

Health Care and Corporate Finance

by

Tianjiao Tong

Business Administration
Duke University

Date: _____

Approved:

John Graham, Advisor

Manuel Adelino

Alon Brav

Allan Collard-Wexler

David Robinson

Dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy in Business Administration
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ABSTRACT

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Abstract

Health care costs for U.S. employers have tripled in the past twenty years. By constructing a novel dataset with firm-specific health care expenses, I show that firms negatively adjust both capital expenditures and R&D expenses in response to changes in health care costs. I estimate that, on average, a 1% increase in health care costs is associated with a 0.7% decrease in total investment. The effects are stronger for financially constrained firms, firms employing more high-skilled workers, and firms working with fewer insurers. Additional tests confirm that hiring fewer workers and reducing wages do not offset rising health costs enough to counteract this lower investment channel. Overall, my findings suggest that rising health care costs limit firms' ability to expand either physically or via innovation.

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1 Introduction

A prominent feature of the US health care system is its heavy dependence on the private business sector. Nearly 60% of working-age Americans receive health care through their employers. In 2016, employers spent \$727 billion to provide health coverage for 175 million people.¹ Reflecting decades of rapid growth, health insurance premiums increased a cumulative 213% from 1999 to 2016. In contrast, workers' earnings increased by 60%, and overall inflation was 44%.² Despite the magnitude of health care costs, few studies have examined how firms' corporate decisions adjust to changes in employee health care costs. In this paper, I explore the effect of health care costs on firms by examining whether and how these costs affect firms' capital and R&D investment decisions.

The direction in which health care costs affect investment is theoretically ambiguous. Traditional theory argues that employers pass through the increments in health care costs dollar for dollar to workers in the form of lower wages (Summers, 1989; Gruber, 1994). According to this view, a rise in health care costs should have no impact on firms' production and investment decisions. The theoretical framework assumes that labor and product markets are perfectly competitive, and it ignores institutional constraints such as mandated minimum wages and union pressure. Along these lines, more recent research shows a partial substitution between wage and health benefits and a reduction in employment (Currie and Madrian, 1999; Baicker and Chandra, 2005; Lubotsky and Olson, 2015). But it is still unclear whether firms' investment would be affected.

¹National Health Expenditure Data, Centers for Medicare and Medicaid Services, 2016.

²Kaiser Family Foundation Employer Health Benefits Survey ("KFF Survey"), 2016.

Health care costs may increase investment by reducing worker mobility. In particular, the prevalence of employer-sponsored health benefits could create “job-lock,” a phenomenon in which employees decide to keep jobs for fear of losing health coverage (e.g., Madrian, 1994; Garthwaite, Gross, and Notowidigdo, 2014). This situation occurs because employees might not necessarily receive the same benefit when changing jobs. For example, the Health Insurance Portability and Accountability Act (HIPAA) allows firms to differentiate health benefit offerings based on job tenure. The differences in health benefits widen after health care costs increase. As a result, employees stay in their current positions and are more likely to invest in firm-specific skills, which in turn enhance productivity, and this motivates firms to increase corporate investment (e.g., Belot, Boone, and Van Ours, 2007; Jeffers, 2018).

In contrast, health care costs can decrease corporate investment through two nonmutually exclusive channels. First, since health care costs are a part of labor costs, an increase in input costs reduces the optimal scale of the firm, and investment. Second, a rise in firms’ health benefit expenses decreases internal cash, as firms need to either make higher payments to insurance companies or contribute more to their health plan funding reserves. Because external financing is costly (Fazzari, Hubbard, and Petersen, 1988; Lamont, 1997; Rauh, 2006), firms reduce investment in response. Both channels predict a negative relationship between health care costs and investment.

There are several obstacles to empirically establishing the relation between health care costs and corporate investment. First, it is difficult to distinguish the effect of health care costs from other factors, such as investment opportunities, that could also affect firms’ investment decisions. For example, a growing firm can offer generous health plans, and at the same time invest heavily. I address this issue by employing two identification strategies that explore settings rarely considered in the finance literature. The first identification strategy uses mergers-induced local health insurance market concentration changes as an instrument for health price changes. The second strategy is a quasi-natural experiment tied to medical malpractice tort reforms.

An additional challenge is that data is sparse on firms’ health care spending and plan

characteristics. I therefore construct a novel dataset on firm-level health benefits gathered from Form 5500 welfare benefit plan data maintained by the U.S. Department of Labor. These data contain information about total insurance expenses, number of participants, type of plan, and other bundled fringe benefits for welfare plans with more than 100 participants.

For my first identification strategy, I exploit the fact that the U.S. health insurance market competition varies across geographical markets and that the industry is concentrated overall. Past studies have found that insurer concentration positively correlates with health premium prices (Dranove, Gron, and Mazzeo, 2003; Dafny, Duggan, and Ramanarayanan, 2012; Starc, 2014). Because employers purchase health policies from insurance companies or hire insurance companies to design health plans and process claims, a change in the health insurance price impacts the health care costs faced by employers.

I therefore use variations in insurance market concentration as a proxy for health care costs. Because the period-to-period change in competitiveness might shift with general economic conditions, I examine the abrupt changes in local insurance market competitiveness induced by national-level mergers (those occur for reasons unrelated to the issues I study, as explained below). Specifically, I use the projected change in the Herfindahl-Hirschman Index (HHI) after mergers to measure concentration changes. Actual changes in the HHI following mergers could be tied to local economic conditions and thus not be orthogonal to corporate investment. As described in more detail below, I therefore follow the approach used by Dafny et al. (2012) and Ashenfelter, Hosken, and Weinberg (2015) and employ the projected increase in the HHI as the actual instrument. Using this instrument, I conduct a two-stage least square regression analysis to look at how health care costs affect corporate investment. This specification also includes local macroeconomic indicators, as well as year and firm fixed effects to control for pre-existing market conditions and trends.

The estimates indicate that, on average, a 1% increase in health care costs decreases the sum of capital expenditures and R&D expenses by 0.7% from its average level. Additionally, a back-of-the-envelope calculation shows that, in 2016, a 10% increase in health care costs represented \$2.1 million for the median firm in the sample. Therefore, the analysis estimates

a corresponding reduction of \$2.5 million in the median firm's total investment. The analysis also confirms that change in projected HHI highly correlates with increases in premium prices, which validates the relevance criterion. In particular, a one standard deviation increase in the change in projected HHI is associated with a 6.4% increase in employers' health care costs.

The key assumption of this identification strategy is that insurance market competitiveness affects corporate investment only through employers' health care costs. Merger events are not random; however, by restricting merger type and exploring mergers' purpose, it is possible to explore a context in which insurer mergers do not relate to companies' investment opportunities. First, I exclude mergers in which the operation of the acquiror and the target overlap in only one state, thus reducing the likelihood that the merger is to expand business in that particular state. As a robustness check, I include only mergers in which the target and the acquiror have more than thirty overlapping states in operation, and the results hold. Second, the driving force behind the wave of mergers during my sample period relates to the enactment of the Medicare Modernization Act (MMA), which opened up the senior care market to private insurers. In response to financial incentives created by Medicare expansion, insurers enter this market via mergers and acquisitions. Therefore, it is unlikely that insurer mergers are driven by real firms and their corporate investment opportunities.

My second identification strategy is related to state-level medical malpractice tort reforms that reduce health care costs. These tort reforms aim to lower patients' abilities to enter into litigation and/or reduce patient damages in alleged medical malpractice cases. Therefore, the reforms mitigate health providers' precautionary behavior when treating patients ex ante. Prior studies have found that tort reforms affect medical treatment intensity (Currie and MacLeod, 2008; Frakes, 2012). As a consequence of lower treatment intensity, tort reforms reduce medical costs (Kessler and McClellan, 1996) and employer-sponsored health insurance premiums (Avraham, Dafny, and Schanzenbach, 2010). Tort reforms affect employers' underlying medical costs directly.

Using Avraham (2018)'s tort reform dataset, I utilize a difference-in-differences research

design that exploits the staggered change of tort reforms across states to analyze the relationship between health care costs and corporate investment. Specifically, I focus on the tort reform concerning caps on noneconomic damages, which aims to restrict the amount plaintiffs can claim for physical pain and emotional suffering. A first-stage regression using Form 5500 data confirms that tort reforms reduce employers' health care costs. The second stage results show that the enactment of caps on noneconomic damages increases total corporate investment by 8.9% from its average level.

After establishing a negative relationship between health care costs and corporate investment using the identification strategies of insurer mergers and tort reforms, I explore whether cost rises differentially affect firms with different characteristics.

I first look at the characteristics of the labor composition. Although most large employers in the United States offer health care benefits, their employees might not necessarily enroll in these plans. First, employees need to pay the employee contribution; second, a potential tradeoff may exist between the wage employee receives and whether he or she opt into the health plan. Firms' exposure to health care costs depends on the enrollment rate, and many factors affect employees' enrollment decisions. Among them, theory (Gruber and Levitt, 2000; Rampini and Viswanathan, 2018) implies that higher-wage workers are more likely to participate in firms' health plans due to tax benefits and borrowing constraints. Because wages are highly correlated with employees' skill level, a similar pattern of enrollment is expected for high-skilled labor. Therefore, firms with more high-wage or high-skilled workers have a higher enrollment rate and higher exposure to health care costs. Using industry-level wage and skill information from the Bureau of Labor Statistics and the Department of Labor, and in the setting of tort reforms, I find that firms in industries with higher average wages/skill increase their investment more when there is a reduction in health care costs.

Another dimension that firms can differ in their exposure to health care shocks is the balance of bargaining power with insurance companies. In particular, for firms work with multiple insurers or have a more diverse insurer network, they could better insulate shocks from health care costs when negotiating deals with health insurers. Employers gain

bargaining position by threatening to exit; this threat is more credible when the employer has more insurer options because both the searching and switching costs are lower. By splitting firms into subgroups based on the number of insurers and insurers' shares of participants within the firm, I find that firms with fewer insurer options decrease their investment more after health care costs increase.

I then explore in detail the mechanisms of how health care costs affect firms' investment decisions. If health care costs affect firms' investment through decreasing available funds, then constrained firms' investment will be affected to a higher degree. By examining subgroups of firms based on whether they are financially constrained, I demonstrate that more constrained firms increase investment more when health care costs decrease.

Finally, I investigate whether health care cost shock is only transitory or whether it has a long-term impact on firms' growth. To shed light on this question, I look at innovation production by empirically examining firms' patent holding. I find that a decrease in health care costs is associated with an increase in patent applications (conditional on being granted) and patent accumulation over the next three years. The average citation of an affected firm's patent stock also increases. The findings indicate that health care cost shocks affecting future corporate productivity.

This study contributes to the corporate finance literature on the determinants of corporate investment (e.g., Fazzari, Hubbard, and Petersen, 1988; Lamont, 1997; Rauh, 2006). Furthermore, my paper relates to an emerging branch of literature that examines how labor market frictions affect investment decisions. For example, Bai, Fairhurst, and Serfling (forthcoming) study investment changes in response to changes in labor protection law, and Gustafson and Kotter (2018) and Cho (2018) look at minimum wage changes. This study expands the scope of empirical work investigating how input costs affect investment by looking beyond minimum-wage sensitive industries, and investigates an important component in labor costs, namely the health care costs, which applies to almost all large firms.

Moreover, this paper relates to a broader set of literature studying the effect of labor markets on firm value and corporate decisions (e.g., Chen, Kacperczyk, and Ortiz-Molina,

2011; Agrawal and Matsa, 2013; Serfling, 2016). This paper highlights the importance of labor heterogeneity in affecting firms' outcomes (e.g., Belo, Li, Lin, and Zhao, 2017; Ghaly, Anh Dang, and Stathopoulos, 2017), by documenting that firms with more high-skilled workers are most affected by shocks from health care costs.

The health economics literature documents that the health insurance market is becoming more concentrated (e.g. Dranove, Gron, and Mazzeo, 2003; Dafny, Duggan, and Ramanarayanan, 2012; Starc, 2014). The results in this paper show that this concentration adversely affects real business outcomes. Prior studies on employer-sponsored health benefits investigate labor market outcomes and firms' decision-making on whether to offer and plan generosity, and these studies usually focus on small businesses (e.g., Bundorf, 2002; Abraham, Feldman, and Graven, 2016). I look at large firms and their corporate decisions. Almeida et al. (2018) examined how the ACA affects public firms and found no evidence on the deterioration of firm performance. This paper is the first to document that health care costs crowd out corporate investment.

The rest of the paper is organized as follows. Section 2 provides background information on employer-sponsored health benefits, the health insurance market, and tort reforms. Section 3 describes the data and the sample selection procedure. Section 4 describes the empirical methodology and presents the main results and robustness checks using two identification strategies. Section 5 investigates the differential effect on firms with different characteristics. Section 6 analyzes the potential channels through which health care costs affect corporate investment and the implications for innovation production. Section 8 concludes.

