/freezing the DB plans than M&A deals.

To examine the difference of the impact of PE buyout and M&A deals on pension characteristics, I add the interaction term of *Post* and *MAtreat*, and repeat the tests in the previous section. The results are shown in Table 14. At the plan level, I find that M&A deals have negative impact on the pension’s assets, contribution and funding ratio, similar to the findings of Bergstresser, Desai, and Rauh (2006). However, I do not find any statistically significant impact of M&A deals on discount rate, PBO or number of participants. The

F-tests between the coefficients of $Post \times PE_{treat}$ and of $Post \times MA_{treat}$ suggest that the impacts of PE buyout on discount rate, PBO, funding ratio and contribution are statistically different from the M&A deals, and the magnitudes of PE effect is greater than the M&A effect. The firm level results are consistent with the plan-level findings. The results echo the findings in the previous section that PE firms are more aggressive about managing the DB plans of the target firms' employees.

The plan-level results of the comparison between PE buyout and M&A effects on asset allocations is presented in Table 15. I find that the M&A deals have positive impact on weights of safe assets, but negative impact on weights of risky debt. More specifically, the coefficients estimates in plan-level results indicate that after the buyout year, the weights of safe assets increase by 3.3 percentage points and the weights of risky debt drop by 1.9 percentage points. The firm-level results, which are unreported for brevity, show similar impact. I compare the coefficients between M&A deals and PE buyouts with F-test shown in the last row in both tables. The plan-level and firm-level F-test results both show the impact on asset allocations are statistically different between PE buyout and M&A deals in the weights of safe assets, risky debt and equity. The comparison depict that after the buyout, the target firms of PE deals tend to increase the risks of the DB plans investment, while the target firms of M&A deals tend to decrease the risks. Concerning the realized returns, I do not find any significant impact of M&A deals.

In summary, PE buyout and M&A deals both have qualitatively similar effects on the plans' termination/freeze, but the PE buyout effect is bigger. The comparison in pension characteristics and asset allocation reveal that PE buyout are more aggressive in managing the DB plans after the acquisition than M&A deals, including using higher discount rate, reducing more contribution and taking more investment risks.

CHAPTER 7. ROBUSTNESS

In this section, I conduct several robustness checks.

7.1. Mahalanobis distance matching

Identifying the PE buyout effect is complicated by the endogenous selection of buyout targets by PE firms. The previous findings may be due to differences between the PE-acquired firms and the control firms.

I first examine which variables can predict a PE buyout. I perform a cross-sectional regression where the dependent variable is a dummy equal to one if the firm is acquired by a PE firm. The independent variables include plan-related and firm-related variables before the buyout year, such as the average expense ratio, average funding ratio, natural logarithm of the average number of participants, average plan age, average pension assets, average firm assets, and average sales.

The results are presented in Table [A.2](#). In both columns, I include cohort fixed effects to account for the impact of different buyout years. The findings suggest that PE firms tend to select target firms with a higher number of participants, younger plans, lower funding ratios, and higher sales before the buyout. These results indicate that the PE buyout decision is influenced by pension-related variables, which may introduce biases in the main analyses.

To address this concern, I perform Mahalanobis-distance-based 1-to-1 matching to alleviate observable disparities between treated firms and control firms.¹⁸ I initially partition the entire sample into cohorts and industries, and conduct the matching for the firms using variables including expense ratio, natural logarithm of plan age, PA, PBO, number of participants, and the firms' total assets and sales in the year before the buyout. I manage to match 1,158 firms, and Table [A.3](#) presents the summary of both the PE-acquired firms

¹⁸Recent financial studies using this matching approach include [Bennett, Stulz, and Wang \(2020\)](#) and [Bai and Wu \(2023\)](#).

and the matched control firms. The comparison shows that there is no significant difference between the PE target firms and the control group.

I repeat the tests using the matched sample and the results are shown in the Table [A.4](#), [A.5](#), [A.6](#), [A.7](#), and [A.8](#). The coefficient estimates are similar to the baseline results, meaning that the findings are not driven by (observable) differences between the PE-acquired firms and the control firms.

7.2. Entropy balancing

Entropy balancing is proposed by [Hainmueller \(2012\)](#) and [Zhao and Percival \(2016\)](#). This method uses the concept of information entropy to construct weights for each observation in the sample, such that the weighted distributions of covariates in the treatment and control groups become more similar. In other words, by reweighting the observations, the mean, the variance, and skewness become closer between the treatment and control group.

I repeat the tests in the previous sections with the entropy balancing weights computed using the software developed by [Hainmueller and Xu \(2013\)](#). I use only the data in year $t - 1$ and generate the entropy balancing weight by cohort. I set the constraints based on mean and the variance of the sample. The results of the termination and freeze are presented in Table [A.9](#). The results with entropy balancing weight are consistent with the main findings that the PE buyout increases the probability of plan getting terminated or frozen and the probability of firm terminating or freezing its DB plan.

The plan-level results are shown in Table [A.10](#), and the firm-level results are presented in Table [A.11](#). The results are consistent with the findings in previous sections, that PE-backed plans tend to use higher discount rate, have lower PBO after the buyout, less participants, less pension assets, and receive less contribution from the employer.

The results on the asset allocation at plan level is shown in Table [A.12](#), while the results at the firm level are shown in Table [A.13](#). With entropy balanced samples, I do not find any significant results regarding the allocation on safe assets and risky debt at both plan level and

firm level. However, consistent with the previous finding, I observe a significantly positive effect on the equity held by the pension. The coefficient estimates suggest that with the entropy balanced sample, the weight on equity increases for both PE-backed plan and firm by approximately 2.4 percentage point, which is roughly 18% of the sample mean. And this discovery imply that the risk taken by the pension fund is higher after the PE buyout. The result in column four imply that the weight on mutual fund is decreasing by 2.6 percentage point at the plan level, and 5.8 percentage point at the firm level. In column six of both Table [A.12](#) and Table [A.13](#), I find that the fund allocated to employers' properties and stocks is increasing after the buyout at both plan and firm level. The coefficient estimates are small at both plan and firm level. I do not find any evidence showing that the performance of the pension assets investment improves after the PE buyout.

In sum, the results with entropy balanced samples confirm the robustness of my findings in the previous section.

7.3. Time window

I repeat the tests in the previous section with various time window, including four years and five years before and after the buyout year. The results are consistent with the previous findings, and therefore not tabulated.

CHAPTER 8. CONCLUSION

The literature on PE buyouts continues to debate on whether the PE buyout harms the employees or not. While buyouts can bring benefits such as new job opportunities, better working conditions, and safer working environments, they can also result in layoffs, reduced compensation, and worse work-life balance for employees. This paper helps answer this question by investigating whether employees suffer from PE buyouts. The study utilizes a stacked difference-in-difference framework and Form 5500 and Pitchbook data to investigate whether employees suffer from the PE buyout through looking at the DB plan, which is a deferred compensation for employees' human capital.

The empirical results of the study reveal that PE-backed firms are more likely to freeze their DB plans, and this effect is observed at both the plan and firm levels. Meanwhile, the existing DC plans experience adverse impacts stemming from PE buyouts, manifesting in lower employers' contributions, lower contributions per participants, and a lower match ratio. Furthermore, I find that after the buyout, PE-backed firms are more likely to have higher discount rates, lower PBOs, lower pension assets, and lower contributions, but the funding ratio remains unchanged. Regarding asset allocation, the results show that PE-backed firms, at both the plan and firm levels, reduce their allocation to mutual funds but increase their weight on equity, but there is no evidence that the investment returns are improved accordingly. Notably, PE-backed firms do not display a proclivity for establishing new DC plans to accommodate former DB plan participants.

In general, the results show that PE firms may use their control over target firms to reduce cash flows to the pension and increase financial slack, potentially detrimental to employee welfare. To mask the weakness of pension plans caused by the reduction, they may adjust the pension actuarial assumptions and other characteristics, although this approach carries risks for employees' post-retirement benefits. The results also suggest that PE financial returns are partly derived from the welfare transferred from employees, including post-retirement

benefits. Therefore, it is essential to establish regulations and oversight mechanisms that safeguard the interests of employees after PE buyouts.

Table 1: **Summary statistics**

This table shows the summary statistics (mean, standard deviation, the 25th, 50th, and 75th percentiles, and the number of observations) of variables at the plan-year level. It covers 30,774 DB plans in the U.S. Panel A presents the plan-level fundamental variables of the DB plans from the Form 5500/Form 5500-SF, Schedule B/SB and Schedule H/I, and Panel B describe the firm-level variables. Variable definitions are provided in Table A.1. All dollar terms are expressed in the year 2000 dollars.

Panel A. Summary statistics at the plan level						
	mean	sd	p25	p50	p75	count
p(T/F)	0.049	0.217	0.000	0.000	0.000	251,547
p(F)	0.045	0.207	0.000	0.000	0.000	251,547
p(T)	0.006	0.080	0.000	0.000	0.000	251,547
Dis.Rate	4.195	1.041	3.456	4.141	5.010	244,002
LogNPartcp	4.010	2.414	1.946	3.761	5.684	243,456
LogONPartcp	5.873	2.339	4.820	5.872	7.448	780,538
LogPA	14.785	2.135	13.275	14.366	16.055	243,850
LogPBO	14.724	2.151	13.195	14.297	16.035	243,226
LogPlanAge	37.632	18.104	25.000	38.000	50.000	90,051
LogTA	6.458	4.788	2.330	5.872	10.148	56,351
LogSales	5.896	4.721	1.957	5.024	9.122	50,305
FundRatio	1.119	0.377	0.903	1.051	1.239	243,216
ExpRatio	0.002	0.005	0.000	0.000	0.003	218,645
LogContri	12.417	1.922	11.230	12.144	13.394	224,324
LogOCont	13.321	2.158	11.813	13.112	14.835	657,624
LogOContPP	7.418	1.524	6.531	7.378	8.305	621,854
MatchRatio	0.550	0.387	0.291	0.446	0.712	331,122
SafeAssets	0.109	0.200	0.000	0.018	0.132	104,496
Equity	0.136	0.218	0.000	0.000	0.233	104,496
RiskyDebt	0.052	0.105	0.000	0.000	0.064	104,496
MutualFunds	0.327	0.382	0.000	0.112	0.701	104,496
Trust	0.476	0.443	0.000	0.406	0.971	104,496
R1	0.073	0.094	0.013	0.078	0.129	101,770
R2	0.070	0.085	0.012	0.076	0.126	103,786