2 Background

2.1. Employer-Sponsored Health Benefits

The cost of employer-sponsored health benefits has increased sharply in the past twenty years. In 2017, the average family plan premium was \$19,235, up from \$ 5,791 in 1999.¹ Despite the rise, the generosity of plan benefits is largely intact, especially for big employers. The share of nonwage benefits in employee compensation grew from 5% in the 1960s (Woodbury, 1983) to 30%, and health is the biggest item. The offering and generosity of health benefits has become an important tool for firms to attract and retain talents in the domestic market. Larger firms are more susceptible to potential negative effects on firm reputation and employee morale if they cut benefits. A typical large employer contributes more than 80% of the cost for single premiums and 75% for family premiums, and this contribution ratio has remained stable over the past twenty years. Anecdotal evidence shows that employers explicitly state their health plan contribution ratio when introducing health plan offerings to employees, and thus might be unwilling to change the ratio. Also, although offering health benefits is voluntary, most large employers do so. In fact, in the period 1999-2018, on average more than 98% of firms with 200 or more employees offered health benefits; for firms with 10-199 employees, however, the offering rate dropped from 81% to 70%. These figures show that big employers are less likely to use contribution ratio adjustments or termination of plan offerings to buffer health care price hikes.

A firm can choose to fully insure or self-insure its employee health plan or use a

¹KFF Survey, 2017

combination of two. In a traditional fully-insured plan, the employer purchases health policies from outside health insurance companies. In self-insurance, the employer pays employees' medical claims directly; the employer sets up tax-exempt reserves for claim payouts and regularly contributes to this reserve. However, self-insured firms still hire insurance companies as third-party administrators (TPAs) for network access, plan designing, and medical claim processing. Some firms also buy stop-loss insurance for catastrophic losses.

Firms usually offer a menu of health plan options for employees. These plans can vary in the restrictiveness of the provider network, or the ratio between out-of-pocket expenses and annual premiums. HMO (health maintenance organization), POS (point of service), PPO (preferred provider organization), and Indemnity plans are the most common traditional plans, ordered by the restrictiveness of provider choice. HMOs are the most restrictive type, covering only in-network providers; by contrast, Indemnity plans have no restrictions on the network status of providers. High deductible health plans (HDHPs) gained popularity in the mid-2000s. These plans require a higher deductible and a lower annual premium. Some believe that HDHPs could save costs for people with few anticipated medical needs. However, HDHPs are usually offered alongside traditional plans; in 2018, only about 5% of employers offered HDHP only plans. Employers thus cannot stop employees from accessing traditional plans which have lower deductibles and out-of-pocket caps. Moreover, to incentivize employees to enroll in HDHPs, the employer's contribution ratio is usually higher than in traditional plans. For example, in 2018, employers on average contribute \$12,444 for an HDHP family plan, and \$12,121 for a PPO family plan.² For large firms, HDHPs have an even lower deductible. Therefore, even if HDHPs may alleviate employers' burden for employee health benefits to some extent, they cannot eliminate the cost increase.

There is a large literature on employer-sponsored health insurance. Some works focus on employee preference (e.g., Bundorf, 2002), interaction between household demand and employer supply of health benefits (e.g., Abraham, Vogt, and Gaynor, 2006), and adverse

²KFF Survey, 2018

selection problem (e.g., Cutler and Reber, 1998). However, the impact of health price changes on firms is generally ignored, owing to the common belief that employers fully pass through any incremental increases in health care costs to workers in the form of lower wages (Summers, 1989; Gruber, 1994). However, more recent empirical works find only a partial substitution between wage and health benefits. For example, using medical malpractice data, Baicker and Chandra (2005) estimate that a 10% increase in health insurance premiums decreases wages by 2.3%, reduces hours worked by 2.4%, and causes a 1.9% shift from full-time to part-time work. Lubotsky and Olson (2015) find no evidence among Illinois school teachers between 1991 and 2008, that salaries respond to insurance cost changes. They also find no evidence that school districts respond to higher health insurance costs by reducing the number of teachers. The empirical findings on partial substitution between wage and benefits, together with the survey evidence on big employers' limited ability to cut benefit generosity, indicate that health care costs increases could directly affect firms themselves.

2.2. Health Insurance Market Competition

The US health care system is characterized by its significant dependence on private insurance companies. Health insurers act as important intermediaries between patients and providers, as well as more broadly to other parties of interest, such as employers and government. But whether the market is competitive and leads to efficient outcomes is questionable. A 2016 report by the American Medical Association (AMA) on competition in the health insurance market, finds that 71% of 388 metropolitan statistical areas (MSAs) were highly concentrated, according to the Horizontal Merger Guidelines by the Department of Justice and the Federal Trade Commission. High concentration in the health insurance market may lead to the exercise of market power and harm consumer welfare.

There is a growing body of literature about the effect of insurance market competitiveness on premium price and consumer outcome. Gaynor, Ho, and Town (2015) give a great summary of this topic. Dafny, Duggan, and Ramanarayanan (2012) look at how the

health insurance market competition affects the growth rate of employers' health insurance premiums using a proprietary dataset covering over 776 employers from 1998 to 2006. They find that the increase in local market HHI between 1998 and 2006 increases the premium by approximately 7%. They also find evidence that the insurance market exercises monopsony power on upstream health providers. Dranove, Gron, and Mazzeo (2003) focus on local and national HMOs and find that higher competitiveness is related to lower premiums. Lustig (2010) and Starc (2014) study two other health insurance markets under public health insurance programs and draw similar conclusions about concentration and price increase. Lustig (2010) looks at the market for Medicare Advantage. The counterfactual analysis shows that loss of welfare is mainly caused by the exercise of market power when there are few insurers, rather than adverse selection. Starc (2014) studies the Medigap market and finds that in this highly concentrated market, a 1% increase in the two-firm concentration ratio is associated with a 0.26% increase in premium cost.

2.3. Medical Malpractice Tort Reforms

A tort is a civil wrong that causes harm or loss of a claimant and results in legal liability for the person who commits such an act. Tort reform refers to legislative alterations, passed on a state-by-state basis, that aims to reduce the ability of a victim to bring litigation or to limit the type or amount of damages plaintiffs can claim. Tort reforms for different purposes, such as for medical or product liabilities, are passed separately. Medical malpractice liability is an important source in total health care expenditure; the cost of medical malpractice is estimated to be \$55.6 billion per year in 2008 dollars (Mello, Chandra, Gawande, and Studdert, 2010).

The most common medical malpractice tort reforms are listed here. Caps on noneconomic damages put a maximum limit on the amount a plaintiff can claim for physical pain and emotional suffering. Caps on punitive damages restrict the maximum claim for the purpose of punishing the defendant. Collateral source reforms modify the common law rulings that the plaintiff's insurance cannot be used to offset the defendant's share of the damage. Joint

and several liability reforms prevent the plaintiff from collecting full damages from one “deep pocket” defendant, restricting the proportion of damages to each defendant’s share of responsibility. Other less common medical tort reforms include periodic payment, split recovery, caps on total damages, patient compensation funds, and contingency fee funds. Avraham (2007) and Holtz-Eakin (2004) summarize these tort reforms and changes among states over time.

Medical malpractice tort reforms can affect health care costs via two channels. First, tort reforms can lower health providers’ liability cost by reducing litigation expenses and liability premiums. Past studies show that tort reforms reduce the number of lawsuits and total payouts (Avraham, 2007); imposing caps on damages, especially noneconomic damages, reduces medical malpractice costs and decreases liability insurance premiums (Viscusi et al., 1993; Born, Viscusi, and Carlton, 1998). Second, tort reforms could change the way that health care providers behave. Fearing the damage to reputation and monetary loss from malpractice tort lawsuits, health care providers may ex ante carry out excessive tests and procedures, a practice known as “defensive medicine,” in order to demonstrate that there is no negligent care and that all diagnosis and treatment options have been exhausted. Mello et al. (2010) estimate that \$45.6 billion is spent on defensive medicine per year. Tort reforms reduce the practice of defensive medicine since it decreases the threat of potential lawsuits, which transfers to a lower intensity of treatment, and therefore lower the medical costs of an average patient. Empirical studies on this topic often focus on one particular health condition. Kessler and McClellan (1996) study Medicare heart disease patients and find that “direct” tort reforms such as caps on damages and collateral source reforms reduce medical costs by 5%-9% without altering health outcomes. Studies on pregnancy have mixed findings. Earlier works such as Dubay, Kaestner, and Waidmann (1999) find that cesarean sections are associated with greater liability pressures. More recently, Frakes and Jena (2016) use hospital discharge records and clinically validated quality metrics and find no evidence of a deterioration in health care quality following reforms such as caps on noneconomic damages. Currie and MacLeod (2008) find that varying reforms might have opposite effects on health

outcomes depending on whether the physicians are exposed to greater liability. Frakes (2012) finds no evidence that malpractice pressure induces a greater number of cesarean sections but finds that caps on noneconomic damage are associated with reduced use of episiotomies during vaginal deliveries. There is also direct evidence on the effect of medical tort reforms on employer-sponsored health premiums. Avraham, Dafny, and Schanzenbach (2010) use the same proprietary dataset as Dafny et al. (2012) and find that the most common set of tort reforms reduce premiums by about 2% of self-insured firms in the period of 1998 to 2006.

3 Data

3.1. Employer-Sponsored Health Benefits

To investigate the relation between health care costs and corporate investment, I first extract employee health benefit information from Form 5500 welfare benefit plan data maintained by the Department of Labor. The Employee Retirement Income Security Act of 1974 requires firms with 100 or more participants on their welfare benefits plan to file Form 5500 to report plan coverage and characteristics. A firm may submit multiple filings for each benefit plan it sponsors. Each plan contains information about the type of benefits (e.g., health, dental, vision, life insurance), number of participants, and other plan characteristics such as funding method. Several schedules serving various purposes may be attached to the main form; the one relevant for my study is Schedule A, “Insurance Information,” which contains insurer information and insurance expense. Each plan may attach multiple Schedule A forms for each insurer it hires. Data are available by filing year from 1999 onward.

I retain the plans for health benefits and drop plans containing only non-health benefits, such as dental, vision, and life insurance. After collapsing Form 5500 plan-level filing information to firm level, I merge the data with the Compustat universe using the employer identification number (EIN). A firm might have separate EINs for its subsidiaries, but Compustat keeps only one EIN at the consolidated firm level. I therefore manually match Compustat and Form 5500 data by company name, industry and address. I also retrieve the subsidiary list for US public firms from Bureau van Dijk and match by subsidiary names, again restricting on address and industry. This process yields 43,740 firm-year observations,

representing 5,425 unique firms from 1999 to 2016.

Table 3.1, Panel A, reports the summary statistics of health plan variables from the Form 5500-Compustat merged sample. Health insurance expense of a firm aggregates all the insurance expenses on each Schedule A, which is set to be zero if there is no Schedule A attached. Within the Form 5500-Compustat merged sample, 34,430 have Schedule A attachments and therefore non-missing insurance expenses. The average insurance expense per participant is calculated as the ratio of total insurance expense to total number of participants on all insurance policies for each firm. I use the log form of average insurance cost as a measure of firms' health care costs in Section 4. This is because firms only need to file Form 5500 if they have more than 100 participants in a plan, therefore firms with about 100 participants in their plans could enter or exit my sample throughout time. Also, firms report Form 5500 at the individual EIN level, so it is possible that not all benefit plans are successfully linked to their Compustat parent, especially for firms that do not report on a consolidated level. If I scale the insurance expense by a Compustat variable such as total assets, this might introduce time-varying bias depending on firms' reporting and participation patterns. To avoid attenuation bias and possible correlation between firms' reporting pattern and investment decision, I scale insurance expenses by the Form 5500's number of benefit plan participants.

The status of fully/self-/mix insure is determined by a list of factors, including premium per person, third-party administrator (TPA) status, stop-loss status, and funding source (details can be found in the Appendix). The table shows that about 34% of the firms are fully insured, and about 33% are entirely self-insured. The most common fringe benefits bundled with health are prescription drugs, dental, and vision. About half of the firms have HMO plans.

Panels B and C report the summary statistics of non-missing key Compustat variables from the Form 5500-Compustat merged sample and the Compustat universe for the period 1999-2016. A comparison of Panels B and C shows that firms in the Form 5500-Compustat merged dataset are generally larger, older, and more profitable.

Table 3.1**Form 5500-Compustat Merged Sample Summary Statistics**

This table provides the summary statistics of the sample of employer-sponsored health benefits data linked to the Compustat universe. Employer-sponsored health benefit data come from Form 5500 filings maintained by the Department of Labor. The sample covers all public firms from 1999 to 2016 that filed at least one Form 5500 and can be linked to Compustat via an Employer Identification Number (EIN) or name matching, excluding all utility and financial firms.

Panel A reports firm-level information on Form 5500 variables. Panel B reports firm-level information on Compustat variables on the Form 5500-Compustat Merged Sample. Panel C reports the summary statistics of variables in Panel B for the Compustat universe from 1999 to 2016 with non-missing key variables. Standard errors are clustered at the state and firm level. Variable definitions can be found in Section 3 of the paper and the Appendix. For each variable, I report the mean, standard deviation, and 25th, 50th, and 75th percentiles.

Panel A: Form 5500 Variables (N=43,740)

	Mean	Std.Dev	p25	p50	p75
Average Expense per Participant	4279	6279	1966	3656	5524
Fully Insure	0.344	0.475	0	0	1
Self-Insure	0.328	0.470	0	0	1
Mix Insure	0.327	0.469	0	0	1
Dental	0.323	0.468	0	0	1
Vision	0.186	0.389	0	0	0
Prescription Drug	0.508	0.500	0	1	1
Life Insurance	0.130	0.337	0	0	0
HMO Plan	0.549	0.498	0	1	1
PPO Plan	0.393	0.488	0	0	1

Panel B: Compustat Variables – Form 5500-Compustat Merged Sample (N=43,740)

	Mean	Std.Dev	p25	p50	p75
Assets(\$mil)	3294.6	11799.7	150.3	515.2	1911.8
PPENT(\$mil)	878.8	2952.8	18.0	87.4	432.2
Profit Margin	-0.342	4.218	-0.031	0.028	0.072
Age	21.2	15.8	9.0	16.0	30.0
q	2.853	5.320	1.173	1.73	2.818
Cash/Assets	0.185	0.204	0.030	0.104	0.271
Capex/Assets	0.058	0.076	0.018	0.035	0.067
R&D/Assets	0.079	0.139	0.000	0.025	0.103
Investment/Assets	0.114	0.143	0.033	0.069	0.140

Panel C: Compustat Variables – Compustat Universe (N=69,246)

	Mean	Std.Dev	p25	p50	p75
Assets(\$mil)	2325.8	10782.0	31.8	183.3	942.5
PPENT(\$mil)	618.0	2511.7	3.0	26.1	206.1
Profit Margin	-2.331	12.539	-0.195	0.012	0.063
Age	18.3	14.2	8.0	14.0	24.0
q	3.769	7.355	1.144	1.803	3.336
Cash/Assets	0.212	0.235	0.032	0.116	0.317
Capex/Assets	0.064	0.106	0.014	0.032	0.068
R&D/Assets	0.118	0.230	0.000	0.032	0.133
Investment/Assets	0.146	0.216	0.032	0.076	0.169

3.2. Health Insurance Market Competition

The first identification strategy relies on the change in competitiveness of the health insurance market over time. The National Association of Insurance Commissioners (NAIC) reports the top 125 groups by state for total health premiums written each year, and the findings are available from 2004 to 2016. I use this information to calculate the market share of insurance firms in each state for each year. Each regional insurance carrier has a unique NAIC code that can be tracked over time and linked to its national parent firm if exists.

I then obtain health insurance company merger information from Zephyr and SDC Platinum. For selection criteria, I require both the acquiror and the target to be in the industry of Direct Health and Medical Insurance Carriers (NAICS Code: 524114), and I restrict the search to be within the United States. I include only complete deals with a deal value greater than \$10 million if this information is available. Both acquiror and target must also have a valid record from the NAIC, which ensures that they both have a non-trivial market share at the state level. I also require both acquiror and target operate in more than one state. Targets with a single line of business in Medicaid or Medicare are excluded because they are unlikely to impact the competition for employer-sponsored group health insurance market; also excluded are targets that sold only part of their business, because this is unidentifiable via the NAIC dataset. There are 14 such mergers in the period 2005-2016. Table 3.2 shows the list of mergers. The last three columns of the table show how many state-level markets the acquiror and target operate one year before the merger, as well as how many states they both operate before the merger.

Table 3.2

Health Insurance Market M&A, 2004-2016

This table presents the list of horizontal mergers in the health insurance industry from 2005 to 2015. The mergers are identified using Zephyr and SDC Platinum. To be included in the list, both acquiror and target need to be in the industry of Direct Health and Medical Insurance Carriers (NAICS Code:524114), and both must be US firms with a valid National Association of Insurance Commissioners (NAIC) code, and operate in more than one state-level market. Only complete deals with a deal value greater than \$10 million are included.

The table reports the completion dates for the merger deals, the names of acquiror and target, and the deal value if available. The last three columns show the number of state-level markets the acquiror and target operate before the merger, as well as how many states they both have operations in before the merger.

Complete Date	Acquiror	Target	Deal Value(\$Mil)	Acquiror Market #	Target Market #	Overlapping Market #
12/21/2005	Unitedhealth Group Inc	Pacificare Health Systems Inc	8734	51	40	40
12/28/2005	Wellpoint Inc	Wellchoice Inc	6497	51	2	2
2/25/2008	Unitedhealth Group Inc	Sierra Health Services Inc	2600	51	32	32
4/1/2008	Cigna Corp	Great-West Healthcare	1500	51	51	51
7/1/2008	Centene Corporation	Celtic Group Inc	80	6	43	5
10/1/2010	Coventry Health Care Inc	Mercy Health Plans Inc	n.a.	51	4	4
11/30/2010	Healthspring Inc	Bravo Health Inc	545	47	24	22
8/22/2011	Wellpoint Inc	Caremore Medical Group Inc	800	51	2	2
1/31/2012	Cigna Corp	Healthspring Inc	3800	51	51	51
2/9/2012	Unitedhealth Group Inc	XLHealth Corporation	2000	51	6	6
4/2/2012	Humana Inc	Arcadian Management Services	n.a.	51	15	15
8/31/2012	Cigna Corp	Great American Supplemental	305	51	50	50
12/24/2012	Wellpoint Inc	Amerigroup Corporation	4900	51	10	10
5/7/2013	Aetna Inc	Coventry Health Care Inc	7300	51	51	51

3.3. Tort Reform

The second identification strategy is a quasi-natural experiment in the setting of medical malpractice tort reforms. I use the sixth edition of the Database of State Tort Law Reforms (Avraham, 2018) as my reference for medical malpractice tort reforms. This dataset contains 11 medical malpractice tort reforms either enacted or struck down from 1980 to 2018. I focus on caps on noneconomic damages but also look at three other common reforms: caps on punitive damages, collateral source reforms and joint and several liability reforms. The sample period, 1999-2016, overlaps with the sample period of the Form 5500 dataset. Twelve, nine, five and five states, respectively, passed the four tort reforms of interest during the sample period. Table 3.3 shows the states with changes of tort reform by year from 1990 to 2018.

Table 3.3
Summary of State Medical Malpractice Tort Reforms

This table presents the changes in state tort reforms from 1990 to 2018. The data are from the sixth edition of Database of State Tort Law Reforms data (Avraham, 2018).

	Caps Noneconomic Damages		Caps Punitive Damages		Collateral Source Reform		Joint and Several Liability	
	Enactment	Strike Downs	Enactment	Strike Downs	Enactment	Strike Downs	Enactment	Strike Downs
1990					ME ID		NH MS	
1991		WI NH				GA		
1992		OH					TN NE	
1993		AL	ND			KS		
1994				AL			WI	
1995	IL WI		IN		WI	KY	IL	
1996	ND SD MT		NC NJ OK					
1997	OH		PA OH			AL	OH	
1998		IL OH	AK	OH		OH		IL OH
1999								
2000		OR	AL					
2001					AL			
2002					PA OH		PA	
2003	NV OH MS FL		AR MS		WV		NV OH AR	
2004	OK TX		ID MT		OK			
2005	GA		OH					
2006	IL SC		MO				SC	PA
2010		GA IL						
2011							PA	
2012	NC TN		TN SC					
2014				MO				
2015		UT						

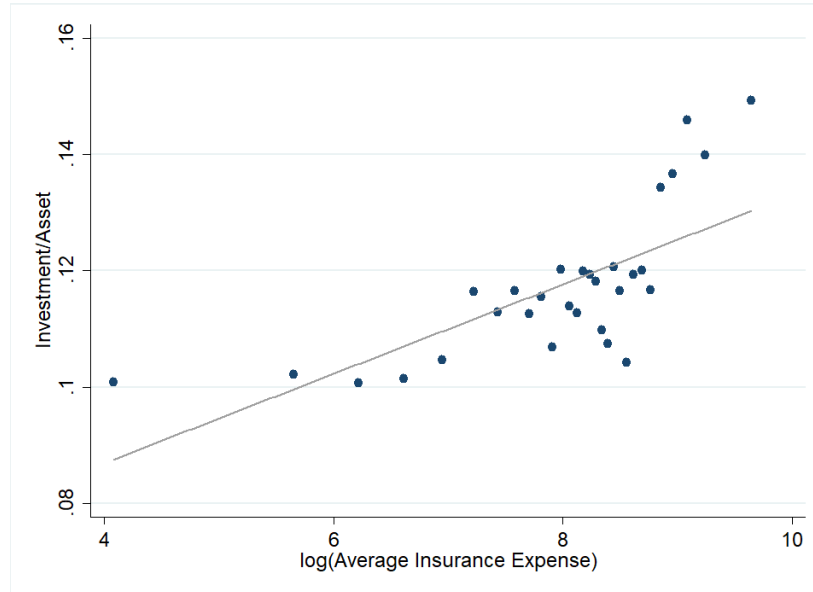
4 Empirical Strategy and Results

4.1. Firm Investment Decision and Health Premium

I start my analysis by examining the relation between health insurance expense and investment at the firm-year level before moving on to formal identification. This initial step examine how strongly the variation in employers' health expense is correlated with the variation in their corporate investment. Figure 4.1 shows the scatter-bar plot of the relation. The y -axis is $Investment/Asset$ is the sum of capital and R&D expenditure divided by the lagged total assets. The x -axis is the log form of average insurance costs per participant, $\log(Average\ Insurance\ Costs)$. It is divided into 30 equal-weighted groups, and the scatter graph shows the average $Investment/Asset$ within the group. The gray line shows the linear polynomial fit using the underlying raw observations. The graph indicates a positive correlation between average insurance expenses and investment. The positive correlation persists for the subsample of fully-insured firms.

Two factors could move health care costs and investment in the same direction. The first is a market effect; for example, an economic boom in the local area may increase both investment and demand for health care, thus driving up the price of health insurance policies. The second is a firm effect; for example, a growing firm might increase its investment and provide more generous health benefits, thus driving up its health care spending. To investigate the real effect of health care costs on firms' investment, I move on to use exogenous variations in health care costs.

Figure 4.1. Correlation between Firm Investment and Average Health Care Costs



4.2. Insurance Market Mergers and Acquisitions

The first set of external variations relies on the industrial organization of the health insurance market. As discussed in Section 2.2, prior literature finds that the health insurance market is highly concentrated and that an increase in concentration is correlated with an increase in premium (Dranove et al., 2003; Dafny et al., 2012; Starc, 2014). The changes in premium costs induced by variations in the health insurance market concentration could be used as a source of variation for health care costs faced by employers.

To assess whether changes in market concentration would be a viable instrument for health care costs faced by employers, I first examine the competition dynamics for the local health insurance market. I compute the Herfindahl-Hirschman Index (HHI) in each state, using NAIC's data on health insurers' market share in each state from 2004 to 2016. Figure 4.2 is the snapshot of the HHI in each state in 2004, 2008, 2012, and 2016. Consistent with AMA'S findings, many health insurance markets are highly concentrated. As shown by

the graphs, there is great variation in the health insurance market HHI across states and across time. Table 4.1 Panel A shows that the mean HHI for the state-level health insurance market is 1951, and the top four firms in each state-level market on average contribute to 68.6% of total market share.