Panel B. Summary statistics at the firm level

	mean	sd	p25	p50	p75	count
Pr(T/F)	0.050	0.218	0.000	0.000	0.000	185,367
Pr(F)	0.047	0.211	0.000	0.000	0.000	185,367
Pr(T)	0.005	0.073	0.000	0.000	0.000	185,367
Dis.Rate	4.180	1.037	3.435	4.131	4.998	218,930
LogPartcp	3.879	2.424	1.792	3.497	5.568	218,888
LogPA	14.712	2.144	13.211	14.261	15.933	218,938
LogPBO	14.644	2.160	13.124	14.181	15.909	218,620
LogPlanAge	23.574	20.266	6.000	15.000	41.000	154,823
LogTA	8.032	5.212	3.783	7.874	12.758	49,192
LogSales	7.615	5.351	3.158	7.213	12.890	42,938
FundRatio	1.125	0.374	0.908	1.057	1.247	218,620
ExpRatio	0.002	0.004	0.000	0.000	0.002	197,081
LogContri	12.424	1.856	11.274	12.147	13.328	168,224
SafeAssets	0.121	0.202	0.001	0.029	0.161	59,072
Equity	0.149	0.226	0.000	0.000	0.278	59,072
RiskyDebt	0.057	0.113	0.000	0.000	0.078	59,072
MutualFunds	0.319	0.371	0.000	0.120	0.657	59,072
Trust	0.417	0.433	0.000	0.215	0.940	59,072
R1	0.051	0.103	-0.008	0.055	0.109	59,072
R2	0.048	0.094	-0.011	0.052	0.106	59,072

Table 2: Cross-sectional results of PE buyout on termination or freeze of a DB plan

This table reports the results of cross-sectional regressions on the effects of PE buyout on termination and freeze decisions at the plan level and firm level. The dependent variables are the dummy variables that equal to one when the plan is terminated or frozen within one year, three years or five years after the buyout the year. Variable definitions are provided in Table A.1. The time period is from 2004 to 2020. The regression contains the cohort-by-industry fixed effects, and standard errors are clustered at firm level. t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Plan level			Firm level		
	(1)	(2)	(3)	(4)	(5)	(6)
	T/F1Y	T/F3Y	T/F5Y	T/F1Y	T/F3Y	T/F5Y
PEtreat	0.045** (2.16)	0.113*** (3.38)	0.142*** (3.49)	0.059** (2.54)	0.132*** (3.72)	0.157*** (3.90)
LogPartcpt _{t-1}	0.005** (2.55)	0.010** (2.24)	0.013* (1.81)	0.005** (2.41)	0.011** (2.17)	0.017** (2.08)
LogPA _{t-1}	-0.011*** (-6.38)	-0.026*** (-6.36)	-0.039*** (-5.98)	-0.012*** (-6.29)	-0.029*** (-6.32)	-0.048*** (-6.56)
LogPlanAge	0.006*** (3.21)	0.017*** (4.02)	0.027*** (3.99)	0.011*** (6.65)	0.026*** (5.80)	0.040*** (5.63)
ExpRatio _{t-1}	0.800*** (3.27)	1.495*** (2.63)	1.615* (1.88)	0.750*** (2.92)	1.460** (2.45)	1.268 (1.41)
LogSales _{t-1}	0.000 (0.34)	-0.000 (-0.30)	-0.001 (-0.53)	-0.001 (-0.86)	-0.001 (-0.66)	0.000 (0.12)
LogTA _{t-1}	-0.000 (-0.28)	0.001 (0.48)	0.002 (0.95)	0.001 (0.74)	0.001 (0.45)	0.000 (0.11)
LogNPlan				-0.008* (-1.84)	-0.034*** (-3.35)	-0.067*** (-4.32)
Constant	0.171*** (8.83)	0.420*** (9.04)	0.660*** (9.04)	0.168*** (7.92)	0.441*** (8.60)	0.759*** (9.38)
Observations	35417	31748	27729	29126	26341	23241
Within R^2	0.005	0.012	0.018	0.006	0.015	0.025
Cohort×Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table 3: PE buyout and DC plans' characteristics at the plan level

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on the employer's contribution, the employer's contribution per person, the number of participants, matching ratio, and establishment of new DC plans. The dependent variables are the dummy variables that equal to one when the plan is established within six years after the buyout the year, and the natural logarithm of employer's contribution, number of participants of other plans, the employer's contribution per person, and the ratio of employer's contribution to the employee's contribution at the plan level. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. The regressions contain the cohort-by-industry-by-year fixed effects and cohort-by-plan fixed effects, and standard errors are clustered at firm level. t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort.

Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)
	LogCCont	LogCNPartcp	LogCContPP	MatchRatio
Post $\times$ PEtreat	-0.265** (-2.14)	-0.052** (-2.30)	-0.181** (-2.23)	-0.051** (-2.19)
LogPlanAge	0.163 (0.83)	0.083 (1.29)	-0.077 (-0.79)	-0.014 (-0.31)
ExpRatio _{t-1}	0.708*** (2.80)	-0.079* (-1.79)	0.779*** (2.86)	0.435 (1.39)
LogTA _{t-1}	-0.005 (-0.27)	0.010*** (2.75)	-0.008 (-0.57)	0.002 (0.62)
LogSales _{t-1}	0.003 (0.23)	-0.008** (-2.00)	0.001 (0.10)	-0.006** (-2.01)
Constant	16.049*** (23.73)	9.371*** (40.85)	7.653*** (22.37)	0.611*** (4.14)
Observations	656739	780538	620999	330443
Within R^2	0.001	0.003	0.001	0.002
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Table 4: PE buyout and DC plans' characteristics and new establishment at the firm level

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on the employer's contribution, the employer's contribution per person, the number of participants, matching ratio, and establishment of new DC plans. The dependent variables are the dummy variables that equal to one when the plan is established within six years after the buyout the year, and the natural logarithm of employer's contribution, number of participants of other plans, the employer's contribution per person, and the ratio of employer's contribution to the employee's contribution at the plan level. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. The regressions contain the cohort-by-industry-by-year fixed effects and cohort-by-plan fixed effects, and standard errors are clustered at firm level. t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort.

Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	LogCCont	LogCNPartcp	LogCContPP	MatchRatio	NewDC
Post $\times$ PEtreat	-0.339*** (-3.21)	-0.114* (-1.66)	-0.237*** (-2.92)	-0.078* (-1.88)	0.067 (1.39)
LogAge	0.113 (1.39)	0.005 (0.11)	-0.055 (-0.72)	0.048 (1.60)	-0.130*** (-4.02)
ExpRatio _{t-1}	17.481** (2.46)	5.528*** (2.82)	24.606*** (5.34)	5.940*** (2.90)	3.329** (2.14)
LogTA _{t-1}	-0.018 (-0.97)	-0.005 (-1.15)	-0.002 (-0.13)	-0.006 (-1.22)	-0.008** (-2.11)
LogSales _{t-1}	0.028 (1.57)	-0.002 (-0.41)	0.010 (0.77)	0.007 (1.25)	-0.002 (-0.43)
LogNPartcp _{t-1}					-0.009 (-1.25)
LogPA _{t-1}					0.019*** (4.15)
Constant	16.556*** (60.93)	8.365*** (53.98)	7.440*** (29.76)	0.523*** (5.20)	0.637*** (4.65)
Observations	547497	447207	471541	320868	471541
Within R^2	0.006	0.003	0.009	0.004	0.020
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Firm FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Table 5: PE buyout and discount rate at the plan level

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on discount rate for computing PBO at the plan level. The dependent variables are the discount rate in percentage point in the year t . Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	Dis.Rate	Dis.Rate	Dis.Rate	Dis.Rate	Dis.Rate
Post $\times$ PEtreat	0.127** (2.10)	0.129** (2.19)	0.152** (2.42)	0.130*** (2.80)	0.131*** (2.87)
LogNPartcp _{t-1}		0.033 (1.52)	0.020 (0.79)	0.049* (1.68)	0.052* (1.81)
LogPA _{t-1}		-0.034** (-2.18)	-0.042*** (-2.88)	-0.062*** (-3.49)	-0.062*** (-3.45)
LogPlanAge		-0.065 (-1.37)	-0.181 (-1.36)	-0.084** (-1.98)	-0.085** (-1.99)
ExpRatio _{t-1}		-2.149 (-1.01)	-2.094 (-0.66)	1.827 (0.73)	1.441 (0.58)
LogTA _{t-1}			0.003 (0.53)	0.005 (1.01)	0.005 (0.99)
LogSales _{t-1}			-0.007 (-1.29)	-0.011** (-2.50)	-0.011** (-2.48)
D(Frozen)					0.070** (2.08)
Constant	4.382*** (14695.92)	5.010*** (13.17)	5.701*** (8.36)	5.434*** (13.19)	5.401*** (13.03)
Observations	1876027	1873843	329433	308185	308185
Within R^2	0.000	0.002	0.005	0.007	0.008
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Year FE	Yes	Yes	Yes	No	No
Cohort $\times$ Ind $\times$ Year FE	No	No	No	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes

Table 6: PE buyout and PBO at the plan level

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on PBO at the plan level. The dependent variables are the natural logarithm of PBO in the year t . Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	LogPBO	LogPBO	LogPBO	LogPBO	LogPBO
Post $\times$ PEtreat	-0.050** (-2.15)	-0.064** (-2.50)	-0.057** (-2.21)	-0.046* (-1.95)	-0.035 (-1.59)
LogPlanAge		0.037 (1.01)	0.038 (1.02)	0.028 (0.72)	0.039 (1.06)
ExpRatio _{t-1}		-8.495*** (-2.70)	-8.032** (-2.51)	-7.856** (-2.44)	-7.362** (-2.46)
LogTA _{t-1}		0.002 (0.57)	0.002 (0.52)	0.003 (0.68)	0.001 (0.36)
LogSales _{t-1}		-0.000 (-0.03)	-0.000 (-0.04)	-0.002 (-0.33)	-0.001 (-0.26)
D(Frozen)			-0.051** (-2.35)	-0.042** (-2.14)	-0.028 (-1.47)
Dis.Rate				-0.127** (-2.18)	-0.128** (-2.20)
LogNPartcp _{t-1}					0.320*** (3.19)
Constant	20.166*** (150081.01)	20.219*** (139.67)	20.216*** (138.21)	20.807*** (59.72)	17.704*** (16.36)
Observations	1737220	308182	304694	304426	304426
Within R^2	0.000	0.002	0.002	0.014	0.031
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Table 8: PE buyout and pension discount rate and PBO at the firm level

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on pension characteristics at the firm level. The dependent variables are the discount rate and natural logarithms of PBO in the year t . Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)
	Dis.Rate	LogPBO	LogPBO	LogPBO
Post $\times$ PEtreat	0.130** (2.44)	-0.076** (-2.17)	-0.056* (-1.87)	-0.043 (-1.49)
LogNPartcp _{t-1}	-0.065* (-1.65)			0.306*** (5.21)
LogPA _{t-1}	0.119*** (3.73)			
ExpRatio _{t-1}	3.505** (2.22)	-11.401*** (-3.03)	-10.766*** (-2.96)	-10.086*** (-2.83)
LogPlanAge	-0.021 (-0.66)	0.059** (2.53)	0.054** (2.37)	0.051** (2.55)
LogTA _{t-1}	0.009* (1.70)	0.005 (0.62)	0.007 (0.89)	0.005 (0.61)
LogSales _{t-1}	-0.010** (-2.06)	-0.006 (-1.04)	-0.009 (-1.34)	-0.008 (-1.13)
Dis.Rate			-0.148** (-2.33)	-0.151** (-2.37)
Constant	2.620*** (6.05)	20.268*** (213.85)	20.921*** (78.17)	17.974*** (27.64)
Observations	196767	202792	201109	201109
Within R^2	0.004	0.003	0.017	0.040
Cohort $\times$ Firm FE	Yes	Yes	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Table 9: PE buyout and pension characteristics at the firm level

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on pension characteristics at the firm level. The dependent variables are the plan characteristics including the funding ratio, and natural logarithms of PA, number of participants and contributions made by employer in the year t . Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)
	LogNPartcp	LogPA	FundRatio	LogContri
Post $\times$ PEtreat	-0.045*	-0.102**	0.048	-0.297*
	(-1.80)	(-2.55)	(1.06)	(-1.85)
ExpRatio _{t-1}	-6.473***	-15.632***	-6.801***	24.223**
	(-3.98)	(-4.27)	(-4.46)	(2.58)
LogPlanAge	0.014	0.057**	0.011	0.157
	(0.62)	(2.11)	(0.57)	(0.97)
LogTA _{t-1}	0.001	0.002	0.003	0.000
	(0.56)	(0.25)	(0.87)	(0.01)
LogSales _{t-1}	0.001	-0.005	-0.002	-0.025
	(0.32)	(-0.85)	(-0.54)	(-1.15)
Constant	9.674***	20.412***	1.104***	16.718***
	(109.39)	(190.99)	(15.91)	(30.63)
Observations	205113	204977	205113	164061
Within R^2	0.007	0.006	0.006	0.003
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes
Cohort $\times$ Firm FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Table 10: PE buyout and pension asset allocation at the plan level

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on pension asset allocation at the plan level. The dependent variables are the weights allocated to safe assets, risky debt, equities, mutual funds, and trust in the year t , respectively, together with realized returns. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	SafeAssets	RiskyDebt	Equity	MutualFunds	Trust
Post $\times$ PEtreat	-0.026** (-2.11)	-0.014 (-1.22)	0.033* (1.85)	-0.051* (-1.77)	0.074 (1.40)
LogNPartcp _{t-1}	0.001 (0.36)	0.005** (1.99)	0.004* (1.90)	0.059*** (7.78)	-0.045*** (-6.40)
ExpRatio _{t-1}	0.291 (1.11)	-2.235*** (-7.44)	0.512 (1.64)	-3.280*** (-8.13)	-1.788** (-2.23)
LogPA _{t-1}	0.000 (0.62)	-0.005*** (-7.49)	-0.002** (-2.46)	0.003*** (2.59)	0.006*** (2.83)
LogPlanAge	-0.006 (-1.31)	-0.029*** (-4.68)	-0.000 (-0.06)	-0.022*** (-3.28)	0.058*** (3.79)
LogTA _{t-1}	0.001*** (4.30)	-0.000 (-0.02)	0.000 (0.54)	-0.004*** (-4.54)	-0.003** (-2.35)
LogSales _{t-1}	-0.001** (-2.23)	0.001*** (3.24)	0.001 (1.27)	0.002** (2.37)	-0.000 (-0.06)
Constant	0.068*** (2.73)	0.220*** (6.28)	0.130*** (3.66)	-0.372*** (-5.04)	0.705*** (7.40)
Observations	252188	252188	252188	169353	252430
Within R^2	0.001	0.012	0.001	0.006	0.006
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Table 11: PE buyout and pension asset allocation at the firm level

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on pension asset allocation at the firm level. The dependent variables are the weights allocated to safe assets, risky debt, equities, mutual funds, and trust in the year t , respectively. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	SafeAssets	RiskyDebt	Equity	MutualFunds	Trust
Post $\times$ PEtreat	-0.024*	-0.000	0.032*	-0.034**	0.079
	(-1.70)	(-0.02)	(1.81)	(-2.16)	(1.37)
LogNPartcp _{t-1}	-0.006	0.008	0.014**	-0.005	-0.042***
	(-1.21)	(1.49)	(2.43)	(-1.03)	(-3.03)
ExpRatio _{t-1}	0.112	-1.291	1.060	-1.586**	-2.379
	(0.13)	(-1.12)	(1.04)	(-2.56)	(-0.97)
LogPlanAge	0.000	0.002	0.010	0.008	-0.023
	(0.01)	(0.27)	(0.97)	(0.69)	(-0.68)
LogPA _{t-1}	0.002	-0.003	-0.005**	0.003	0.009
	(1.10)	(-1.27)	(-2.16)	(1.37)	(1.18)
LogTA _{t-1}	0.001	-0.002	-0.001	-0.004*	-0.001
	(1.23)	(-1.51)	(-0.50)	(-1.85)	(-0.25)
LogSales _{t-1}	0.000	0.004**	0.002	0.003	-0.005
	(0.43)	(2.05)	(1.24)	(1.38)	(-0.98)
Constant	0.085	0.025	0.032	0.023	1.027***
	(1.03)	(0.38)	(0.45)	(0.37)	(4.94)
Observations	141094	156594	156594	156594	156594
Within R^2	0.002	0.005	0.004	0.002	0.008
Cohort $\times$ Firm FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Table 12: PE buyout and realized return on pension assets

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout on realized returns on pension assets. The dependent variables are the realized returns in the year t , defined as Equations 1 and 2, respectively. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Plan level		Firm level	
	(1)	(2)	(3)	(4)
	R1	R2	R1	R2
Post $\times$ PEtreat	0.008 (0.70)	0.008 (1.03)	0.004 (0.34)	0.006 (0.86)
LogNPartcp _{t-1}	-0.002 (-1.22)	-0.002* (-1.71)	0.002 (1.35)	0.002 (1.59)
ExpRatio _{t-1}	0.865*** (4.05)	0.819*** (4.92)	1.186*** (4.76)	1.196*** (6.19)
LogPlanAge	0.004 (1.42)	-0.001 (-0.65)	0.014*** (5.95)	0.007*** (3.43)
LogPA _{t-1}	0.008*** (3.61)	0.001** (2.35)	0.001** (2.17)	0.000 (0.71)
Equity _{t-1}	-0.008 (-1.38)	-0.001 (-0.23)	-0.012*** (-4.24)	0.003 (1.29)
Trust _{t-1}	-0.002 (-0.62)	0.005 (1.58)	-0.008*** (-2.90)	0.001 (0.30)
SafeAssets _{t-1}	0.016* (1.81)	0.007 (0.88)	0.041*** (6.46)	0.008 (1.55)
RiskyDebt _{t-1}	0.011 (1.35)	0.006 (0.86)	0.008 (0.90)	-0.014** (-2.30)
MutualFunds _{t-1}	-0.010*** (-2.80)	-0.001 (-0.28)	-0.001 (-0.48)	0.002 (0.99)
Emplr _{t-1}	-0.076 (-1.62)	-0.043 (-1.51)	-0.161*** (-3.16)	-0.223*** (-5.56)
LogTA _{t-1}	-0.000 (-0.21)	0.000 (0.92)	0.000 (0.61)	0.001 (1.60)
LogSales _{t-1}	-0.001* (-1.94)	-0.000* (-1.89)	-0.001** (-2.08)	-0.001* (-1.88)
Constant	-0.076** (-2.20)	0.061*** (4.31)	-0.024 (-1.13)	0.004 (0.25)
Observations	252133	251964	155624	155624
Within R^2	0.004	0.001	0.008	0.009
Cohort $\times$ Plan FE	Yes	Yes	No	No
Cohort $\times$ Firm FE	No	No	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Table 13: Comparison between the effects of PE and M&A on decision of termination/freeze

This table reports the results of comparison between the effects of PE and M&A on decision of termination/freeze. The dependent variables are the same as Table 2. The time period is from 2004 to 2020. The regressions contain the cohort-by-industry fixed effects, and standard errors are clustered at firm level. The last row of the table presents the p-value of F-test between the coefficients of PE_{treat} and MA_{treat} . t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Plan level			Firm level		
	(1) T/F1Y	(2) T/F3Y	(3) T/F5Y	(4) T/F1Y	(5) T/F3Y	(6) T/F5Y
PE _{treat}	0.050** (2.30)	0.127*** (3.59)	0.164*** (3.93)	0.073*** (3.39)	0.149*** (4.66)	0.156*** (4.28)
MA _{treat}	0.042** (1.99)	0.064** (2.04)	0.070* (1.88)	0.034* (1.84)	0.064** (2.31)	0.065* (1.91)
LogNPartcp _{t-1}	0.005*** (2.76)	0.012** (2.54)	0.012* (1.69)	0.005** (2.25)	0.010** (2.02)	0.016* (1.95)
LogPA _{t-1}	-0.011*** (-6.54)	-0.027*** (-6.63)	-0.039*** (-5.88)	-0.012*** (-6.32)	-0.028*** (-6.27)	-0.047*** (-6.54)
LogPlanAge	0.006*** (3.19)	0.018*** (4.13)	0.030*** (4.31)	0.012*** (6.96)	0.026*** (5.99)	0.040*** (5.74)
ExpRatio _{t-1}	0.908*** (3.60)	1.676*** (2.88)	1.757** (2.00)	0.706*** (2.77)	1.437** (2.43)	1.260 (1.42)
LogSales _{t-1}	0.000 (0.42)	-0.000 (-0.10)	-0.001 (-0.47)	-0.001 (-0.85)	-0.001 (-0.71)	0.000 (0.05)
LogTA _{t-1}	-0.000 (-0.15)	0.001 (0.39)	0.002 (1.15)	0.001 (0.67)	0.001 (0.46)	0.000 (0.16)
LogNPlan				-0.007 (-1.53)	-0.033*** (-3.29)	-0.066*** (-4.33)
Constant	0.172*** (8.72)	0.422*** (8.99)	0.643*** (8.73)	0.169*** (7.97)	0.437*** (8.59)	0.756*** (9.40)
Observations	33783	30221	27041	29474	26668	23540
Within R^2	0.006	0.014	0.020	0.006	0.016	0.025
Cohort×Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
p(PE=MA)	0.809	0.184	0.093*	0.180	0.044**	0.065*