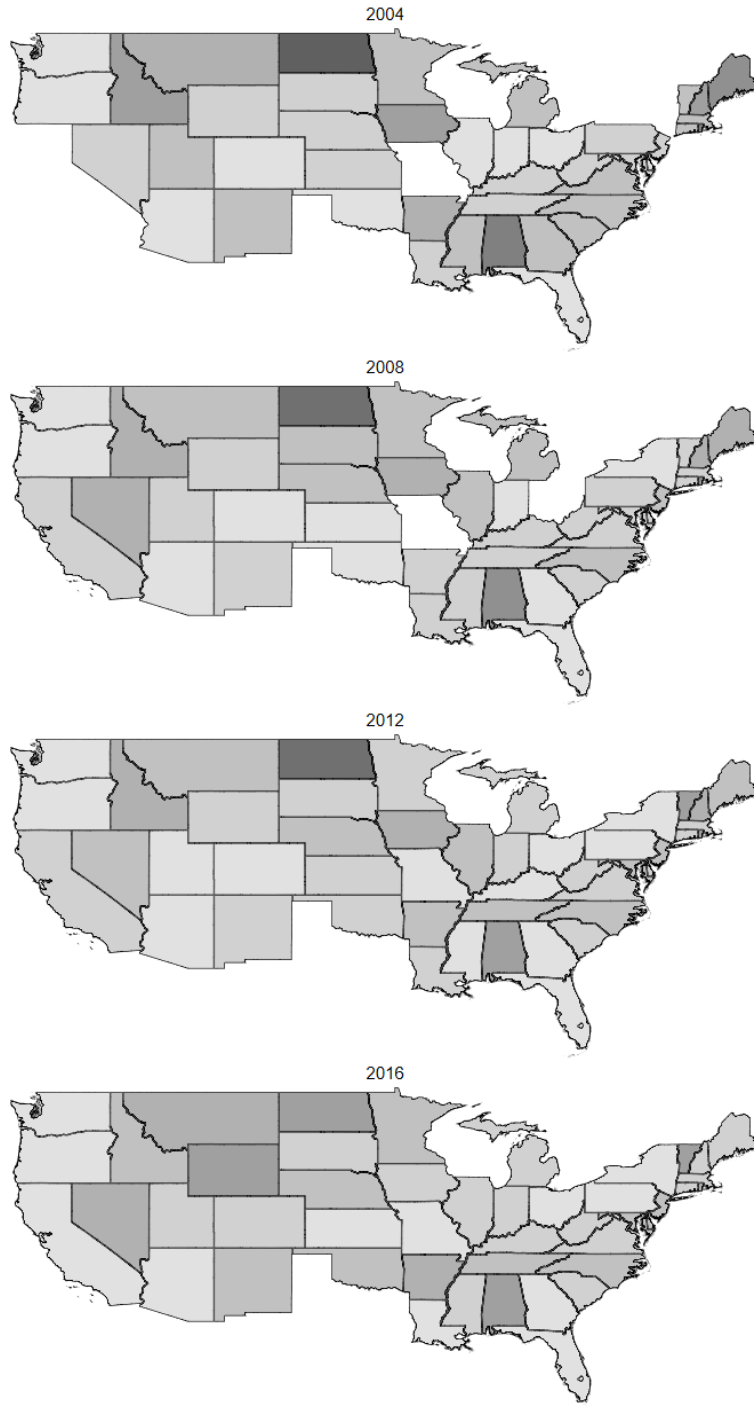
Although changes in health insurance market concentration are largely orthogonal to individual non-insurance firms, the insurance market HHI may not be a good candidate to instrument for health care costs because both local insurance market competitiveness and firms' local investment might be subject to regional economic conditions. To address this issue, I look at the induced change in concentration following merger and acquisition (M&A) activities among national health insurance companies. Because the pre-merger market shares captured by the acquiror and target vary across geographic markets, the merger would create a heterogeneous effect on concentration across regions. I gather a list of horizontal mergers in the health insurance market in the period 2004-2016. Table 3.2 presents the list, and Section 3.2 describes the data collection procedure.

$$\begin{aligned}
 \text{sim}\Delta HHI_{mt} &= (\text{TargetShare}_{mt-1} + \text{AcquirorShare}_{mt-1})^2 \\
 &\quad - (\text{TargetShare}_{mt-1}^2 + \text{AcquirorShare}_{mt-1}^2) \\
 &= 2 \times \text{TargetShare}_{mt-1} \times \text{AcquirorShare}_{mt-1}
 \end{aligned} \tag{4.1}$$

To measure the changes in concentration after mergers, I build on the works of Dafny et al. (2012) and Ashenfelter et al. (2015) to construct the “cumulative simulated change in the HHI”. It is the anticipated change in HHI that would have occurred after the merger if nothing else changes. The purpose of using the projected change (instead of the actual change) in HHI is to tease out post-merger adjustment by merged firms and other players which may correlate with local market conditions. The construction of the projected change in the HHI ($\text{sim}\Delta HHI$) is illustrated in Equation 4.1. It takes the difference between the HHI of combined market shares of acquiror and target after the merger, and the sum of the separate HHIs of acquiror and target before the merger. AcquirorShare and TargetShare

Figure 4.2. Health Insurance Market Concentration over Time

This figure shows the changes in health insurance market concentration across time and geographical regions. The plots present the state-level Herfindahl-Hirschman index (HHI), categorized into groups of fixed intervals and with increments of 500 (on the scale of 0 to 10,000), for 2004, 2008, 2012 and 2016. Darker shades indicate higher HHI. HHI is calculated using the annual Market Share Reports from the National Association of Insurance Commissioners (NAIC).



are the market shares in each local market m for the target and acquiror one year before the merger completed. To account for the persistence of the merger effect, as well as subsequent mergers in the local market, I construct $c_sim\Delta HHI$ which is the cumulative increment in $sim\Delta HHI$ over the year for local market m and use it as the instrument for health insurance price changes.

To evaluate whether $c_sim\Delta HHI$ is a valid instrument for premium changes, we need to know if it is relevant to insurance market concentration changes. Table 4.1 Panel B displays how $c_sim\Delta HHI$ is related to market concentration. It shows that $c_sim\Delta HHI$ is strongly correlated to market concentration in the current period and the next period. But it does not perfectly correlate the change in market structure in the next period, indicating that there is a readjustment in the local market after the mergers.

Table 4.1
Health Insurer Market Competition

This table presents an overview of the health insurance market competition at the state level from 2004 to 2016. The Herfindahl-Hirschman index (HHI) and the total market share of top insurance firms are calculated using the annual Market Share Reports from the National Association of Insurance Commissioners (NAIC). $C_sim\Delta HHI$ is the cumulative simulated change in HHI described in Section 4.2 and Equation 4.1. Panel A reports the summary statistics of variables related to market competition. Panel B reports the state-level regression of the actual HHI or top players' market share of this or the next year on $c_sim\Delta HHI$. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Summary Statistics

	N	Mean	Std.Dev	p25	p50	p75
$c_sim\Delta HHI$	663	56.2	174.7	0.77	8.1	30.2
HHI	663	1951.6	801.4	1442.3	1793.7	2267.2
Total Marketshare Top 4 Firms	663	0.686	0.092	0.629	0.687	0.753

Panel B: Regression Results

	HHI		Total Marketshare Top 4 Firms	
$c_sim\Delta HHI$	0.646*** (4.953)		0.726*** (4.408)	
l1. $c_sim\Delta HHI$		0.423*** (3.350)		0.452*** (2.812)
Observations	663	612	663	612
R-squared	0.866	0.874	0.839	0.849
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

The key assumption for the analysis here is that health insurer M&As only affect firms' financial decisions through a rise in health care costs induced by mergers. In our case, the health insurer merger activities that began in the mid-2000s could be driven by the expansion of the Medicare market following the Medicare Modernization Act (MMA). The MMA was enacted in 2003 and went into effect on January 2006. One of the act's most prominent features is Medicare Part D, an optional prescription drug benefit program for Medicare enrollees. In 2018, 44 million people were enrolled in more than 700 drug plans. The MMA also changed Medicare Advantage plans to facilitate the involvement of private insurers in selling Medicare plans. Enrollment in Medicare Advantage plans increased from 5 million in 2003 to 22 million in 2019. The MMA has no direct impact on employers because it concerns for Medicare beneficiaries, who no longer rely on employers for health benefits. But given the vast number of Medicare enrollees and the surging demand for prescription drugs, the enactment of the MMA was a monumental event for the US health care system, and insurers were likely to respond to it. For example, in the case of the merger between UnitedHealth and PacificCare, the press release stated that "PacifiCare is best known for its strong focus on senior health care...and [UnitedHealth] joins PacifiCare as a leader in Medicare program innovation." In fact, in checking monthly Medicare Part D and Medicare Advantage enrollment data via the Centers for Medicare & Medicaid Services (CMS) , which is available starting in 2006, and aggregating enrollment by insurer, I find that many targets in the sample are big players in the Medicare market, and only three targets (Wellchoice, Great West Healthcare, and Celtic Group) are not identified as Medicare Part D or Medicare Advantage service providers.

To validate the instrumental variable (IV) strategy approach, I run the first stage regression of $c_sim\Delta HHI$ on average insurance expense per participant using Equation 4.2. Table 4.2, Column 1, presents the results. It shows that the simulated change in the HHI is strongly correlated with the average insurance expense. A one standard deviation increase in $c_sim\Delta HHI$ leads to a 6.4% increase in average health costs.

$$\log(\text{avg insurance exp})_{imt} = \beta_1 \cdot c_sim\Delta HHI_{mt-1} + \phi_1 \cdot controls_{it-1} + \alpha_{1i} + \lambda_{1t} + \epsilon_{1it} \quad (4.2)$$

Columns 2-4 of Table 4.2 show the instrumental variables two-stage-least-squares (IV-2SLS) results of average health insurance expense on investment based on Equation 4.3, instrumented by $c_sim\Delta HHI$. The dependent variables in Column 2-3 *CAPEX* and *R&D* are Compustat variables of capital and R&D expenditure scaled by lagged assets, and *INVESTMENT* in Column 4 is the sum of scaled capital and R&D expenditures assuming R&D to be zero if missing. Firm and year fixed effects are included in all specifications. I also include firm and state-level controls to ensure that the results are not driven by firm-level time-varying factors and macroeconomic factors. Firm controls include lagged size, cash, Q, PPENT, profit margin; state-level controls include income per capita and unemployment rate. The results are unaffected in the absence of these controls. Standard errors are clustered at the state and firm level for all regressions. Since the effects of insurance company M&A and tort reforms in Section 4.3 are at state level, this clustering method accounts for potential heteroskedasticity and arbitrary correlation in the error term within the local market and firm over time (Bertrand, Duflo, and Mullainathan, 2004).

$$Investment_{imt} = \beta_3 \cdot \widehat{\log(\text{avg insurance exp})}_{imt-1} + \phi_3 \cdot controls_{it-1} + \alpha_{3i} + \lambda_{3t} + \epsilon_{3it} \quad (4.3)$$

Table 4.2

Health Insurance Merger Effect on Firm Investment

This table presents how a firm’s investment decisions are affected by the health care cost changes induced by mergers in the health insurance industry. The sample period is 2004-2016, the years for which health insurance market share data from NAIC are available. Column 1 shows the first stage result regressing $\log(\text{average insurance expense})$ on $c_sim\Delta HHI$. $\log(\text{average insurance expense})$ is from Form 5500, and the independent variable $c_sim\Delta HHI$ is the cumulative simulated change in the HHI described in Section 4.2 and Equation 4.1. Columns 2-4 show the instrumental-variables-two-stage-least-squares (IV-2SLS) results using $c_sim\Delta HHI$ as an instrument for $\log(\text{average insurance expense})$. The dependent variables in Columns 2 and 3, $CAPEX$ and $R\&D$, are Compustat variables of capital and R&D expenditure scaled by lagged assets; INV is the sum of scaled capital and R&D expenditures.

All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q , $\log(\text{PPENT})$, profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	First Stage	IV-2SLS		
	$\log(\text{avg insurance exp})$	CAPEX	R&D	INV
	(1)	(2)	(3)	(4)
$c_sim\Delta HHI$	3.676*** (5.257)			
$\log(\text{average insurance expense})$		-0.094*** (-5.052)	0.011 (0.991)	-0.080*** (-4.067)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	15,632	15,189	11,265	15,189
F-stats	27.64			

Columns 2 and 3 show that the negative shock of health care costs has a significant effect on capital expenditure. Aggregating capital expenditure and R&D expense together, the coefficient of -0.08 in Table 4.2, Column 4, indicates that a 1% increase in average health care costs is associated with a 0.7% decrease in the total investment level. To elaborate on the magnitude of this number, I make a back-of-the-envelope estimate using the median firm in my sample in 2016. The median employment for the Compustat-Form 5500 merged sample is 3,223, and the median total investment is \$35 million. According to the Medical Expenditure Panel Survey-Insurance Component (MEPS-IC) survey for 2016, the enrollment rate for firms with 100 or more employees is 56%. For average health costs per enrollee, MEPS-IC reports that, in 2016, the single premium is \$6,499, the employee-plus-one premium is \$12,701, and the family premium is \$18,784. The percentage of enrollment for these three types of plans are about 50%, 20% and 30% percent. Thus, a 10% increase in health care costs is a \$2.1 million increase in health costs for a median firm in my sample, and the coefficient in Table 4.2 predicts a \$2.5 million reduction in the total investment.

Two potential channels may explain the inverse relation between health care costs and investment. First, a change in input cost affects firms' optimal scale, thus firms cut back investment. Secondly, firms use cash to pay for health expenses, and an increase in health costs decreases available cash and subsequent investment. The underlying mechanism is discussed in more detail in Section 6.

There might be concerns that the results are driven by the insurers' intention of capturing a particular market. If the target operates only in one state, it is reasonable to suspect that the acquisition correlates with that state's economic outlook. Thus, as a robustness check, I include only mergers in which the acquiror and the target have more than 30 overlapping markets, so that their decisions to merge, as well as the impact of the merger, do not depend on a single market. There are in total six such mergers. I repeat the exercise from Table 4.2 using these mergers only, and Table A.1 shows that the results still hold if I exclude mergers that affect fewer regions. The analysis is also robust when excluding the three non-Medicare Part D insurer mergers.

It is also unlikely that these mergers were aiming for some particular real firms as these insurance companies' potential customers. The median number of employees in Compustat-Form 5500 merged sample is fewer than five thousands, whereas the total medical enrollment of UnitedHealth is more than 30 million in 2008¹. Therefore, a single employer is rather negligible when considering a national insurer's scope of operation. The M&A decision in the insurance market could not be driven by individual nonfinancial corporations' activities.