Table 14: Comparison between the impact of PE buyout and impact of M&A deals on plan-level pension characteristics

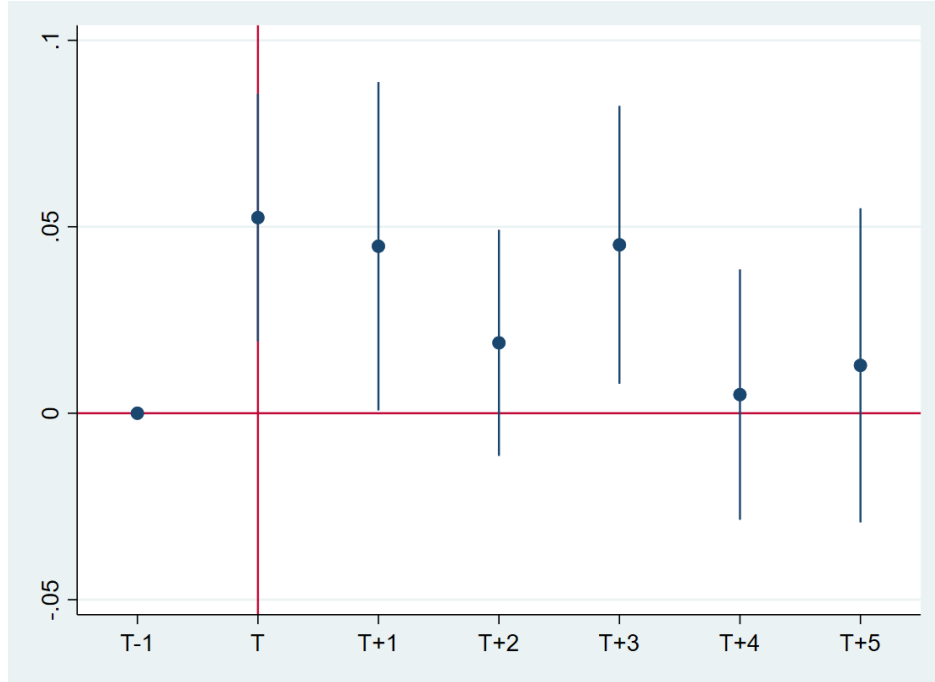
This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout and the effects of M&A deals on pension characteristics at the plan level. The dependent variables are the plan characteristics including the discount rate, funding ratio, and natural logarithms of PBO, PA, number of participants and contributions made by employer in the year t . Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dis.Rate	LogPBO	LogNPartcp	LogPA	FundRatio	LogContri
Post $\times$ PEtreat	0.128*** (2.91)	-0.060** (-2.44)	-0.076** (-2.14)	-0.088*** (-3.12)	0.021 (1.19)	-0.374*** (-2.99)
Post $\times$ MAtreat	-0.052 (-1.44)	0.020 (0.99)	0.008 (0.15)	-0.052* (-1.71)	-0.039** (-1.97)	-0.127* (-1.65)
LogNPartcp _{t-1}	0.049* (1.68)					
LogPA _{t-1}	-0.062*** (-3.49)					
LogPlanAge	-0.081* (-1.92)	0.037 (1.01)	-0.039 (-0.62)	0.049 (1.09)	0.024 (0.80)	-0.220* (-1.71)
ExpRatio _{t-1}	1.778 (0.72)	-8.398*** (-2.69)	-5.738 (-1.43)	-15.775*** (-5.05)	-8.676*** (-7.40)	18.575*** (2.75)
LogTA _{t-1}	0.005 (1.02)	0.002 (0.57)	0.008 (1.16)	0.000 (0.02)	0.002 (1.47)	0.020** (2.07)
LogSales _{t-1}	-0.011** (-2.51)	-0.000 (-0.03)	-0.002 (-0.29)	-0.003 (-0.69)	-0.004** (-2.30)	-0.010 (-0.99)
Constant	5.421*** (13.17)	20.217*** (139.86)	10.485*** (42.60)	20.315*** (114.29)	1.068*** (9.31)	17.932*** (35.43)
Observations	308893	309159	309493	310282	305081	263255
Within R^2	0.007	0.002	0.001	0.005	0.018	0.002
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
p(PE=MA)	0.002***	0.011**	0.149	0.382	0.023**	0.098*

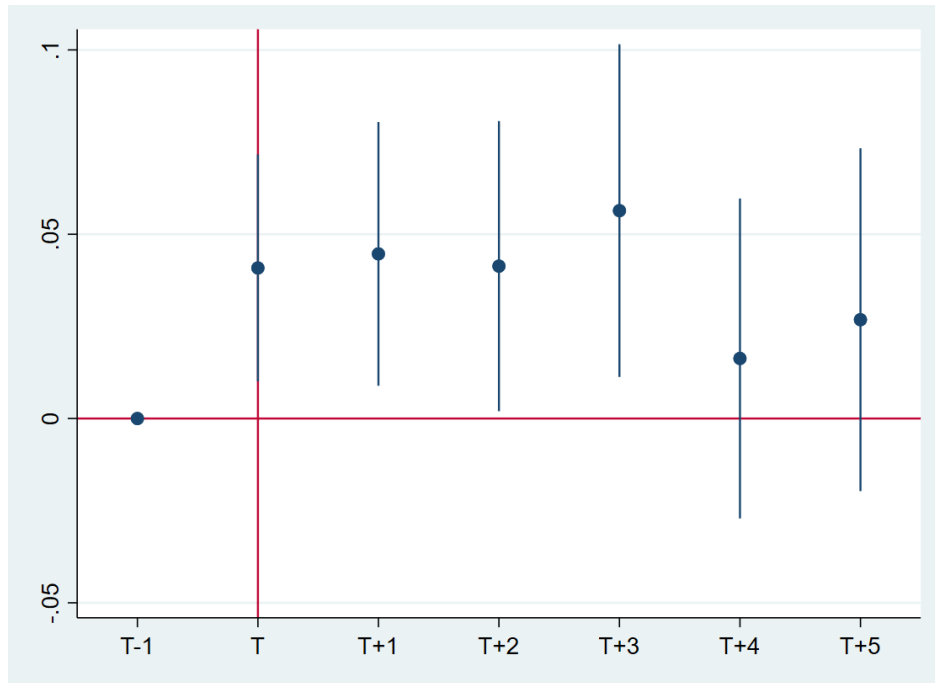
Table 15: Comparison between the impact of PE buyout and the impact of M&A deals on plan-level pension asset allocation

This table reports the results of stacked difference-in-difference regressions on the effects of PE buyout and the effects of M&A deals on pension characteristics at the plan level. The dependent variables are the weights allocated to safe assets, risky debt, equities, mutual funds, and trust in the year t , respectively, together with realized returns. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	SafeAssets	RiskyDebt	Equity	MutualFunds	Trust
Post $\times$ PEtreat	-0.022* (-1.86)	-0.016 (-1.41)	0.033* (1.93)	-0.051* (-1.94)	0.073 (1.51)
Post $\times$ MA_treat	0.033** (2.07)	-0.019*** (-2.58)	-0.005 (-0.46)	0.016 (0.68)	0.012 (0.35)
LogNPartcp _{t-1}	-0.000 (-0.05)	0.004 (0.66)	0.004 (0.74)	0.058*** (3.29)	-0.045** (-2.51)
ExpRatio _{t-1}	-0.038 (-0.06)	-2.217*** (-2.66)	0.497 (0.60)	-3.280*** (-3.33)	-1.790 (-0.92)
LogPA _{t-1}	0.000 (0.03)	-0.005*** (-3.98)	-0.002 (-1.42)	0.003 (1.31)	0.006 (1.40)
LogPlanAge	-0.021 (-1.33)	-0.020 (-0.89)	-0.000 (-0.02)	-0.022 (-1.35)	0.058 (1.53)
LogTA _{t-1}	0.001* (1.91)	-0.000 (-0.10)	0.000 (0.24)	-0.004** (-2.05)	-0.003 (-0.93)
LogSales _{t-1}	-0.001 (-1.02)	0.001 (1.49)	0.001 (0.62)	0.002 (1.06)	-0.000 (-0.03)
Constant	0.143* (1.86)	0.194* (1.79)	0.132 (1.53)	-0.367** (-2.15)	0.701*** (2.91)
Observations	251207	259122	253128	170085	253450
Within R^2	0.002	0.008	0.001	0.006	0.006
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
p(PE=MA)	0.005***	0.780	0.058*	0.049**	0.291

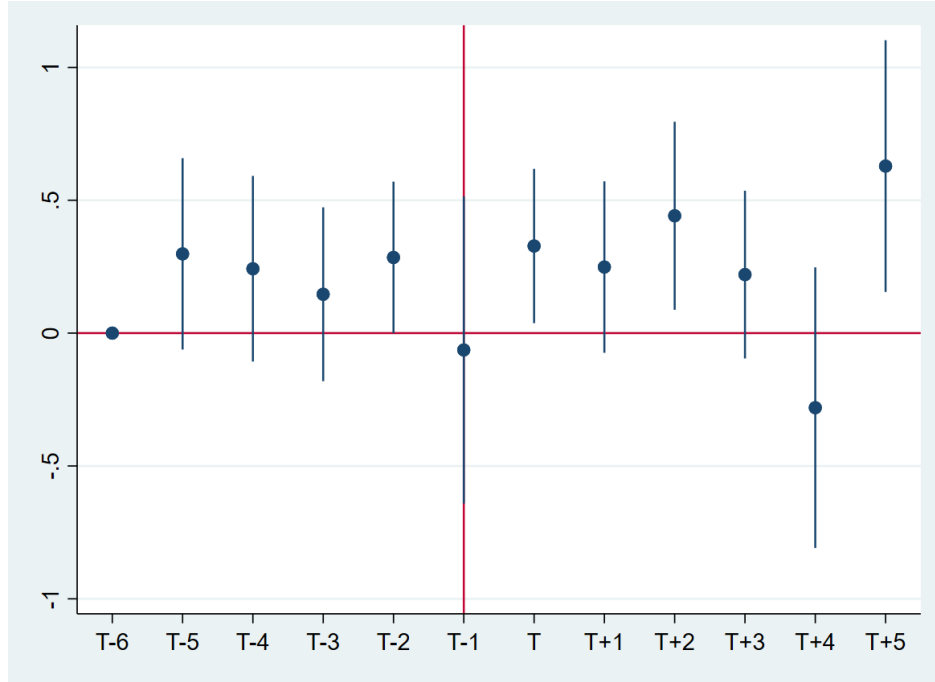


(a) Coefficient plot for the plan level termination/freeze

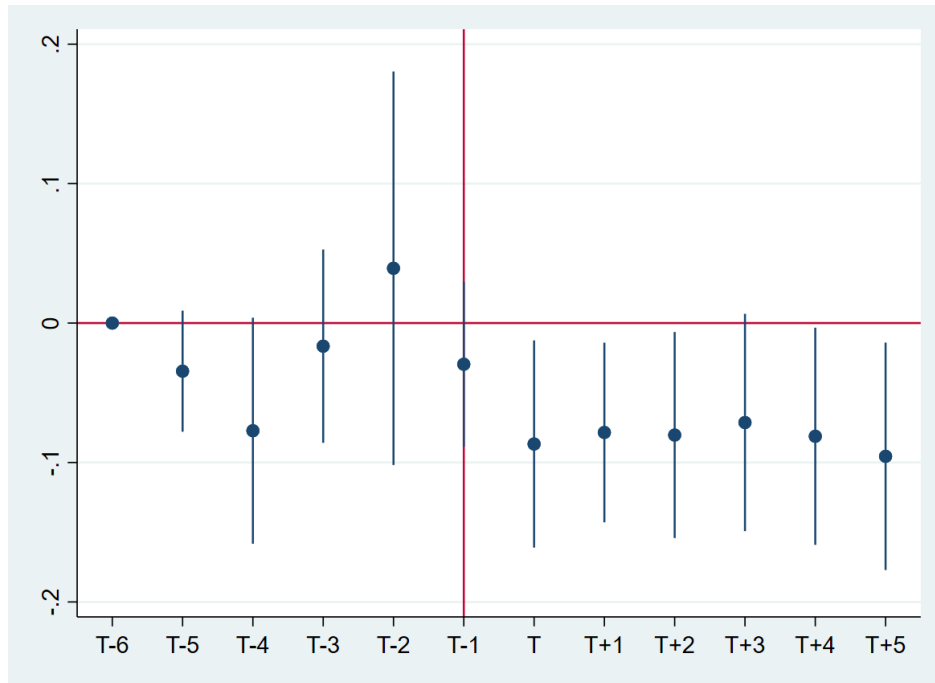


(b) Coefficient plot for the firm level termination/freeze

Figure 1: **Coefficient plot of termination/freeze analysis** Panel (a) shows the coefficient plot at the plan level. Panel (b) shows the coefficient plot at the firm level. The base year for both plots is year $T - 1$, which is one year before the buyout.



(a) Coefficient plot for the plan level discount rate



(b) Coefficient plot for the plan level PBO

Figure 2: **Coefficient plot of test on discount rate and PBO** Panel (a) shows the coefficient plot of test on discount rate at the plan level. Panel (b) shows the coefficient plot of PBO. The base year for both plots is the starting year of each cohort.

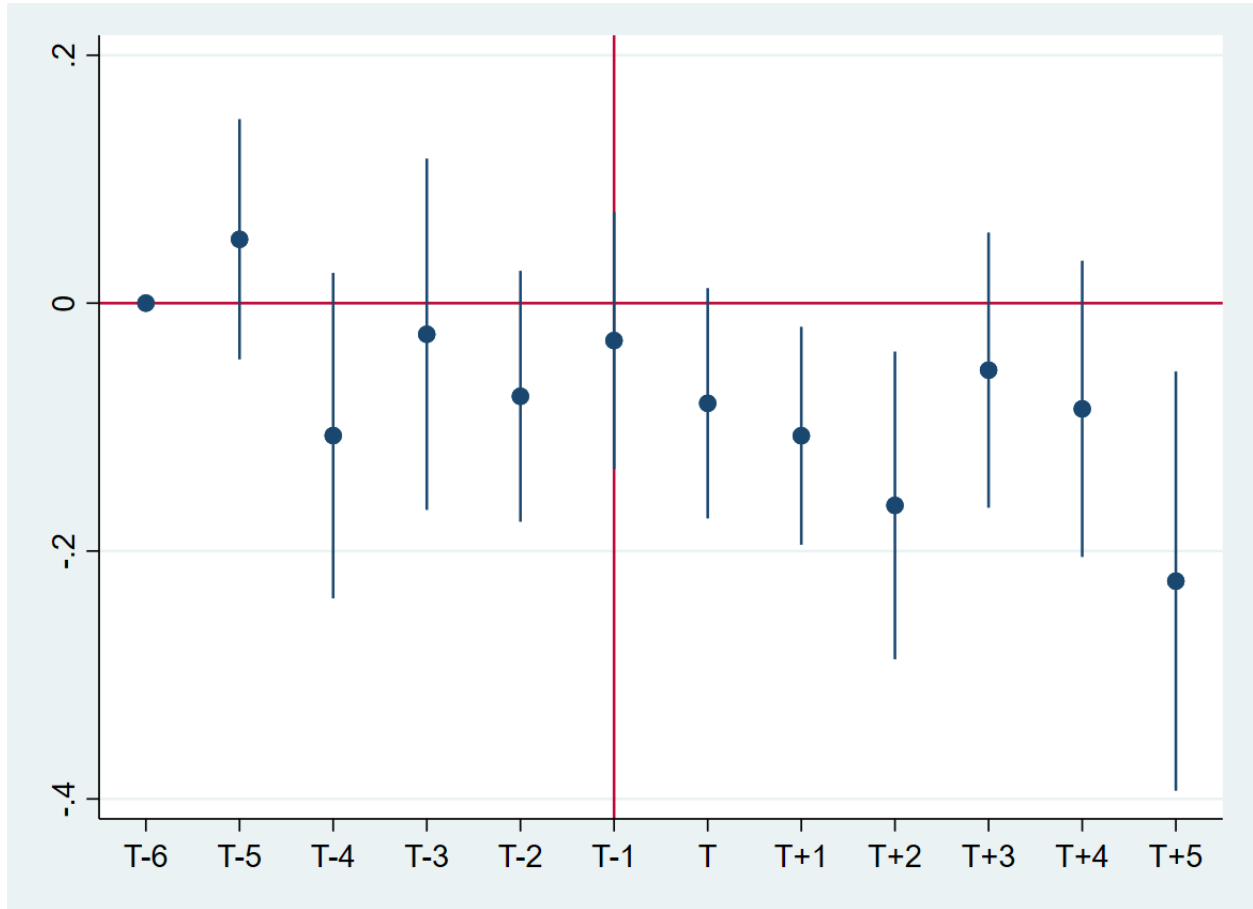


Figure 3: **Coefficient plot of test on contribution at the plan-level** This figure shows the coefficient plot of the test on pension contribution. The independent variables of interests are the interaction of year dummies with the PE treat dummy. The base year is one year before the PE buyout.

References

- Agrawal, A., and Y. Lim, 2022, “Where do shareholder gains in hedge fund activism come from? Evidence from employee pension plans,” Journal of Financial and Quantitative Analysis, 57(6), 2140–2176.
- Agrawal, A., and P. Tambe, 2016, “Private equity and workers’ career paths: The role of technological change,” The Review of Financial Studies, 29(9), 2455–2489.
- Anantharaman, D., and Y. G. Lee, 2014, “Managerial risk taking incentives and corporate pension policy,” Journal of Financial Economics, 111(2), 328–351.
- Andonov, A., R. M. Bauer, and K. M. Cremers, 2017, “Pension fund asset allocation and liability discount rates,” The Review of Financial Studies, 30(8), 2555–2595.
- Antoni, M., E. Maug, and S. Obernberger, 2019, “Private equity and human capital risk,” Journal of Financial Economics, 133(3), 634–657.
- Bacon, N., M. Wright, R. Ball, and M. Meuleman, 2013, “Private equity, HRM, and employment,” Academy of Management Perspectives, 27(1), 7–21.
- Bai, X., and Y. Wu, 2023, “Private Equity and Gas Emissions: Evidence from Electric Power Plants,” https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4364437.
- Baker, A. C., D. F. Larcker, and C. C. Wang, 2022, “How much should we trust staggered difference-in-differences estimates?,” Journal of Financial Economics, 144(2), 370–395.
- Ballester, M., D. Fried, and J. Livnat, 2002, “Pension plan contributions, free cash flows and financial slack,” Unpublished working paper, New York University.
- Bartram, S. M., 2017, “Corporate postretirement benefit plans and real investment,” Management Science, 63(2), 355–383.
- , 2018, “In good times and in bad: Defined-benefit pensions and corporate financial policy,” Journal of Corporate Finance, 48, 331–351.
- Bennett, B., R. Stulz, and Z. Wang, 2020, “Does the stock market make firms more productive?,” Journal of Financial Economics, 136(2), 281–306.
- Bergstresser, D., M. Desai, and J. Rauh, 2006, “Earnings manipulation, pension assumptions, and managerial investment decisions,” The Quarterly Journal of Economics, 121(1), 157–195.
- Bernstein, S., and A. Sheen, 2016, “The operational consequences of private equity buyouts: Evidence from the restaurant industry,” The Review of Financial Studies, 29(9), 2387–2418.
- Bloom, N., R. Sadun, and J. Van Reenen, 2015, “Do private equity owned firms have better management practices?,” American Economic Review, 105(5), 442–446.