How heavily firms are affected by the dynamics in the health insurance market depends on the extent that they are fully or self-insured. Self-insured firms pay out employees' medical claims directly and have less exposure to health insurance providers.² Although I control for a battery of firm observables, it is possible that the sensitivity of per dollar change in health care costs for fully and self-insured firms' investment decision is different. Nevertheless, the insurance M&A setting establishes the negative relation between health care costs and firm investment and demonstrates the adverse effect of health care market concentration on real firms. Next, I will move on to the setting of tort reforms, which induce a more homogeneous change in health care costs on firms, regardless of their plan funding method.

4.3. Tort Reform

I next exploit quasi-experimental variation in employer health care spending using a series of medical malpractice tort reforms from 1999 to 2016. As described in Section 2.3, medical malpractice tort reforms reduce health providers' medical liability and exposure to malpractice lawsuits and thus lessen the intensity of treatment and the practice of defensive medicine. In this way, tort reforms reduce patients' average medical costs and the health care costs of the employer. With consideration of past literature, I focus on tort reforms to caps on noneconomic damages, which is the most common reform with significant consequences, but I also look jointly at caps on noneconomic damages, together with caps on punitive

¹Source: *Directory of Health Plans: 2009* (Washington, DC: Atlantic Information Service, 2009).

²Still, they hire insurance companies as TPAs to set up the network and process claims.

damages and collateral source, as well as joint and several liability reforms.

4.3.1. Main Results

To investigate how health costs reductions induced by medical malpractice tort reforms affect corporate investment, I adopt a difference-in-differences research design to explore the staggered change of tort reforms across states. The panel regression model is shown in Equation 4.4. *TortReform* is a dummy variable that equals one after the reform is passed in state m . The list of tort reforms is described in Section 3.3. I use the same set of firm and state level time-varying controls as the previous exercise, which includes lagged size, cash, Q, PPENT, profit margin, age, income per capita and unemployment rate. Standard error continues to be clustered at the state and firm level.

$$Investment_{imt} = \beta \cdot TortReform_{mt-1} + \phi \cdot controls_{it-1} + \alpha_i + \lambda_t + \epsilon_{it} \quad (4.4)$$

Table 4.3 presents the results using Equation 4.4. Columns 1-3 show the effect of tort reforms of caps on noneconomic damages on various investment variables, and Column 4 shows the results on the four most common reforms in the sample period. The point estimate of 0.006 in Column 1 implies that the enactment of caps on noneconomic damages increases the capital expenditure to asset ratio by 0.6%, which translates into a 9.4% increase in *CAPEX*, given that the average is 0.064 during the sample period. Column 3 shows that the enactment of tort reform increases total investment by 1.3%, which translates into an 8.9% increase from the average level in the sample period. Pulling all four tort reforms together in Column 4 yields similar results. The sign of the coefficient of joint and several liability reform is consistent with of Currie and MacLeod (2008), which find an opposite effect on physician behavior for this reform compared with other reforms. The result is robust with the absence of controls; as well as with extending the sample period back to 1990.

Figure 4.3 shows the effect of tort reform on investment by the difference in years relative to the event. The excluded year is four or more years before the reform. As shown by the graph, before the reforms, the estimated difference between control states and treatment

states is not statically significant from zero. Following the reform, the total investment level increases significantly in the treated states relative to the control states. This figure presents the dynamics of change in total investment from four years or more before the enactment of caps on noneconomic damages reform to four years or more after. The dependent variable *Investment* is the sum of scaled capital and R&D expenditure. Independent variables are the set of dummies indicating whether the observation fits into the specific time frame of the tort reform. I plot the β_k coefficients, which are the estimates representing the differences in *Investment* between the treated firm and firms with no change in the tort reform during the sample period. The omitted category is four years or more before the enactment.

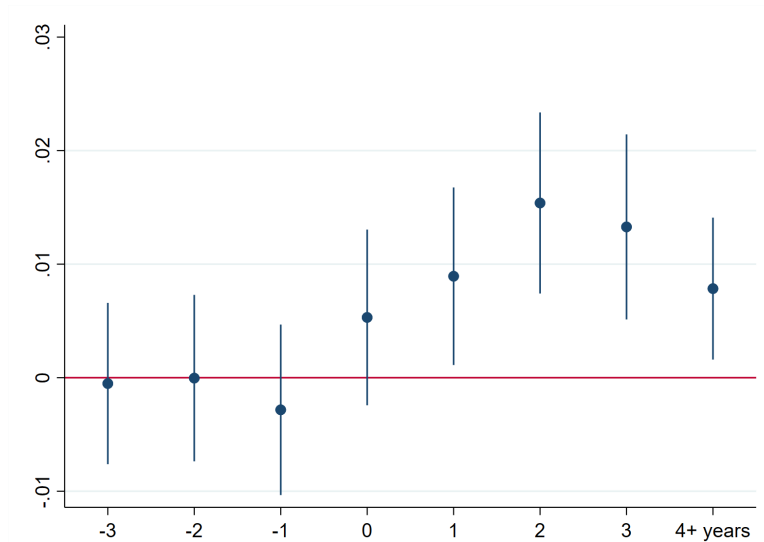


Figure 4.3. Difference in Investment by Year to Tort Reform Enactment

Table 4.3
Effect of Tort Reforms on Firm Investment

This table presents how a firm's investment decisions are affected by state-level medical tort reforms from 1999 to 2016. The dependent variables *CAPEX* and *R&D* are Compustat variables of capital and R&D expenditure scaled by lagged assets; *INV* is the sum of scaled capital and R&D expenditures. The independent variables are four common medical malpractice tort reforms during the sample period, equals one if the reform is in effect in that year. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, log(PPENT), profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	CAPEX (1)	R&D (2)	INV (3)	INV (4)
Caps Noneconomic Damages	0.006** (2.557)	0.009*** (2.829)	0.013*** (2.814)	0.013*** (2.826)
Caps Punitive Damages				-0.000 (-0.166)
Collateral Source Reform				0.015** (2.034)
Joint and Several Liability Reform				-0.013*** (-3.062)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	61,408	44,893	61,408	61,408
Adjusted R ²	0.532	0.704	0.666	0.666

4.3.2. Robustness Checks

Propensity Score Matching

For difference-in-differences research designs, treatment and control firms ideally should be identical in all factors that determine firms' investment decisions. To account for this, I assemble a matched sample based on the closest propensity score between treatment and control firms. I also restrict the period to be three years before and after the enactment of caps on noneconomic damages.

First, I investigate the differences in observable firm characteristics to determine the dimensions for matching between treatment and control firms. The treatment firms are those that enacted the caps on noneconomic damage reform during the sample period, excluding firms in states that stroke down the reform in the following year. The sample of control firms is composed of firms headquartered in the states that did not experience changes in tort law during the sample period, keeping the years which tort reforms took place in some states. Table 4.4 Panel A shows mean and standard deviation for relevant firm characteristics of treatment firms and the full control sample before matching. The last column reports the t-statistics for the differences in mean values. The results show that the treatment firms and the control firm sample are statistically different in age, size, Q, cash-to-asset, $\log(\text{PPENT})$ and profit margin, which is the set of controls I use in all analyses. These dimensions are also used for propensity score matching.

Panel B displays the treatment and control firms' summary statistics after propensity score matching. The matched control firm is from the same year and same 2-digit SIC industry as the treatment firm, with the closest propensity score estimated using firm size, age, Q, cash-to-asset, $\log(\text{PPENT})$ and profit margin one year before the enactment. I use two rounds of matching with replacement. The t-statistics show that the treated and matched are similar in the dimensions of interest.

Table 4.4 Panel C shows the OLS regression results of specification 4.4 using the matched sample. Consistent with the baseline analysis, the results using the matched sample predict

an increase in investment level after the enactment of caps on noneconomic damages tort reforms, and the effect is stronger than the unrestricted full sample. The results are similar if using five years before and after the enactment, or using one round of matching.

Table 4.4

**Effect of Medical Malpractice Tort Reforms on Firm Investment:
Matched Sample Analysis**

This table presents how a firm’s investment decisions are affected by state-level medical tort reforms from 1999 to 2016 using the matched subsample analysis. Treatment firms are those with the enactment of caps on noneconomic damage reform during the sample period, excluding states that strike down the reform in the following year. The control sample is assembled by firms headquartered in the states that do not experience changes in the tort law during the sample period, restricting on the years that the treatment took place. Panel A is the comparison of mean for treatment firms and the full control sample before propensity score matching. The last column reports the t-statistics for the differences in mean values between the treatment firms and the control firm sample. ***, **, and * in the last column indicate significance at the 1%, 5%, and 10% levels, respectively, for a t-test of whether the two sample have equal means.

Panel B shows the comparison of the mean for treatment and control firms after propensity score matching. The control firms are selected from the same year and same 2-digit SIC industry with the closest propensity score, which is estimated using firm size, age, q, cash-to-asset, log(PPENT) and profit margin from one year before the enactment. I use two rounds of matching with replacement. The last column reports the t-statistics for the differences in mean values between the treatment firms and the control firm sample. ***, **, and * in the last column indicate significance at the 1%, 5%, and 10% levels, respectively, for a t-test of whether the two sample have equal means.

Panel C shows the OLS regression results of the difference-in-differences specification using the matched sample. I include observations from three years before through three years after the enactment of caps on noneconomic damages for both treatment and matched firms. $I(Tort)$ is a dummy variable that equals one if the caps on noneconomic damages tort reform are enacted in the state in which the firm is present during the sample period, $I(After)$ is a dummy variable equals one if the treatment firm (matched control firm) is present within $[t+1, t+3]$ years after the year of enactment. $I(Tort) \times I(After)$ is the interaction term of the two. The dependent variable $CAPEX$ is Compustat variables of capital scaled by lagged assets; $INVESTMENT$ is the sum of scaled capital and R&D expenditures. All specifications include firm and year fixed effects. Columns 2, 5 includes state-level controls of income per capita and unemployment rate. Columns 3, 6 add firm controls including lagged size, cash-to-asset, q, log(PPENT), profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics based on robust standard errors are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Summary Statistics of Treatment and Control Sample – Full Sample in t-1 Year

	Treatment		Control		t stats
	(N=1313)		(N=7072)		
	Mean	Std.Dev	Mean	Std.Dev	
log(Age)	2.676	0.777	2.602	0.804	(3.17)**
log(Assets)	4.894	2.566	5.107	2.601	(-2.75)**
Q	3.580	6.314	3.155	6.049	(2.25)*
Cash	0.252	0.362	0.166	0.269	(8.13)***
log(PPENT)	2.825	3.097	3.427	3.080	(-6.48)***
Profit Margin	-1.815	8.961	-1.096	6.058	(-2.79)**
Employment	6.910	19.086	8.020	21.225	(-1.88)
Leverage	0.328	0.702	0.364	0.699	(-1.70)
Market Value	1985	6871	1768	6246	(1.07)
Sales	1.211	0.921	1.189	0.883	(0.80)
Sales Growth	0.071	0.443	0.080	0.435	(-0.65)
ROA	-0.037	0.443	-0.011	0.432	(-1.91)

Panel B: Summary Statistics of Treatment and Control Sample – Propensity Score Matched Sample in t-1 Year

	Treatment		Control		t stats
	(N=920)		(N=1487)		
	Mean	Std.Dev	Mean	Std.Dev	
log(Age)	2.551	0.746	2.577	0.769	(0.82)
log(Assets)	4.773	2.603	4.818	2.629	(0.42)
Q	3.458	5.643	3.230	5.819	(-0.95)
Cash	0.215	0.319	0.201	0.301	(-1.06)
log(PPENT)	2.798	3.048	2.957	3.041	(1.25)
Profit Margin	-1.742	7.861	-1.334	6.730	(1.31)

Panel C: Regression Results

	CAPEX			INVESTMENT		
	(1)	(2)	(3)	(4)	(5)	(6)
$I(Tort) \times I(After)$	0.009** (2.425)	0.009** (2.430)	0.010*** (2.997)	0.014*** (3.195)	0.014*** (3.000)	0.017*** (3.825)
$I(After)$	-0.001 (-0.197)	-0.001 (-0.240)	-0.003 (-0.833)	-0.005 (-1.320)	-0.005 (-1.240)	-0.008* (-2.004)
Firm Controls	No	No	Yes	No	No	Yes
Macro Controls	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,066	14,066	13,414	14,066	14,066	13,414
Adjusted R ²	0.470	0.470	0.528	0.621	0.621	0.688

Product Liability

Besides tort reforms for medical malpractice, another major category of tort reforms is for product liability. One might be concerned that the tort reforms used in the analysis affect firms' investment and operation through changes in product liability, rather than through the health care cost channel. However, this is not likely the case. Different types of tort reforms are usually passed individually. Even in the domain of medical malpractice, there is variation in the time of enactment and that of strike down among different types, as shown by Table 3.3. The tort reforms used in this set of analysis are specific to medical malpractice, excluding individual productivity liability tort reforms. Also, product liability constitutes only 1.9% of all tort cases in the United States, whereas medical malpractice makes up to 14.5%.³ Also, product liability tort reform centers around the debate over the statute of repose limitations (Hubbard, 2006), which limits how long after the sale or first use of a product a plaintiff can bring a lawsuit for injuries. Caps on noneconomic damage reform is much less prevalent for product liability tort reforms.

Although it is not likely that product liability tort reforms drive the results, as a robustness check, I run the specification in Equation 4.4 excluding industries that are prone to product liability: Machinery, Automobile and Truck, Aircraft, Transportation, and Abrasive and Asbestos Products.⁴ Table 4.5 shows the results. The results are unaffected after excluding the industries that could potentially benefit from product liability tort reforms. In another test, I exclude the states (Oregon and Mississippi) that either enacted or struck down caps on noneconomic damages tort reform for both medical and nonmedical liability together in my sample period, and the results are unchanged (untabulated).

³Department of Justice, Bureau of Justice Statistics, Civil Trial Cases and Verdicts in Large Counties, 2001, NCJ 202803 (April 2004)

⁴Machinery; Automobile and Truck; Aircraft; Transportation; Abrasive and Asbestos Products.

Table 4.5

Effect of Tort Reforms on Investment – Excluding Industries

This table presents how a firm’s investment decisions are affected by state-level medical tort reforms from 1999 to 2016 excluding industries that are susceptible to product liability lawsuits. The excluded industries are Machinery (Fama-French 48 Industry: 21); Automobile and Truck (Fama-French 48 Industry: 23); Aircraft (Fama-French 48 Industry: 24); Transportation (Fama-French 48 Industry: 40); and Abrasive and Asbestos Products (SIC 3290-3293). The dependent variables *CAPEX* and *R&D* are Compustat variables of capital and R&D expenditure scaled by lagged assets; *INV* is the sum of scaled capital and R&D expenditures. The variables of interest are four common medical malpractice tort reforms during the sample period. The reforms are a dummy variable that equals one if the reform is in effect in that year. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, log(PPENT), profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	CAPEX (1)	R&D (2)	INV (3)	INV (4)
Caps Noneconomic Damages	0.007** (2.640)	0.008** (2.574)	0.013*** (2.835)	0.014*** (2.848)
Caps Punitive Damages				-0.002 (-0.644)
Collateral Source Reform				0.015** (2.156)
Joint and Several Liability Reform				-0.013*** (-3.088)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	57,062	42,579	57,062	57,062
Adjusted R ²	0.533	0.704	0.668	0.668

Partisan Status

Another question is whether a state's partisan status would move investment and tort reforms in the same direction. One might speculate that tort reform passed more easily when the "pro-business" Republican Party is in power, and encourages business activity and investment at the same time. I thus interact the tort reform of caps on noneconomic damages with whether the state is a Republican state in that year using the State Partisan Balance Data from Klarner (2013). A Republican state is defined as one in which Republicans control two or more of three state institutions: each chamber of the state legislature and the governor's office.

The results are shown in Table 4.6: the coefficient on tort reform remains largely unchanged, and the interaction term is statistically insignificant, proving that the investment increase is not driven by a state's partisan status. Another potential concern is that lobbying activity might influence the passage of tort reforms. However, if there are lobbying activities involved in medical malpractice tort reform, they are most likely hired by health care providers, liability insurance companies and trial lawyers, not by business owners.

Table 4.6

Effect of Tort Reforms on Investment – State Politics

This table presents the results on whether the effect of state-level medical tort reforms on firm’s investment decisions is driven by state partisan status. The dependent variables *CAPEX* and *R&D* are Compustat variables of capital and R&D expenditures scaled by lagged assets; *INVESTMENT* is the sum of scaled capital and R&D expenditures. $I(Tort)$ is a dummy variable that equals one if the caps on noneconomic damages tort reform is in effect, and $I(Republican State)$ is a dummy variable equals one if the Republican Party controls two or more of three state institutions: each chamber of the state legislature and the governor’s office. Data on state partisan balance are from Klarner (2013) and are available from 1990 to 2011. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, log(PPENT), profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	CAPEX (1)	R&D (2)	INVESTMENT (3)
$I(Tort)$	0.012*** (2.881)	0.010** (2.054)	0.019*** (2.808)
$I(Republican State)$	0.004*** (2.823)	0.000 (0.019)	0.005 (1.417)
$I(Tort) \times I(Republican State)$	-0.005 (-1.260)	-0.000 (-0.119)	-0.005 (-0.876)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	48,001	35,468	48,001
Adjusted R ²	0.527	0.710	0.665

Geographical Dispersion

I use a firm's headquarters as the state in which the insurer M&As and tort reforms take effect on the firm, following previous studies studying effects of labor law on firms (e.g., Agrawal and Matsa, 2013; Acharya, Baghai, and Subramanian, 2013). This is because Compustat only has a firm's incorporation and headquarters states, and typically a significant portion of operations and employees are in the firm's headquarters state. For firms with multiple establishments in numerous states, this approach will only bias down the estimation magnitude compared to the case of ideally constructing an employee-weighted indicator of establishment locations. It is still worthwhile to confirm that using headquarters state is a reasonable approach. To do this, I explore whether geographically dispersed firms have smaller effects facing health care shocks. Since geographically more dispersed firms have a lower percentage of employees in the headquarters state, these firms should be affected less when the headquarters state's health care costs changes.

I use data on geographic dispersion from Garcia and Norli (2012), who parse SEC filings and measure dispersion by the frequency of mentions for each state name. The dataset runs from 1995 through 2008; I use the extrapolation method to extend the data to suit my sample period. Results are shown in Table 4.7. Columns 1 and 2 are the subsamples split by whether the number of states in which a firm is present exceeds the sample median. Column 4 is the subsample on the firms present in more than one state, and Column 5 is the firms who are present in only one state. Column 3 and 6 are the interaction exercises. As the results show, firms that are more geographically dispersed have a smaller effect when facing health care shocks than less dispersed firms.

Table 4.7

Effect of Tort Reforms on Investment – Geographical Location

This table presents the results on whether the effect of state-level medical tort reforms on firm’s investment decisions is driven by state partisan status. The dependent variables *INVESTMENT* is the sum of scaled capital and R&D expenditures. $I(Tort)$ is a dummy variable that equals one if the caps on noneconomic damages tort reform is in effect. The sample is split into “Dispersed” and “Less Dispersed” by whether the number of states in which the firm is present exceeds the sample median or whether the firm is present in more than one state. Geographical dispersion data are from Garcia and Norli (2012). All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q , $\log(PPENT)$, profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

INVESTMENT						
	Split by Median			Present in Multiple States		
	Dispersed	Less Dispersed	Interaction	Dispersed	Less Dispersed	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)
$I(Tort)$	0.008** (2.413)	0.013** (2.064)	0.013** (2.065)	0.009* (1.937)	0.031*** (3.203)	0.031*** (3.228)
$I(Tort) \times I(GeoDispersed)$			-0.004 (-0.828)			-0.022*** (-2.799)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,008	28,147	53,155	50,442	2,713	53,155
Adjusted R ²	0.661	0.690	0.687	0.669	0.769	0.675

Industry-Level Shocks

In many cases, firms use health benefits to attract employees from competitors, and therefore the benefits offered and firms' sensitivity to health care costs is more similar within an industry than across industries. To account for the possibility that industry-level shocks induce the M&A activities in the health insurance industry and alter firms' investment decision at the same time, I exclude financial and insurance firms from the analysis. In the previous subsection, I also excluded the industries that could be associated with product liability lawsuits, to show that the investment increase is not caused by industries that benefit from product liability tort reforms. To further address unobservable time-varying industry factors that may simultaneously affect investment decisions and health insurer M&A or medical malpractice tort reforms in Equations 4.3 and 4.4, I include industry-year fixed effects to the baseline analysis for the M&A and tort reforms setting. The results are shown in Tables 4.8 and 4.9.

The results show that adding industry-year fixed effects does not change the negative relation between health care costs and firm investment. The magnitudes shown in Tables 4.8 and 4.9 are smaller than the baseline results in Tables 4.2 and 4.3, but they are not statistically different. The smaller coefficient is because different industries have different sensitivities toward health care costs; in particular, industries with more high-skilled workers are more prone to health care costs, which translates into a stronger effect on investment. Section 5 explains these issues in detail. Therefore, adding industry-year fixed effects might underestimate the average effects among all treated firms. Importantly, the results in Tables 4.8 and 4.9 demonstrate that the negative relation between health care costs and investment is not driven by transitory industry shocks.

Table 4.8

Insurance Merger Effect on Investment - Industry Shocks

This table presents how a firm's investment decisions are affected by health care cost changes induced by mergers in the health insurance industry. The sample period is 2004-2016, the years for which health insurance market share data from NAIC are available. Column 1 shows the first stage result regressing $\log(\text{average insurance expense})$ on $c_sim\Delta HHI$. $\log(\text{average insurance expense})$ is from Form 5500, and the independent variable $c_sim\Delta HHI$ is the cumulative simulated change in the HHI described in Section 4.2 and Equation 4.1. Columns 2-4 shows the IV-2SLS results using $c_sim\Delta HHI$ as an instrument for $\log(\text{average insurance expense})$. All specifications include firm and 3-digit NAICS industry-year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, $\log(\text{PPENT})$, profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	First Stage	IV-2SLS		
	$\log(\text{avg insurance exp})$ (1)	CAPEX (2)	R&D (3)	INV (4)
$c_sim\Delta HHI$	2.759*** (3.796)			
$\log(\text{avg insurance exp})$		-0.082*** (-3.414)	0.020 (1.412)	-0.061** (-2.477)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	15,632	15,185	11,240	15,185
F-stats	14.41			

Table 4.9

Effect of Tort Reforms on Firm Investment - Industry Shocks

This table presents how a firm's investment decisions are affected by state-level medical tort reforms from 1999 to 2016. The dependent variables *CAPEX* and *R&D* are Compustat variables of capital and R&D expenditure scaled by lagged assets; *INVESTMENT* is the sum of scaled capital and R&D expenditures. The independent variables are four common medical malpractice tort reforms during the sample period, equals to one if the reform is in effect in that year. All specifications include firm and 3-digit NAICS industry-year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, log(PPENT), profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	CAPEX (1)	R&D (2)	INV (3)	INV (4)
Caps Noneconomic Damages	0.003** (2.204)	0.009** (2.430)	0.008*** (3.328)	0.008*** (3.428)
Caps Punitive Damages				0.001 (0.349)
Collateral Source Reform				0.011** (2.017)
Joint and Several Liability Reform				-0.010*** (-3.816)
Industry-Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	61,408	44,893	61,408	61,408
Adjusted R ²	0.558	0.701	0.670	0.670

Using Form 5500 Insurance Expense Data

For the baseline analysis in Section 4.3.1, the underlying assumption is that tort reform of caps on noneconomic damages reduce employers' health care costs. The negative relation between tort reforms and employers' insurance premium paid has been established in the previous study (Avraham et al., 2010) using proprietary data; here, I use the health insurance expense data from Form 5500 to verify the relation. One drawback of Form 5500 data is that it contains only insurance expense part of employers' health care costs, and this insurance expense can be all or part of firms' health care costs depending on whether the plan is fully-insured. Therefore, the effect of tort reforms on health expenses is expected to manifest only in fully-insured firms using Form 5500 data, although tort reforms affect employers' true costs regardless of funding methods.

The results of 2SLS regression of investment on health care costs, instrumented by tort reforms are shown in Table 4.10. The first three columns are the first stage results regressing $\log(\text{average insurance expense})$ on the indicator of tort reform of caps on noneconomic damages. The independent variable is the log form of total insurance expense divided by the total number of people covered by the firm, aggregating all the health benefit plans of a firm using Form 5500. In Column 1, the sample includes all Compustat firms matched to the Form 5500 dataset. Columns 2 and 3 are subsamples of whether the firm is fully-insured. Column 3 shows that for fully insured firms, the enactment of tort reforms on average decreases the health care costs by 11.1% over the period 1999-2016. Including firms that are not fully-insured lessens the statistical significance and economic magnitude in Column 1 and 2. Columns 4-6 show the IV-2SLS results using $I(\text{tort})$ as an instrument for $\log(\text{average insurance expense})$ on the fully insured subsample. The magnitude of 2SLS results is comparable for the M&A setting in Table 4.2.