- Callaway, B., and P. H. Sant’Anna, 2021, “Difference-in-differences with multiple time periods,” Journal of Econometrics, 225(2), 200–230.
- Chu, L., M. A. Goldstein, X. Li, and T. Yu, 2020, “Do Firms Set Pension Discount Rates Strategically?,” https://papers.ssrn.com/sol3/Papers.cfm?abstract_id=3627965.
- Cocco, J. F., and P. F. Volpin, 2005, “The corporate governance of defined benefit pension plans: Evidence from the United Kingdom,” ECGI-Finance Working Paper, (76).
- Cohn, J., N. Nestoriak, and M. Wardlaw, 2021, “Private equity buyouts and workplace safety,” The Review of Financial Studies, 34(10), 4832–4875.
- Davis, S. J., J. Haltiwanger, K. Handley, R. Jarmin, J. Lerner, and J. Miranda, 2014, “Private equity, jobs, and productivity,” American Economic Review, 104(12), 3956–3990.
- Davis, S. J., J. C. Haltiwanger, K. Handley, B. Lipsius, J. Lerner, and J. Miranda, 2019, “The (heterogenous) economic effects of private equity buyouts,” working paper, National Bureau of Economic Research.
- Davis, S. J., J. C. Haltiwanger, R. S. Jarmin, J. Lerner, and J. Miranda, 2011, “Private equity and employment,” working paper, National Bureau of Economic Research.
- Edgerton, J., 2012, “Agency problems in public firms: Evidence from corporate jets in leveraged buyouts,” the Journal of Finance, 67(6), 2187–2213.
- Fang, L. H., J. Goldman, and A. Roulet, 2022, “Private equity and pay gaps inside the firm,” https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4306840.
- Garcia-Gomez, P., E. G. Maug, and S. Obernberger, 2020, “Private equity buyouts and employee health,” https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3601813.
- Goodman-Bacon, A., 2021, “Difference-in-differences with variation in treatment timing,” Journal of Econometrics, 225(2), 254–277.
- Gormley, T. A., and D. A. Matsa, 2011, “Growing out of trouble? Corporate responses to liability risk,” Review of Financial Studies, 24, 2781–2821.
- Gornall, W., O. Gredil, S. T. Howell, X. Liu, and J. Sockin, 2021, “Do employees cheer for private equity? the heterogeneous effects of buyouts on job quality,” https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3912230.
- Hainmueller, J., 2012, “Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies,” Political analysis, 20(1), 25–46.
- Hainmueller, J., and Y. Xu, 2013, “Ebalance: A Stata package for entropy balancing,” Journal of Statistical Software, 54(7).
- Harper, J. T., and S. D. Treanor, 2014, “Pension conversion, termination, and wealth transfers,” Journal of Risk and Insurance, 81(1), 177–198.

- Harris, R. S., T. Jenkinson, and S. N. Kaplan, 2014, "Private equity performance: What do we know?," The Journal of Finance, 69(5), 1851–1882.
- Jang, D., and Y. Wu, 2021, "Size and Investment Performance: Defined Benefit vs. Defined Contribution Pension Plans," https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3697711.
- Kaplan, S., 1989, "The effects of management buyouts on operating performance and value," Journal of financial economics, 24(2), 217–254.
- Kaplan, S. N., and J. C. Stein, 1993, "The evolution of buyout pricing and financial structure in the 1980s," The quarterly journal of economics, 108(2), 313–357.
- Karamcheva, N., and V. Perez-Zetune, 2023, "Defined Benefit and Defined Contribution Plans and the Distribution of Family Wealth," Working Papers 58305, Congressional Budget Office.
- Kisser, M., J. Kiff, and M. Soto, 2017, "Do managers of US defined benefit pension plan sponsors use regulatory freedom strategically?," Journal of Accounting Research, 55(5), 1213–1255.
- Korteweg, A., and M. Sorensen, 2017, "Skill and luck in private equity performance," Journal of Financial Economics, 124(3), 535–562.
- Lambert, M., N. Moreno, L. Phalippou, and A. Scivoletto, 2021, "Employee views of leveraged buy-out transactions," https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3926300.
- Lerner, J., M. Sorensen, and P. Strömberg, 2011, "Private equity and long-run investment: The case of innovation," The Journal of Finance, 66(2), 445–477.
- Munnell, A. H., J.-P. Aubry, C. V. Crawford, et al., 2015, "Investment returns: Defined benefit vs. defined contribution plans," Issue in Brief, (15-21).
- Nikoskelainen, E., and M. Wright, 2007, "The impact of corporate governance mechanisms on value increase in leveraged buyouts," Journal of Corporate Finance, 13(4), 511–537.
- Olsson, M., and J. Tåg, 2017, "Private equity, layoffs, and job polarization," Journal of Labor Economics, 35(3), 697–754.
- Palepu, K. G., 1990, "Consequences of leveraged buyouts," Journal of Financial Economics, 27(1), 247–262.
- Pedersen, D. J., 2019, "Risk shifting and corporate pension plans: Evidence from a natural experiment," Journal of Financial and Quantitative Analysis, 54(2), 907–923.
- Petersen, M. A., 1992, "Pension reversions and worker-stockholder wealth transfers," The Quarterly Journal of Economics, 107(3), 1033–1056.

- Peterson, M. A., 1994, “Cash flow variability and firm’s pension choice: A role for operating leverage,” Journal of Financial Economics, 36(3), 361–383.
- Phan, H. V., and S. P. Hegde, 2013, “Corporate governance and risk taking in pension plans: Evidence from defined benefit asset allocations,” Journal of Financial and Quantitative Analysis, 48(3), 919–946.
- Pontiff, J., A. Shleifer, and M. S. Weisbach, 1990, “Reversions of excess pension assets after takeovers,” The RAND Journal of Economics, pp. 600–613.
- Rauh, J. D., 2009, “Risk shifting versus risk management: Investment policy in corporate pension plans,” The Review of Financial Studies, 22(7), 2687–2733.
- Rauh, J. D., I. Stefanescu, and S. P. Zeldes, 2013, “Cost shifting and the freezing of corporate pension plans,” .
- Sheen, A., Y. Wu, and Y. Yuan, 2021, “Private equity and financial adviser misconduct,” https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3986875.
- Sorensen, M., and A. Yasuda, 2023, “Impact of private equity,” Handbook in Economics: Corporate Finance, 1.
- Taylor, A., and C. Bryant, 2007, “Private equity buyouts and employee health,” Financial Times, <https://www.ft.com/content/757b1c6c-e096-11db-8b48-000b5df10621>.
- Treynor, J. L., 1977, “The principles of corporate pension finance,” The Journal of Finance, 32(2), 627–638.
- Tykvová, T., and M. Borell, 2012, “Do private equity owners increase risk of financial distress and bankruptcy?,” Journal of Corporate Finance, 18(1), 138–150.
- Zhao, Q., and D. Percival, 2016, “Entropy balancing is doubly robust,” Journal of Causal Inference, 5(1), 20160010.

Table A.1: Variable descriptions

Variable	Description
PEtreat	A dummy variable equal to 1 if the plan or firm is acquired by a PE firm within the time window
Matreat	A dummy variable equal to 1 if the plan or firm is acquired by a PE firm within the time window
Post	A dummy variable equal to 1 if the plan year is after the deal year
p(T/F)	Probability of a plan got terminated or frozen in the given year. <i>Source: Form 5500 line 8a.</i>
p(F)	Probability of a plan got frozen in the given year.
p(T)	Probability of a plan got terminated in the given year.
PBODis.Rate	Discount rate for computing the projected benefit obligation (PBO). <i>Source: Form 5500 Schedule SB line 5 and Form 5500 Schedule B line 6a.</i>
LogPartcp	Natural logarithm of the total number of participants. <i>Source: Form 5500 Schedule SB line 3d(1) and Form 5500 Schedule B line 2b(1)(4).</i>
LogMkt.PA	Natural logarithm of the market value of the pension assets. <i>Source: Form 5500 Schedule SB line 2a and Form 5500 Schedule B line 1b.</i>
LogPBO	Natural logarithm of the market value of the PBO. <i>Source: Form 5500 Schedule SB line 3d(3) and Form 5500 Schedule B line 2b(3)(4).</i>
PlanAge	The number of years since the plan inception. <i>Source: (1) plan year: Form 5500 Schedule SB line 1 and Form 5500 Schedule B line 1a; (2) starting year: Form 5500 line 1c.</i>
LogContri	Natural logarithm of the total contribution made by the employer. <i>Source: Form 5500 Schedule SB line 18b and Form 5500 Schedule B line 3b.</i>
LogTA	Natural logarithm of the book value of assets. <i>Source: S&P 500 CapitalIQ.</i>
LogSales	Natural logarithm of the revenue. <i>Source: S&P 500 CapitalIQ.</i>
FundingRatio	A ratio of market value of pension assets to PBO
ExpenseRatio	A ratio of total administrative expenses divided by the average of the total assets at the beginning and end of the year.
Contribution/PBO	A ratio of total total contribution made by employer divided by the PBO
SafeAssets	The fraction of plan assets investments in cash, government bonds, and funds held in insurance company general accounts. <i>Source: Form 5500 Schedule H line a, c(2) and c(14)</i>
Equity	The fraction of plan assets invested in preferred and common stocks, including sponsor's stocks. <i>Source: Form 5500 Schedule H line 1c(4) and 1d and Form 5500 Schedule I line 3d.</i>

Variable	Description
RiskyDebt	The fraction of plan assets invested in all corporate debt, loans, and loans to the participants. <i>Source: Form 5500 Schedule H line 1c(3), 1c(7) and 1c(8) and Form 5500 Schedule I line 1e and 1f.</i>
MutualFunds	The fraction of plan assets invested in mutual funds. <i>Source: Form 5500 Schedule H c(13).</i>
Trust	The fraction of plan assets invested in common/collective trusts, pooled separate accounts, master trust investment accounts, and 103-12 investment entities. <i>Source: Form 5500 Schedule H line c(9), c(10), c(11), and c(12)</i>
R1	Realized return defined as Equation 1
R2	Realized return defined as Equation 2
LogCCont	Natural logarithm of the employer contribution to the DC plans. <i>Source: Form 5500 Schedule H line 1b(1) and Form 5500 Schedule I line 2a(1).</i>
LogCNPartcp	Natural logarithm of the number of participants of DC plan . <i>Source: Form 5500 line 5 and Form 5500-SF line 5a.</i>
LogCContPP	Natural logarithm of the employer contribution per participant.
MatchRatio	The ratio of employer contribution to employee contribution.
NewDC	Dummy variable equal to one if there is new DC plan established in a given year