Table 4.10
Effect of Tort Reform on Insurance Expense Using Form 5500 Data

This table presents the relation between health care insurance premium from Form 5500 and firm investment decisions using the variations from medical malpractice tort reforms. The first three columns are the first stage results regressing $\log(\text{average insurance expense})$ on the indicator of tort reform for caps on noneconomic damage. In Columns 1, the sample includes all Compustat firms matched to the Form 5500 dataset; in Columns 2, firms with fully insured health plans are excluded; in Column 3, only firms with fully insured health plans are included. Columns 4-6 shows the IV-2SLS results using $I(\text{tort})$ as an instrument for $\log(\text{average insurance expense})$ on the fully-insured subsample. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q , $\log(\text{PPENT})$, profit margin, and age. Utility and financial firms are excluded from all analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	First Stage			IV-2SLS		
	log(avg insurance expense)			CAPEX	R&D	INV
	All	Exclude Fully-I	Fully-I only	Fully-Insured only		
	(1)	(2)	(3)	(4)	(5)	(6)
$I(\text{Tort})$	-0.045 (-1.031)	-0.045 (-0.807)	-0.111** (-2.482)			
log(avg insurance expense)				-0.089** (-2.186)	-0.069 (-1.197)	-0.125** (-2.254)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,311	16,742	12,569	11,706	9,172	11,706
F-stats	1.240	2.288	13.52			

5 What Types of Firms Are Affected More?

5.1. High-Skilled Firms

Although most US public firms have offered health care benefits to employees, even before the enactment of the ACA, where ACA requires firms having 50 or more full-time employees to offer health insurance or risk paying a penalty. Firms' exposure to health care costs depends on employees' enrollment rate for the plan. From the employer's supply side, under the Health Insurance Portability and Accountability Act (HIPAA) nondiscrimination rules, employers have the discretion to offer different plans based on "bona fide employment-based classifications." One common way to separate plan eligibility is by full-time status. From the employee's demand side, not all employees will enroll in the offered health benefits, because the plans are not without cost. First, employees still need to pay a portion of the costs as the employee contribution. Second, health benefits are part of the compensation package, and taking the benefits may affect the real wage employees receive. Apart from factors such as health risks and whether a spouse also has employer-sponsored health benefits, income is an important factor for employees' enrollment decision. Health benefits are exempt from federal income and payroll tax and are therefore worth more for employees in higher income brackets since they reduce taxable income (Gruber and Levitt, 2000). Rampini and Viswanathan (2018) show that insurance is monotone increasing in household wealth due to limited enforcement. Survey evidence also suggests that the employer-sponsored health plan enrollment rate increases with household income. For example, the 2018 National Compensation Survey from the Bureau of Labor Statistics (BLS) reports that the participation rates (offering rate times enrollment rate) of health care plans among employees

are 26%, 61%, 74% and 82% respectively from the lowest quartile to the highest quartile of the average wage. This pattern is not driven by full-time status.¹ Thus, high-wage workers are more likely to take up health benefits compared to their lower-income peers, and firms with more high-wage workers should be affected more by changes in health care costs.

Table 5.1, Panel A, tests whether the negative relation between health care costs and investment is sensitive to firms' average wage level. The exercise is carried out on subsamples split by higher or lower average industry wage in the setting of medical malpractice tort reforms. Tort reforms are used here since those reforms affect firms' health spending regardless of health plan funding method. I obtain industry-level wage data using Occupational Employment Statistics (OES) data from the BLS for the period 1999-2016, following Belo et al. (2017) and Ghaly, Anh Dang, and Stathopoulos (2017). Pre-2002 data are at the 3-digit SIC level and post-2002 at the 4-digit NAICS level. OES data contain information on occupational-level hourly wage and number of workers linked to each industry. I therefore compute the weighted average hourly wage for each industry based on its occupation distribution. The results, shown in Table 5.1, Panel A, confirm that firms in higher-wage industries increase investment more than firms in lower-wage industries in response to a decrease in health care costs, consistent with theoretical prediction and survey evidence.

Workers' skill level is highly correlated with wage (Murphy and Welch, 1992), and thus it is likely that firms with more high-skilled workers are affected more by changes in health care costs. Table 5.1 Panel B tests this hypothesis. Labor skill data are derived from OES data and the Department of Labor's O*NET database. O*NET has information on the skill level ranking (job zone) ranging from one to five for each Standard Occupational Classification (SOC) occupation. I then calculate the weighted average industry-level skill index similar to what is done for average wage. On subsamples split by higher or lower average industry skill level, Table 5.1, Panel B, shows that firms with more high-skilled workers are affected more by changes in health care costs.

¹See also Kaiser Family Foundation Analysis of National Health Interview Survey, 2014

Table 5.1

Firm Investment and Health Care Costs – Role of Labor Wage and Skill

This table presents how a firm’s investment decisions are affected by costs of providing health benefits to employees, conditional on average wage of the industry. The sample is split into “Low” and “High” by whether the industry-level average hourly wage or the industry-level average skill level exceeds the sample median. Wage and occupational skill data comes from the Bureau of Labor Statistics - Occupational Employment Statistics industry-occupation matrix, at the 4-digit NAICS level. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q , $\log(\text{PPENT})$, profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Role of Labor Wage

	CAPEX			R&D			INVESTMENT		
	High (1)	Low (2)	Interaction (3)	High (4)	Low (5)	Interaction (6)	High (7)	Low (8)	Interaction (9)
$I(\text{Tort})$	0.013** (2.517)	0.003* (1.893)	0.003* (1.946)	0.018** (2.218)	0.005* (1.717)	0.005 (1.467)	0.030*** (2.844)	0.006** (2.328)	0.006** (2.228)
$I(\text{Tort}) \times I(\text{HighWage})$			0.010*** (4.041)			0.013** (2.501)			0.024*** (5.774)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,352	30,496	58,848	22,814	20,364	43,178	28,352	30,496	58,848
Adjusted R ²	0.582	0.486	0.546	0.688	0.657	0.713	0.663	0.606	0.678

Panel B: Role of Labor Skill

	CAPEX			R&D			INVESTMENT		
	High	Low	Interaction	High	Low	Interaction	High	Low	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>I(Tort)</i>	0.010** (2.103)	0.004** (2.557)	0.004** (2.568)	0.020*** (2.753)	0.004 (1.586)	0.004 (1.097)	0.026*** (2.690)	0.006*** (2.743)	0.006** (2.361)
<i>I(Tort) × I(HighSkill)</i>			0.006*** (2.594)			0.016*** (2.958)			0.020*** (4.748)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,109	30,739	58,848	21,668	21,510	43,178	28,109	30,739	58,848
Adjusted R ²	0.590	0.473	0.545	0.686	0.683	0.712	0.670	0.618	0.676

5.2. Insurer Availability

When purchasing insurance policies or services, firms engage in a bargaining process with insurers to set the price. Many factors might affect firms' bargaining power; for example, Dafny (2010) finds that more profitable firms face higher premium prices. After controlling for firm characteristics, a firm's set of current insurers can be an important determinant in negotiating a better deal. To illustrate why this might be the case, hypothetically, think about a firm with an Atena HMO plan and a Cigna PPO plan, and when negotiating about renewing the Atena HMO plan, the firm finds the terms proposed by Atena are unfavorable. The firm can threaten to divert employees to the Cigna PPO plan or move the HMO plan to Cigna, and therefore has a better bargaining position with Atena compared with the case that the firm only has Atena plans. If the firm does switch to Cigna for its HMO plan, the cost is lower compared to the case of initiating the HMO plan with a new insurer. First, the searching cost is minimized because the firm is already having a working relationship with Cigna. Secondly, the switching cost associated with changing plans is lower, as the employer and at least some employees are familiar with Cigna's system, such as its claim reimbursement procedure and provider network. When concentration in the insurance market increases, firms are subjected to higher prices regardless of whether they have business with the merger parties. However, if the firms are working with multiple insurers or a more diverse base of insurers, they could gain better control over the magnitude of price increases.

To examine firms' insurer network and availability affect insurance price increases, I gather firm-level insurer information using Form 5500, Schedule A. Cross-validation with NAIC data on national-level insurer affiliation yields 264 unique insurance groups for the Form5500-Compustat merged dataset. To quantify firms' insurer network size, I construct two measures. First, I count the number of insurers that a firm works with in a given year. The median number of insurer that a firm has each year is 2. To further account for how insurers split participants within the firm, I also construct a *within-firm insurer HHI* measure, which is the sum of squares of insurer share of participants within a firm in a given

year. The median within-firm insurer HHI is 0.56.

To see how bargaining power affects firms' outcome differentially, I examine the average insurance expense and investment changes after insurer M&A for firms with varied network size and the within-firm insurer HHI. In addition to the set of controls used in previous analysis, I also control for the geographic dispersion of the firm, using the number of states that a firm operates in from Garcia and Norli (2012) as in Section 4.3.2, to take into account of the correlation between network size and geographically dispersion of the firm. Table 5.2 shows the results. The first four columns are the results on samples split by whether a firm works with more than one insurer in that year, and the last four columns are sample split by the insurer HHI. Columns 1, 2, 5, 6 show the first stage result regressing $\log(\text{average insurance expense})$ on $c_sim\Delta HHI$, conditional on insurer network. The results suggest that firms with more insurer options or lower within-firm insurer concentration could better insulate themselves from health premium price shocks. Columns 3, 4, 7, 8 show the reduced-form results of regressing firm investment on $c_sim\Delta HHI$. (The coefficient of unsplit sample is -0.327 with t statistics of -4.179.) The results in Column 3 and 4 suggest that firms with more insurer options reduce investment less than those who only work with one insurer. Similarly, Column 7 and 8 shows that firms with a even distribution of participants among insurers reduce investment less than the ones with more concentrated insurer networks.

Table 5.2

Firm Investment and Health Care Costs – Role of Insurer Availability

This table presents how a firm’s investment decisions are affected by the costs of providing health benefits to employees, conditional on the firm’s insurer network. The sample is split into “Low” and “High” by whether the firm’s number of insurers or the within-firm insurer HHI exceeds the sample median. Columns 1, 2, 5, 6 show the first stage result regressing $\log(\text{average insurance expense})$ on $c_sim\Delta HHI$, conditional on insurer network. $\log(\text{average insurance expense})$ is from Form 5500, and the independent variable $c_sim\Delta HHI$, which is the cumulative simulated change in the HHI, is an instrument for insurance price increase and described in Section 4.2 and Equation 4.1. Columns 3, 4, 7, 8 show the reduced-form results regressing firm investment on $c_sim\Delta HHI$. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, $\log(\text{PPENT})$, profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

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DepVar=	<u>log(avg insurance expense)</u>		<u>INVESTMENT</u>		<u>log(avg insurance expense)</u>		<u>INVESTMENT</u>	
	Number of Insurer				Within-Firm Insurer HHI			
	> 1 (1)	= 1 (2)	> 1 (3)	= 1 (4)	Low (5)	High (6)	Low (7)	High (8)
c_simΔ HHI	0.117 (0.091)	5.683*** (5.691)	-0.086 (-0.966)	-0.593*** (-8.770)	0.659 (0.519)	5.945*** (5.283)	-0.043 (-0.496)	-0.574*** (-9.518)
Geo Disp	0.004 (1.028)	0.004 (0.490)	0.000 (0.862)	-0.001 (-0.826)	0.006 (1.456)	0.004 (0.599)	0.000 (0.776)	-0.001 (-1.005)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,203	6,991	9,196	6,998	8,364	7,830	8,376	7,818
Adjusted R ²	0.614	0.665	0.845	0.820	0.618	0.655	0.846	0.819

6 Channels

In previous sections, I show a negative relation between health care costs and firm investment. Here, I further explore the mechanism through which health care costs affect firm investment.

Health benefits are offered as part of employees' compensation packages and are therefore a component of labor cost. An increase in labor cost reduces firms' optimal scale; as a result, firms reduce production and cut investment (*scale channel*). If high-skilled workers are complementary to capital (Krusell et al., 2000; Autor, Levy, and Murnane, 2003), and given that high-skilled labor has a higher demand for health benefits, firms may substitute low-skilled for high-skilled labor and cut investment in response to an increase in health care costs.

One piece of evidence to support the scale channel would be observing employment flow moves in the same direction as firm investment. Looking at Compustat *Employment* growth after tort reforms, I find that the confidence interval of the coefficient on employment growth overlaps with the one for total investment, but the coefficient is not statistically significant (Table A.2). Measurement issues may prevent further interpretation of the results. The Compustat *Employment* item does not measure firms' employment flow perfectly. Also, since high-/low-skilled workers have differential demands toward health benefits, it is possible that firms shift to more high-skilled workers in response to a reduction in labor costs for high-skilled work but maintain the same aggregate level of employment. Although the results here provide limited evidence on employment response, the negative correlation between health care costs and employment changes has been well-documented in other

studies using data such as CPS (Baicker and Chandra, 2005) and industry-specific employee data (Lubotsky and Olson, 2015).

Besides the scale channel, health care costs also affect investment through the liquidity channel. Fully insured firms pay the insurance company for the policies on a monthly or an annual basis from their cash holdings. For firms with at least one self-insured plan, a tax-exempt reserve will be set up for future claim payouts, and firms usually deposit three or six months' projected health spending into the reserve in advance. This prepares the firms for catastrophic events and any miscalculations of future health spending projections. As with defined benefit retirement plans, the assets in the reserve can also be used to invest in financial securities. If there is a reduction in health care costs, firms can pay less cash to the insurance company or contribute less to the health plan reserves. Because external finance is costly (Fazzari, Hubbard, and Petersen, 1988; Lamont, 1997; Rauh, 2006), firms will respond by increasing investment when there is more internal cash available.

I test this potential channel by examining whether more financially constrained firms are more affected by changes in health care costs. The results are shown in Table 6.1. I divide the firms into two categories of whether they are more financially constrained measured by whether the firm issues dividends, firm size and profit level. Columns 1, 4 and 7 show results for firms that do not issue dividends, are of a smaller size and have lower profit level, respectively, that is, those that are more financially constrained. Column 2, 5, and 8 are the subsamples of less financially constrained firms. Column 3, 6, 9 show the interaction exercise. The dependent variable is total investment expenditure over lagged assets. The results show that more financially constrained firms increase investment more when there is a reduction in health care costs. Unreported results on firms who filed Form 5500, Schedule H,¹ shows that both the contribution to the reserve and total expenses out of the reserve decrease following a reduction in health care costs.

¹Filed by firms with self-insured plans to report their financial information for funding the plan

Table 6.1

Firm Investment and Health Care Costs – Role of Financial Constraint

This table presents how a firm’s investment decisions are affected by health care cost reductions induced by tort reforms, conditional on whether the firm is financially constrained. The dependent variables *INVESTMENT* is the sum of scaled capital and R&D expenditures. The sample is split into “More Constrained” or “Less Constrained” by whether the firm does not pay a common dividend, firm size is below the sample median, or operating profit before depreciation scaled by lagged assets is below the sample median. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, log(PPENT), profit margin, and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	INVESTMENT								
	Dividend			Size			Profit		
	More Con- strained (1)	Less Con- strained (2)	Interaction (3)	More Con- strained (4)	Less Con- strained (5)	Interaction (6)	More Con- strained (7)	Less Con- strained (8)	Interaction (9)
<i>I(Tort)</i>	0.023*** (2.937)	0.008*** (2.976)	0.008*** (2.898)	0.018** (2.322)	0.008** (2.488)	0.008*** (2.958)	0.020** (2.616)	0.008** (2.211)	0.008*** (3.056)
<i>I(Tort) × I(Constrained)</i>			0.016*** (3.701)			0.010** (2.546)			0.012*** (2.667)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,465	31,940	60,405	28,464	31,941	60,405	28,264	32,141	60,405
Adjusted R ²	0.654	0.705	0.684	0.653	0.668	0.676	0.649	0.661	0.671

7 Implication to Innovation Production

It is important to know whether the effect of investment changes due to health care cost shocks is transitory, or have a long-term impact on firms' productivity. If firms spend the cost-saving of health care on meaningful projects and improve firms' fundamentals, then curbs on health care cost rises are critical for businesses; otherwise, the issue might be less severe. To shed light on this question, I examine firms' patent production and accumulation following changes in health care costs. The patent data is from Ma (2019), which contains the full list of patents that a public firm owns at each point in time between 1976 and 2012. It also provides information on the number of lifetime citations received by each patent as well as the sources of those citations. I examine the quantity of new patent produced following health care costs reduction, as well as the quality of new patents and the patent portfolio. The results are shown in Table 7.1.

The results in Column 1 to 4 show a decrease in health care costs is associated with an increase in the number of patents applied (conditional on being granted) in the next one or three years; firms also obtain more patents in their portfolio. Looking through Column 5 to 8, the average citation of the new patent applied after tort reform has no significant changes; but the average citation of all patent stock increases. This might because firms are able to acquire more high quality patents either directly from the market for technology or through corporate M&A. Together, the results indicate that after health care costs decline, innovative firms are able to produce more patents and maintain a patent portfolio with higher quality. Additional untabulated tests confirm that the results still hold after removing firms from medical device industry. The results indicate that health care cost shocks can be

translated into a real impact for firms' future productivity.

Table 7.1

Health Care Costs and Firms' Innovation

This table presents how a firm's innovation are affected by costs of providing health benefits to employees in the quasi-experiment setting of tort reforms. The sample period is 1999-2012. The independent variable is medical malpractice tort reform of caps on noneconomic damages, equals to one if the reform is in effect in that year. The dependent variables are patent citation measurements and the count of patents aggregated to firm level. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, market value, age and number of patents held by the firm. Utility and financial firms are excluded from all analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable:	New Patents Applied		New Patents		Average Citation New Patent Applied		Average Citation All Patents	
	Next 1 Year	Next 3 Years	Next 1 Year	Next 3 Years	Next 1 Year	Next 3 Years	Next 1 Year	Next 3 Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>I(Tort)</i>	0.111** (1.995)	0.303** (1.999)	0.093** (2.535)	0.256** (2.438)	0.016 (0.590)	0.026 (0.291)	0.022*** (2.862)	0.059*** (2.901)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,466	23,402	26,232	23,169	10,729	6,271	26,459	23,393
Adjusted R ²	0.766	0.870	0.750	0.843	0.439	0.697	0.886	0.932

8 Conclusion

Health care issues have received immense attention from both the public and policymakers in recent years. Despite employers' heavy involvement in health care provision in the United States, the impact of health care changes on employers has been largely ignored. This paper attempts to highlight employers' concerns about rising health care costs by studying the relation between employer-sponsored health benefit costs and firms' investment decisions. I construct a new dataset on employer-sponsored health benefits on US public firms from 1999 to 2016. Using variations in health insurance market concentration, as well as changes in state medical malpractice tort reforms, I then show that changes in health care costs faced by employers negatively affect capital expenditures and R&D spending by US public firms. The effect is especially prominent in firms with more high-skilled workers. This pattern can be explained by the cash channel, where I find that the effect is exacerbated in firms that are more financially constrained.

9 Appendix

9.1. Key Variable Definitions

Variable	Definition and Construction
Financial variables	
Assets	Total book assets in millions, adjusted to 2004 US dollars.
Size	The natural logarithm of total book assets, in millions, adjusted to 2004 US dollars.
Age	Number of years since IPO. The natural logarithm of this variable is used in the paper.
Profit margin q	Income before extraordinary items divided by sales (book value of debt + market value of equity)/(book value of debt + book value of equity)
Cash/Assets	Cash and short-term investment scaled by total assets.
Capex/Assets	Capital expenditure scaled by total assets.
R&D/Assets	Research and development expenses scaled by total assets.
Investment/Assets	The sum of capital expenditure and R&D expenses scaled by total assets.
Advertising	Advertising expenditure scaled by total assets.
Acquisition	Acquisition expenditure scaled by total assets.
Employment Growth	The growth of Compustat employment from t to t-1.
Sales Growth	The growth of net sales from t to t-1.
Form 5500 variables	
log(Average Insurance Expense)	The natural logarithm of (total insurance expense/total number of participants). Both information from Schedule A, aggregated to firm level by Employer Identification Number (EIN).
Self-/Mix/Fully insure	An indicator variable that takes a value of one if a firm's health benefits funding method is self-/mix/fully insured. For details, see Appendix "Form 5500 Data."
Other variables	

HHI	The Herfindahl-Hirschman Index calculated using total premium written by the insurer at state level.
sim Δ HHI	The difference between the sum of the pre-merger HHI of target and acquiror and the HHI of post-merger combined two firms.
c.sim Δ HHI	The sum of sim Δ HHI from the start of the sample period to the current year.
I(Tort)	An indicator variable that takes a value of one if the tort reform of caps on noneconomic damages is in place.
I(Republican State)	An indicator variable that takes a value of one if the Republican Party controls two or more of three state institutions: each chamber of the state legislature and the governor's office. Data from Klarner (2013).
I(High Wage)	An indicator variable that takes a value of one if the wage at 4-digit NAICS level is above median.
I(High Skill)	An indicator variable that takes a value of one if the occupational skill level at the 4-digit NAICS level is above the median.
I(Geo Dispersed)	An indicator variable that takes a value of one if the number of states in which the firm is present exceeds the sample median or whether the firm is present in more than one state. Data from Garcia and Norli (2012).

9.2. Form 5500 Data

9.2.1. Overview

The Employee Retirement Income Security Act (“ERISA”) and the Internal Revenue Code (“Code”) establish disclosure requirements for the private-sector employee benefit plans. The Department of Labor (“DOL”), the Internal Revenue Service, and the Pension Benefit Guaranty Corporation jointly developed the Form 5500 series in 1975 to allow private firms that sponsor benefit plans for their employees to report and satisfy ERISA and Code requirements. Most Form 5500s are filed for employee pension plans. Welfare plans with certain size and characteristics are exempt from reporting. Exceptions include plans with fewer than 100 participants, plans for highly compensated employees only, government plans, church plans, and overseas plans that serve mainly nonresident aliens.

I retrieve and download all available Form 5500 welfare plan filings data using the EFAST2 system of the DOL. To clean up the data, I first drop all retirement plans, direct filing entities, voluntary filings with fewer than 100 participants, and duplicates filings. I keep plans that indicate they are for health benefits, and therefore exclude stand-alone welfare plans for other non-health benefits such as dental, life insurance, and long-term disability. I aggregate plan level information to firm level using Employer Identification Numbers (“EIN”) reported in Form 5500. I then merge the Form 5500 data to Compustat universe using EIN as well as name match.

9.2.2. Imputation of Variables

How the plan is funded – whether fully insured, self-insured, or a mix of the two (mixed insured) – is not reported and must be imputed using available information. I follow the algorithm created by the Department of Labor and described in Form 5500 Group Health Plan Research File User Guide (“User Guide”) to sort plans into fully, mixed or self-insure. Generally speaking, if the per capita premium amount reported is below \$1,800¹ or the filing indicates that the insurance policy could be for stop-loss coverage or payments to a third party administrator (TPA), and if the plan is funded through trust or general assets or reports benefit payments, then it will be treated as self-insured. Mixed insure is defined as plans that do not meet the requirements for self-insure; the number of individuals covered under insurance contracts as reported on Schedule A is less than half of the total number of participants as of the end of the plan year; the filing indicates that the plan is funded through a trust or general assets of the sponsor; or the filing has an attached Schedule H or I that indicates benefit payments. Fully insure is defined as plans that do not satisfy the above criteria. For firm-level funding status, if all plans of a firm are fully insured, then the firm is

¹This is used in the User Guide, I also use 0.35 multiplied by the annual average single premium for robustness.

labeled as a fully insured firm; if all plans are self-insured, then the firm is self-insured; otherwise, the firm is mix insured.

For total premium, as suggested by the User Guide, the maximum of the values in the following items is used as the premium for that contract. Part I, 2(a), total amount of commissions paid; Part I, 2(b), total amount of fees paid; Part II, 6(b), premiums paid to carrier; Part III, 9(a)(4), earned premium; Part III, 9(b)(3), incurred claims; Part III, 9(b)(4), claims charged; and Part III, 10(a), total premiums or subscription charges paid to carrier.

Table A.1
Health Insurance Merger Effect on Firm Investment for National Firms

This table presents how a firm's investment decisions are affected by health care cost changes induced by mergers in the health insurance industry. The sample period is 2004-2016, the years for which health insurance market share data from NAIC are available. Only mergers with more than 30 state-level overlapping market are included. Column 1 shows the first stage result regressing $\log(\text{average insurance expense})$ on $c_sim\Delta HHI$. $\log(\text{average insurance expense})$ is from Form 5500, and the independent variable $c_sim\Delta HHI$ is the cumulative simulated change in the HHI described in Section 4.2 and Equation 4.1. Columns 2-4 shows the instrumental-variables-two-stage-least-squares (IV-2SLS) results using $c_sim\Delta HHI$ as an instrument for $\log(\text{average insurance expense})$. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, $\log(\text{PPENT})$, profit margin, and age. Utility and financial firms are excluded from all analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	First Stage	IV-2SLS		
	$\log(\text{avg insurance expense})$ (1)	CAPEX (2)	R&D (3)	INVESTMENT (4)
$c_sim\Delta HHI$	3.976*** (5.018)			
$\log(\text{average insurance expense})$		-0.101*** (-6.668)	0.016 (1.584)	-0.085*** (-6.189)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	15,632	15,189	11,265	15,189
F-stats	25.18			

Table A.2
Health Care Costs and Firms' Other Outcomes

This table presents how a firm's other corporate outcomes are affected by costs of providing health benefits to employees in the quasi-experiment setting of tort reforms. The sample period is 1999-2016. The independent variable is medical malpractice tort reform of caps on noneconomic damages, equals to one if the reform is in effect in that year. The dependent variables *Advertising* is Compustat advertising expenditure divided by total assets; *Acquisition* is Compustat acquisition expenditure scaled by total assets; *Sales Growth* is the difference for the natural algorithm of sales scaled by total asset between current year and the year before; *Employment Growth* is the difference for the natural algorithm of employment between current year and the year before. All specifications include firm and year fixed effects, as well as firm and state-level controls. State-level controls include income per capita and unemployment rate. Firm controls include lagged size, cash-to-asset, q, log(PPENT), profit margin, and age. Utility and financial firms are excluded from all analysis. Standard errors are clustered at the state and firm level. The t-statistics are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Advertising	Acquisition	Sales Growth	Employment Growth
	(1)	(2)	(3)	(4)
<i>I(Tort)</i>	0.002** (2.019)	0.003* (2.006)	-0.002 (-0.326)	0.010 (1.640)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	25,256	59,776	61,086	58,973
Adjusted R ²	0.771	0.114	0.190	0.148

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