Table A.2: Prediction of the PE buyout

This table test the factors that can predict the PE buyout. The dependent variable is the dummy variable equal to one when the firm is acquired by a PE firm. The indenpendent varialbe includes the expense ratio, funding ratio, and the natural logarithm of number of plan participants, plan age, pension assets, total firm assets, and total sales Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)
	PEtreat	PEtreat
LogNPartcp	0.178*** (3.78)	0.218** (2.10)
ExpRatio	6.785 (1.26)	0.533 (0.06)
LogPlanAge	-0.040 (-0.95)	-0.214** (-1.97)
LogPA	-0.094** (-2.24)	0.011 (0.13)
FundRatio	-0.281* (-1.65)	-0.632* (-1.77)
LogTA		0.007 (0.33)
LogSale		0.022** (2.11)
Constant	1.203*** (2.62)	-0.052 (-0.05)
Observations	66637	17086
Within R^2	0.001	0.002
Cohort FE	Yes	Yes

Table A.3: Comparison between treated group and control groups

This table shows the summary statistics (mean, standard deviation, and the number of observations) of variables at the firm-year level for treated firms and control group after the Mahalanobis-distance matching. Variable definitions are provided in Table A.1. All dollar terms are expressed in the year 2000 dollars.

	Control group			PE buyout group			Comparison	
	Mean	St.d	Obs	Mean	St.d	Obs	Diff (C-T)	t
LogPBO	15.317	2.296	1,158	15.367	2.386	1,158	-0.050	(-0.519)
LogPA	15.390	2.224	1,158	15.356	2.528	1,158	0.035	(0.351)
LogNPartcp	5.015	2.367	1,158	5.087	2.496	1,158	-0.073	(-0.721)
LogPlanAge	2.879	0.966	1,158	2.824	1.065	1,158	0.055	(1.301)
ExpRatio	0.004	0.006	1,158	0.004	0.006	1,158	-0.000	(-1.63)
LogTA	9.348	3.760	1,158	9.383	3.761	1,158	-0.111	(-0.964)
LogSale	9.168	2.989	1,158	9.296	2.552	1,158	-0.128	(-1.108)

Table A.4: Termination and freeze analysis with matched sample

This table repeat the tests in Table 2 with matched sample. Variable definitions are provided in Table A.1. The time period is from 2004 to 2020. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Plan level			Firm level		
	(1) T/F1Y	(2) T/F3Y	(3) T/F5Y	(4) T/F1Y	(5) T/F3Y	(6) T/F5Y
PEtreat	0.038** (2.55)	0.042** (2.10)	0.047** (1.99)	0.058*** (3.69)	0.065*** (2.96)	0.073*** (2.78)
LogAge	-0.011 (-0.86)	-0.008 (-0.64)	-0.022 (-1.28)	-0.034 (-1.14)	-0.031 (-0.89)	-0.051 (-1.03)
LogNPartcp _{t-1}	0.049*** (3.21)	0.054** (2.53)	0.059** (2.21)	-0.001 (-0.05)	0.023 (0.56)	-0.007 (-0.15)
LogPA _{t-1}	-0.043*** (-3.90)	-0.044*** (-3.41)	-0.046*** (-3.15)	0.025 (0.86)	0.017 (0.44)	0.029 (0.66)
ExpRatio _{t-1}	-2.554 (-0.80)	-0.996 (-0.30)	-2.512 (-0.64)	2.827 (0.64)	6.677 (1.06)	8.702 (1.01)
LogTA _{t-1}	0.011 (1.17)	0.008 (0.70)	0.007 (0.54)	0.015 (0.98)	0.015 (0.93)	0.015 (0.83)
LogSales _{t-1}	-0.004 (-1.41)	-0.007** (-1.97)	-0.010** (-2.14)	-0.002 (-0.20)	-0.005 (-0.42)	-0.006 (-0.40)
LogNPlan _{t-1}				-0.047 (-0.67)	0.036 (0.32)	0.067 (0.50)
Constant	0.460*** (3.44)	0.510*** (3.40)	0.633*** (3.88)	-0.283 (-0.84)	-0.330 (-0.74)	-0.267 (-0.52)
Observations	2882	2636	2370	2280	2056	1852
Within R^2	0.056	0.035	0.035	0.039	0.038	0.031
Cohort×Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table A.5: PE buyout and plan characteristics with matched sample

This table repeat the tests in Table 5, 6, and 7 with matched sample. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dis.Rate	LogPBO	LogNPartcp	LogPA	FundRatio	LogContri
Post $\times$ PEtreat	0.088** (2.07)	-0.078*** (-2.88)	-0.053*** (-2.85)	-0.070*** (-2.68)	0.005 (0.22)	-0.152** (-2.15)
LogPA _{t-1}	0.140** (2.31)					
LogNPartcp _{t-1}	-0.003 (-0.05)					
ExpRatio _{t-1}	1.425 (0.59)	-5.569** (-2.58)	-1.451 (-0.80)	-10.738*** (-4.08)	-4.862*** (-3.32)	18.947** (2.56)
LogAge	-0.011 (-0.19)	0.261*** (3.60)	0.184*** (3.04)	0.209*** (3.14)	-0.056 (-1.56)	0.149 (0.75)
LogTA _{t-1}	0.017 (0.89)	-0.014 (-1.13)	-0.011 (-0.99)	-0.013 (-0.92)	0.003 (0.20)	-0.032 (-0.60)
LogSales _{t-1}	-0.001 (-0.19)	0.010** (2.21)	0.006* (1.75)	0.010** (2.05)	0.004 (0.71)	0.039** (2.51)
Constant	1.615* (1.75)	17.645*** (61.71)	7.323*** (30.68)	17.862*** (65.57)	1.219*** (7.28)	16.476*** (17.27)
Observations	17824	17851	17833	17851	17851	16135
Within R^2	0.010	0.040	0.026	0.034	0.012	0.008
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table A.6: PE buyout and pension characteristics at the firm level with matched sample

This table repeat the tests in Table 8, and 9 with matched sample. The dependent variables are the discount rate, natural logarithm of PBO, number of participants, PA and employer's contribution and funding ratio in the year t . Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dis.Rate	LogPBO	LogNPartcp	LogPA	FundRatio	LogContri
Post $\times$ PEtreat	0.079** (2.39)	-0.131*** (-3.10)	-0.130*** (-3.97)	-0.101*** (-2.78)	0.013 (0.63)	-0.242* (-1.75)
LogPA _{t-1}	0.055 (1.61)					
LogNPartcp _{t-1}	-0.026 (-0.67)					
ExpRatio _{t-1}	5.333* (1.76)	0.378 (0.05)	1.420 (0.32)	-4.358 (-0.82)	-3.556 (-1.14)	10.373 (0.86)
LogAge	0.015 (0.48)	-0.030 (-0.42)	-0.075 (-1.18)	-0.106 (-1.41)	0.005 (0.12)	-0.213 (-1.26)
LogTA _{t-1}	-0.022 (-0.70)	0.021 (0.35)	0.029 (0.64)	0.033 (0.90)	-0.007 (-0.23)	0.059 (0.70)
LogSales _{t-1}	0.036 (1.34)	0.025 (0.94)	0.002 (0.10)	0.016 (0.62)	-0.001 (-0.09)	0.107 (1.35)
Constant	3.304*** (6.09)	20.600*** (29.17)	10.078*** (17.71)	20.935*** (36.40)	1.220*** (2.69)	14.414*** (11.47)
Observations	15512	16340	16340	16340	16340	11628
Within R^2	0.008	0.006	0.023	0.028	0.005	0.008
Cohort $\times$ Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table A.7: PE buyout and pension asset allocation at the plan level with matched sample

This table repeat the tests in Table 10 with matched sample. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	SafeAssets	RiskyDebt	Equity	MutualFunds	Trust
Post $\times$ PEtreat	-0.010** (-2.02)	0.008 (0.61)	0.024** (2.21)	-0.031* (-1.72)	0.047 (0.76)
LogPA _{t-1}	-0.001 (-0.11)	0.016 (0.69)	0.017 (0.92)	-0.060* (-1.88)	-0.042 (-0.63)
LogNPartcp _{t-1}	-0.023 (-1.62)	-0.001 (-0.03)	-0.007 (-0.37)	0.073* (1.72)	0.005 (0.10)
ExpRatio _{t-1}	-0.256 (-0.38)	0.536 (0.61)	-0.965* (-1.74)	1.076 (0.74)	-6.675 (-1.17)
LogAge	0.001 (0.10)	0.008 (1.01)	0.000 (0.06)	0.042 (1.19)	-0.010 (-0.56)
LogTA _{t-1}	0.004 (0.91)	0.001 (0.28)	0.007 (0.98)	-0.006 (-0.89)	0.002 (0.28)
LogSales _{t-1}	-0.003 (-0.60)	0.001 (0.10)	0.001 (0.24)	0.003 (0.33)	-0.009 (-0.99)
Constant	0.311* (1.67)	-0.320 (-0.54)	-0.162 (-0.65)	0.618 (1.58)	1.633 (1.22)
Observations	11397	9018	10780	10440	8144
Within R^2	0.010	0.009	0.016	0.020	0.020
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Table A.8: PE buyout and pension asset allocation at the firm level with matched sample

This table repeat the tests in Table 11 with matched sample. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. The regressions are weighted by the actuarial pension assets in the beginning year of each cohort. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	SafeAssets	RiskyDebt	Equity	MutualFunds	Trust
Post $\times$ PEtreat	-0.010*	0.010	0.032*	-0.032**	0.044
	(-1.73)	(0.67)	(1.71)	(-2.07)	(0.74)
LogPA _{t-1}	0.001	-0.006	-0.002	0.010	0.005
	(0.13)	(-1.45)	(-0.47)	(1.51)	(0.45)
LogNPartcp _{t-1}	-0.002	0.013	0.008	-0.014	-0.005
	(-0.27)	(1.53)	(0.99)	(-1.02)	(-0.23)
ExpRatio _{t-1}	-1.075	-0.499	-0.488	-2.515	-8.173
	(-0.84)	(-0.36)	(-0.31)	(-0.81)	(-1.32)
LogAge _{t-1}	-0.007	-0.019	0.016	-0.001	-0.036
	(-0.57)	(-0.74)	(1.14)	(-0.07)	(-0.56)
LogTA _{t-1}	-0.001	0.004	0.014**	-0.027	-0.005
	(-0.25)	(0.79)	(2.39)	(-1.52)	(-0.47)
LogSales _{t-1}	0.002	-0.003	-0.007	0.020	-0.001
	(0.61)	(-0.50)	(-1.39)	(1.33)	(-0.11)
Constant	0.121**	0.113	-0.005	0.365***	0.803***
	(2.17)	(1.30)	(-0.07)	(3.10)	(2.63)
Observations	9764	6680	9710	9518	9182
Within R^2	0.012	0.024	0.017	0.078	0.019
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Firm FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Table A.9: Termination and freeze analysis with entropy balancing weights

This table repeat the tests in Table 2 with entropy balancing weights. This table reports the results of cross-sectional regressions on the effects of PE buyout on termination and freeze decisions at the plan level and firm level. The dependent variables are the dummy variables that equal to one when the plan is terminated or frozen within one year, three years or five years after the buyout the year. Variable definitions are provided in Table A.1. The time period is from 2004 to 2020. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Plan level			Firm level		
	(1) T/F1Y	(2) T/F3Y	(3) T/F5Y	(4) T/F1Y	(5) T/F3Y	(6) T/F5Y
PEtreat	0.044** (2.15)	0.138*** (4.21)	0.125*** (3.43)	0.026** (1.99)	0.051** (2.17)	0.083** (2.00)
LogNPartcp _{t-1}	0.001 (0.23)	-0.002 (-0.13)	-0.002 (-0.13)	0.015 (1.60)	0.011 (0.82)	-0.019 (-1.04)
LogPA _{t-1}	-0.007 (-1.58)	-0.012 (-1.13)	-0.014 (-0.89)	-0.023** (-2.23)	-0.033*** (-2.71)	-0.019 (-1.20)
LogPlanAge	-0.002 (-0.25)	-0.005 (-0.36)	-0.021 (-1.01)	0.018 (0.93)	0.025 (1.29)	0.015 (0.59)
ExpRatio _{t-1}	2.365 (1.63)	2.290 (1.27)	2.669 (1.28)	-2.502** (-1.99)	-2.175 (-1.40)	0.382 (0.18)
LogTA _{t-1}	-0.000 (-0.06)	0.001 (0.17)	-0.002 (-0.27)	0.006 (1.56)	0.008 (1.22)	0.003 (0.44)
LogSales _{t-1}	-0.000 (-0.10)	-0.002 (-0.29)	0.003 (0.41)	-0.003 (-0.97)	-0.007 (-1.12)	-0.001 (-0.12)
LogNPlan				-0.016 (-0.94)	-0.019 (-0.93)	-0.030 (-1.26)
Constant	0.141*** (3.46)	0.331*** (2.86)	0.469*** (2.81)	0.258*** (2.82)	0.516*** (3.42)	0.561*** (2.84)
Observations	32053	30360	26758	14354	13111	11712
Within R^2	0.014	0.029	0.023	0.022	0.030	0.039
Cohort×Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table A.10: Plan-level pension characteristics with entropy balancing weights

This table repeat the tests in Table 5, Table 6, and Table 7 with entropy balancing weights. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dis.Rate	LogPBO	LogNPartcp	LogPA	FundRatio	LogContri
Post $\times$ PEtreat	0.067** (2.36)	-0.073*** (-4.67)	-0.072*** (-5.63)	-0.070*** (-3.54)	0.009 (0.68)	-0.151*** (-3.72)
LogNPartcp _{t-1}	0.047* (1.73)					
LogPA _{t-1}	0.034 (1.46)					
LogPlanAge	-0.019 (-0.58)	0.150*** (3.44)	-0.02 (-0.71)	0.135*** (2.67)	-0.002 (-0.13)	-0.069 (-1.00)
ExpRatio _{t-1}	0.009 (0.01)	-7.392*** (-6.37)	-4.163*** (-3.97)	-14.513*** (-10.21)	-5.664*** (-8.63)	7.223** (2.30)
LogTA _{t-1}	0.001 (0.20)	-0.002* (-1.74)	-0.003** (-2.09)	-0.003** (-2.21)	-0.001 (-1.07)	0.009 (1.41)
LogSales _{t-1}	0.003 (0.98)	0.000 (0.35)	0.002* (1.90)	0.003* (1.86)	0.001 (1.27)	-0.013 (-1.64)
Constant	3.367*** (9.82)	17.248*** (113.60)	7.534*** (76.32)	17.372*** (97.21)	1.057*** (16.76)	15.167*** (63.90)
Observations	195672	195690	195716	195821	190747	159623
Within R^2	0.003	0.025	0.014	0.037	0.016	0.002
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table A.11: Firm-level pension characteristics with entropy balancing weights

This table repeat the tests in Table 8, and Table 9 with entropy balancing weights. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dis.Rate	LogPBO	LogNPartcp	LogPA	FundRatio	LogContri
Post $\times$ PEtreat	0.072* (1.88)	-0.192*** (-2.71)	-0.173*** (-2.83)	-0.233*** (-2.95)	0.004 (0.23)	-0.230*** (-3.47)
LogNPartcp _{t-1}	-0.018 (-0.47)					
LogPA _{t-1}	0.031 (0.97)					
ExpRatio _{t-1}	0.326 (0.15)	-11.285*** (-6.18)	-8.579*** (-5.78)	-18.680*** (-8.70)	-6.511*** (-7.35)	16.484*** (3.63)
LogPlanAge	-0.008 (-0.23)	0.230*** (3.88)	0.121** (2.18)	0.166** (2.24)	-0.004 (-0.23)	-0.032 (-0.40)
LogTA _{t-1}	0.007 (1.05)	-0.007* (-1.73)	-0.005 (-1.56)	-0.009* (-1.94)	-0.004 (-1.38)	-0.009 (-0.88)
LogSales _{t-1}	-0.005 (-0.92)	0.003 (0.81)	0.004 (1.17)	0.009** (2.09)	0.005* (1.78)	0.008 (0.81)
Constant	3.884*** (10.30)	17.735*** (90.32)	7.690*** (42.38)	18.095*** (74.04)	1.092*** (15.78)	15.567*** (55.78)
Observations	137658	137715	137658	138159	125656	109777
Within R^2	0.002	0.038	0.037	0.035	0.013	0.006
Cohort $\times$ Firm	Yes	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table A.12: Plan-level asset allocation with entropy balancing weights

This table repeats the tests in Table 10 with entropy balancing weights. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	SafeAssets	RiskyDebt	Equity	MutualFunds	Trust
Post $\times$ PEtreat	0.006 (1.08)	0.001 (0.19)	0.024*** (2.69)	-0.026* (-1.76)	0.017 (0.96)
LogNPartcp _{t-1}	-0.003 (-0.70)	0.004 (0.98)	-0.006 (-0.77)	0.032*** (2.90)	-0.011 (-1.20)
ExpRatio _{t-1}	0.005 (0.02)	-0.065 (-0.42)	1.222*** (3.48)	-2.042*** (-3.52)	-0.205 (-0.32)
LogPA _{t-1}	-0.001 (-0.35)	0.002 (1.18)	0.011* (1.66)	-0.004 (-0.45)	0.005 (0.57)
LogPlanAge	0.009 (1.16)	-0.011* (-1.78)	0.004 (0.40)	-0.043* (-1.96)	0.051** (2.15)
LogTA _{t-1}	-0.000 (-0.99)	-0.000 (-0.46)	-0.001* (-1.69)	0.004** (2.21)	-0.000 (-0.07)
LogSales _{t-1}	0.000 (0.35)	0.000 (1.49)	0.000 (0.10)	-0.002 (-1.07)	-0.000 (-0.12)
Constant	0.096 (1.62)	0.014 (0.37)	-0.044 (-0.40)	0.196 (1.21)	0.361** (2.44)
Observations	171634	171084	171152	170787	172089
Within R^2	0.001	0.002	0.006	0.004	0.002
Cohort $\times$ Plan FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Table A.13: Firm-level asset allocation with entropy balancing weights

This table repeats the tests in Table 11 with entropy balancing weights. Variable definitions are provided in Table A.1. The time period is from 1999 to 2020. In each cohort, there are six years before and after the buyout year. Standard errors are clustered at firm level, and t -statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)
	SafeAssets	RiskyDebt	Equity	MutualFunds	Trust
PEtreat $\times$ PEtreat	0.013 (1.57)	-0.004 (-0.60)	0.030*** (2.78)	-0.058*** (-3.17)	0.036 (1.53)
LogNPartcp _{t-1}	-0.011 (-0.76)	0.002 (0.71)	0.011 (1.48)	-0.035** (-2.11)	-0.046** (-2.18)
ExpRatio _{t-1}	1.622*** (2.80)	0.372 (1.44)	1.697*** (3.31)	-1.039 (-0.76)	-4.311*** (-3.97)
LogPA _{t-1}	0.004 (0.50)	0.000 (0.16)	-0.000 (-0.03)	0.014 (1.17)	0.031** (1.98)
LogPlanAge	0.014 (1.22)	0.002 (0.13)	0.067*** (3.44)	-0.003 (-0.13)	-0.067* (-1.69)
LogTA _{t-1}	-0.001 (-1.25)	0.000 (0.40)	-0.002 (-1.51)	-0.000 (-0.00)	0.001 (0.55)
LogSales _{t-1}	0.002 (1.16)	0.001 (1.31)	0.001 (0.76)	-0.001 (-0.25)	-0.002 (-0.60)
Constant	0.054 (0.81)	0.015 (0.36)	-0.131 (-1.19)	0.316* (1.69)	0.432** (2.30)
Observations	109184	109189	109076	108928	109104
Within R^2	0.005	0.003	0.018	0.005	0.012
Cohort $\times$ Ind $\times$ Year FE	Yes	Yes	Yes	Yes	Yes
Cohort $\times$ Firm FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes